***Replacement Check List***
For rules filed within the
1st Quarter
January 1 - March 31, 2016

# THE ARIZONA ADMINISTRATIVE CODE

Within the stated calendar quarter, this Chapter contains all rules made, amended, repealed, renumbered, and recodified; or rules that have expired or were terminated due to an agency being eliminated under sunset law. These rules were either certified by the Governor's Regulatory Review Council or the Attorney General's Office; or exempt from the rulemaking process, and filed with the Office of the Secretary of State. Refer to the historical notes for more information. Please note that some rules you are about to remove may still be in effect after the publication date of this Supplement. Therefore, all superseded material should be retained in a separate binder and archived for future reference.

## Title 12. Natural Resources

## Chapter 1. Radiation Regulatory Agency

Supplement Release Quarter: 16-1

**Sections, Parts, Exhibits, Tables or Appendices modified**

R12-1-102, R12-1-303, R12-1-306, R12-1-308, R12-1-311, R12-1-313, R12-1-320, R12-1-323, R12-1-418, R12-1-452, R12-1-503, R12-1-703, R12-1-1302, R12-1-1512, R12-1-1901 through R12-1-1999, R12-1-19100 through R12-1-19109, Appendix A, Table 1

| REMOVE Supp. 15-1 | REPLACE with Supp. 16-1 |
|---|---|
| Pages: 1 - 254 | Pages: 1 - 275 |

*The agency's contact person who can answer questions about rules in Supp. 16-1:*

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*Disclaimer: Please be advised the person listed is the contact of record as submitted in the rulemaking package for this supplement. The contact and other information may have changed and is provided as a public courtesy.*

**PUBLISHER**
**Arizona Department of State**
**Office of the Secretary of State, Public Services Division**

## PREFACE

Under Arizona law, the Department of State, Office of the Secretary of State (Office), accepts state agency rule filings and is the publisher of Arizona rules. The Office of the Secretary of State does not interpret or enforce rules in the Administrative Code. Questions about rules should be directed to the state agency responsible for the promulgation of the rule.

Scott Cancelosi, Director
PUBLIC SERVICES DIVISION
March 31, 2016

### RULES

A.R.S. § 41-1001(17) states: "'Rule' means an agency statement of general applicability that implements, interprets, or prescribes law or policy, or describes the procedures or practice requirements of an agency."

### THE ADMINISTRATIVE CODE

The Arizona Administrative Code is where the official rules of the state of Arizona are published. The Code is the official codification of rules that govern state agencies, boards, and commissions.Virtually everything in your life is affected in some way by rules published in the Arizona Administrative Code, from the quality of air you breathe to the licensing of your dentist. This chapter is one of more than 230 in the Code compiled in 21 Titles.

### ADMINISTRATIVE CODE SUPPLEMENTS

Rules filed by an agency to be published in the Administrative Code are updated quarterly. Supplement release dates are printed on the footers of each chapter:

First Quarter: January 1 - March 31
Second Quarter: April 1 - June 30
Third Quarter: July 1 - September 30
Fourth Quarter: October 1 - December 31

For example, the first supplement for the first quarter of 2016 is cited as Supp. 16-1.

### HOW TO USE THE CODE

Rules may be in effect before a supplement is released by the Office. Therefore, the user should refer to issues of the Arizona Administrative Register for recent updates to rule Sections.

### ARTICLES AND SECTIONS

Rules in chapters are divided into Articles, then Sections. The "R" stands for "rule" with a sequential numbering and lettering system separated into subsections.

### HISTORICAL NOTES AND EFFECTIVE DATES

Historical notes inform the user when the last time a Section was updated in the Administrative Code. Be aware, since the Office publishes each quarter by entire chapters, not all Sections are updated by an agency in in a supplement release. Many times just one Section or a few Sections may be updated in the entire chapter.

### ARIZONA REVISED STATUTE REFERENCES

The Arizona Revised Statutes (A.R.S.) are available online at the Legislature's website, www.azleg.gov. An agency's authority note to make rules are often included at the beginning of a chapter. Other Arizona statutes may be referenced in rule under the A.R.S. acronym.

### SESSION LAW REFERENCES

Arizona Session Law references in the introduction of a chapter can be found at the Secretary of State's website, www.azsos.gov/services/legislative-filings.

### EXEMPTIONS FROM THE APA

It is not uncommon for an agency to be exempt to the steps outlined in the rulemaking process as specified in the Arizona Administrative Procedures Act, also known as the APA (Arizona Revised Statutes, Title 41, chapter 6, Articles 1 through 10). Other agencies may be given an exemption to certain provisions of the Act.

An agency's exemption is written in law from the Arizona State Legislature or under a referendum or initiative passed into law by Arizona voters.

When an agency files an exempt rulemaking package with our Office it specifies the law exemption in what is called the preamble of rulemaking. The preamble is published in the Arizona Administrative Register online at www.azsos.gov/rules, click on the Administrative Register link.

In the Administrative Code the Office includes editor's notes at the beginning of a chapter indicating that certain rulemaking Sections were made by exempt rulemaking. Exempt rulemaking notes are also included in the historical note at the end of a rulemaking Section.

The Office makes a distinction to certain exemptions because some rules are made without receiving input from stakeholders or the public. Other exemptions may require an agency to propose exempt rules at a public hearing.

### EXEMPTIONS AND PAPER COLOR

If you are researching rules and come across rescinded chapters on a different paper color, it is because the agency filed a Notice of Exempt Rulemaking. At one time the office published exempt rules on either blue or green paper. Blue meant the authority of the exemption was given by the Legislature; green meant the authority was determined by a court order. In 2001 the Office discontinued publishing rules using these paper colors.

### PERSONAL USE/COMMERCIAL USE

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*Public Services managing rules editor, Rhonda Paschal, assisted with the editing of this chapter.*

# TITLE 12. NATURAL RESOURCES

## CHAPTER 1. RADIATION REGULATORY AGENCY

Authority: A.R.S. § 30-651 et seq.

*Editor's Note: This Chapter has rules in Supp. 16-1 that were filed in the Office on February 3, 2016, with an immediate effective date of February 2, 2016, the date approved by the Governor's Regulatory Review Council, in order to remain in federal compliance with Agreement State status as stipulated in A.R.S. § 41-1032(A)(2).*

### ARTICLE 1. GENERAL PROVISIONS

Section



### ARTICLE 2. REGISTRATION, INSTALLATION, AND SERVICE OF IONIZING RADIATION-PRODUCING MACHINES; AND CERTIFICATION OF MAMMOGRAPHY FACILITIES

Section



### ARTICLE 3. RADIOACTIVE MATERIAL LICENSING

Section

## ARTICLE 4. STANDARDS FOR PROTECTION AGAINST IONIZING RADIATION



## ARTICLE 5. SEALED SOURCE INDUSTRIAL RADIOGRAPHY

**ARTICLE 6. USE OF X-RAYS IN THE HEALING ARTS**



**ARTICLE 7. MEDICAL USES OF RADIOACTIVE MATERIAL**

## ARTICLE 8. RADIATION SAFETY REQUIREMENTS FOR ANALYTICAL X-RAY OPERATIONS



## ARTICLE 9. PARTICLE ACCELERATORS



## ARTICLE 10. NOTICES, INSTRUCTIONS, AND REPORTS TO RADIATION WORKERS; INSPECTIONS



## ARTICLE 11. INDUSTRIAL USES OF X-RAYS, NOT INCLUDING ANALYTICAL X-RAY SYSTEMS

*Article 11, consisting of R12-1-1101 through R12-1-1104, repealed effective June 13, 1997 (Supp. 97-2).*

## ARTICLE 12. ADMINISTRATIVE PROVISIONS

*Article 12, consisting of R12-1-1201 through R12-1-1203 and R12-1-1205, repealed effective January 2, 1996 (Supp. 96-1).*



## ARTICLE 13. LICENSE AND REGISTRATION FEES

*Article 13, consisting of Sections R12-1-1301 through R12-1-1308, adopted effective November 5, 1993 (Supp. 93-4).*

*Article 13, consisting of Sections R12-1-1301 through R12-1-1303, repealed effective November 5, 1993 (Supp. 93-4).*



## ARTICLE 14. REGISTRATION OF NONIONIZING RADIATION SOURCES AND STANDARDS FOR PROTECTION AGAINST NONIONIZING RADIATION



## ARTICLE 15. TRANSPORTATION

*Article 15 consisting of Sections R12-1-1501 through R12-1-1508, and Appendix A adopted effective December 20, 1985 (Supp. 85-6).*

## ARTICLE 16. RESERVED

## ARTICLE 17. WIRELINE SERVICE OPERATIONS AND SUBSURFACE TRACER STUDIES



## ARTICLE 18. RESERVED

## ARTICLE 19. PHYSICAL PROTECTION OF CATEGORY 1 AND CATEGORY 2 QUANTITIES OF RADIOACTIVE MATERIAL

## 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, 2015, 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, 2015, 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.

"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 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 Jan-

uary 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.

"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 the shoulder girdle to the phalanges and the lower two-thirds of the femur to the phalanges.

"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.

"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.

"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 or 14 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.

"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 are within the formula:

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

"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.

"Tribal official" means the highest ranking individual that represents Tribal leadership, such as the Chief, President, or Tribal Council leadership.

"Unrefined and unprocessed ore" means ore in its natural form prior to any processing, such as grinding, roasting, beneficiating, or refining.

"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 or registration issued by the Agency and controlled by employment or contract with a licensee or registrant.

"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). Amended by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

**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.

**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 Unit Dose Equivalent[a] |
|---|---|---|
| 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 2. REGISTRATION, INSTALLATION, AND SERVICE OF IONIZING RADIATION-PRODUCING MACHINES; AND CERTIFICATION OF MAMMOGRAPHY FACILITIES

**R12-1-201. Exemptions**

**A.** Electronic equipment that produces X-radiation incidental to its operation for other purposes is exempt from the registration and notification requirements of this Article, provided that an exposure rate, from any accessible surface, averaged over an area of 10 centimeters squared (1.55 inches squared) does not exceed 5 microsieverts (0.5 milliroentgen) per hour at 5 centimeters (2.0 inches).

**B.** The production, testing, or factory servicing of the electronic equipment in subsection (A) is not exempt from the requirements of this Article.

**C.** Radiation machines in storage or in transit to or from storage are exempt from the requirements of this Article.

**D.** Radiation machines rendered incapable of producing radiation are exempt from the requirements of this Article.

**Historical Note**

Former Rule Section B.3. Former Section R12-1-203 repealed, new Section R12-1-203 adopted effective June 30, 1977 (Supp. 77-3). Former Section R12-1-201 repealed, former Section R12-1-203 renumbered as R12-1-201 and amended effective November 22, 1988 (Supp. 88-4). Amended effective January 2, 1996 (Supp. 96-1). Amended 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. 4302, effective November 14, 2003 (Supp. 03-3). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

**R12-1-202. Application for Registration of Ionizing Radiation Producing Machines**

**A.** A person shall not use a radiation machine except as authorized in this Article.

**B.** A person possessing a nonexempt radiation machine shall apply for registration of the machine with the Agency within 30 days after its installation. The person applying for registration of a radiation-producing machine shall use the application forms provided by the Agency. The applicant shall provide the information identified in Appendix A of this Article.

**C.** In addition to the application form or forms, the applicant shall remit the appropriate registration or licensing fee in R12-1-1306 and provide other information required by R12-1-208.

**D.** Each applicant that applies for registration of a stationary x-ray system, with the exception of applicants from bone densitometry, cabinet radiography, podiatry, dental, bone mineral analyzer and mammography facilities, shall provide a scale

drawing of the room in which the x-ray system is located, or provide measurements from the radiation source to the surrounding barrier surfaces. The drawing shall denote the type of materials and the thickness (or lead equivalence) of each barrier of the room (walls, ceilings, floors, doors, windows). The drawing shall also denote the type and frequency of occupancy in adjacent areas, including those above and below the x-ray room of concern (e.g., hallways, offices, parking lots, and lavatories). Estimates of workload shall also be provided with the drawing.

**E.** An applicant proposing to use a particle accelerator for medical purposes shall not use the particle accelerator until the Agency inspection required in R12-1-914 has been completed.

**Historical Note**

Former Rule Section B.4. Former Section R12-1-204 repealed, new Section R12-1-204 adopted effective June 30, 1977 (Supp. 77-3). Former Section R12-1-202 repealed, former Section R12-1-204 renumbered as R12-1-202 and amended effective November 22, 1988 (Supp. 88-4). 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 June 11, 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. 4302, effective November 14, 2003 (Supp. 03-3).

**R12-1-203. Application for Registration of Servicing and Installation**

**A.** Each person who is engaged in the business of installing or offering to install radiation machines shall apply for registration. For purposes of this Chapter, install includes selling and servicing, or offering to sell or service, x-ray machines in Arizona.

**B.** The applicant shall complete the application for registration on forms that request information required by A.R.S. § 30-672.01, provided by the Agency.

**Historical Note**

Former Rule Section B.5. Former Section R12-1-205 repealed, new Section R12-1-205 adopted effective June 30, 1977 (Supp. 77-3). Former Section R12-1-205 renumbered as R12-1-203 and amended effective November 22, 1988 (Supp 88-4). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

**R12-1-204. Issuance of Notice of Registration**

**A.** Upon determining that the application meets the requirements of the Act and this Article, the Agency shall issue a Notice of Registration.

**B.** All radiation machines located at the same facility may be registered using one Notice of Registration.

**Historical Note**

Former Rule Section B.6. Former Section R12-1-206 repealed, new Section R12-1-206 adopted effective June 30, 1977 (Supp. 77-3). Former Section R12-1-206 renumbered as R12-1-204 and amended effective November 22, 1988 (Supp. 88-4). Amended effective January 2, 1996 (Supp. 96-1). Amended effective June 13, 1997 (Supp. 97-2).

**R12-1-205. Expiration of Notice of Registration or Certification**

**A.** Except as provided in subsection (B), a Notice of Registration, issued according to R12-1-204, or a certificate issued according to R12-1-208, expires at the end of the day on the expiration date stated in the Notice of Registration or certificate.

**B.** If an application for renewal is filed by the registrant or certificate holder not less than 30 days prior to the expiration of the Notice of Registration or certificate, the Notice of Registration or certificate does not expire until a final determination is made by the Agency on the renewal application.

**Historical Note**

Former Rule Section B.7. Former Section R12-1-207 repealed, new Section R12-1-207 adopted effective June 30, 1977 (Supp. 77-3). Former Section R12-1-207 renumbered as R12-1-205 and amended effective November 22, 1988 (Supp. 88-4). Amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

**R12-1-206. Assembly, Installation, Removal from Service, and Transfer**

**A.** A person who assembles, or installs ionizing radiation machines in this state shall notify the Agency in writing within 15 days of:

1. The name and address of the person possessing the machine that was assembled or installed;
2. The manufacturer, model, and serial number of each radiation machine with the tube housing model number and serial number, maximum kVp, and maximum mA, assembled or installed; and
3. The date each machine was assembled or installed, or the first clinical procedure is performed.

**B.** Any person who possesses a radiation machine registered by the Agency shall notify the Agency within 15 days of the machine being taken out of service. The written notification shall contain the name and address of the person receiving the machine, if it is sold, leased, or transferred to another person; the manufacturer, model, and serial number of the machine; and the date the machine was taken out of service.

**C.** In the case of diagnostic x-ray systems that contain certified components, an assembler shall, within 15 days following completion of the assembly, submit to the Agency a copy of the assembler's report (FDA Report No. 2579) prepared in compliance with requirements in 21 CFR 1020.30(d), revised April 1, 2008, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments. The report shall suffice in lieu of any other report by the assembler, if it contains the information required in subsection (A).

**D.** A person shall not make, sell, lease, transfer, lend, assemble, service, or install radiation machines or the supplies used in connection with radiation machines unless the supplies and equipment when properly placed in operation and used, meet the requirements of these rules.

**Historical Note**

Adopted effective June 30, 1977 (Supp. 77-3). Former Section R12-1-209 renumbered as Section R12-1-206 and amended effective November 22, 1988 (Supp. 88-4). 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. 4302, effective November 14, 2003 (Supp. 03-3). 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).

**R12-1-207. Reciprocal Recognition of Out-of-state Radiation Machines**

**A.** If any radiation machine is to be brought into the state for temporary use, the person proposing to bring the radiation machine into the state shall provide written notice to the Agency at least three working days before the radiation machine is to be used in the state. The notice shall include the type of radiation machine; the nature, duration, and scope of use; and the exact location where the radiation machine is to be used. If, for a specific case, the three working-day period would impose an undue hardship, the person may upon application to the Agency, obtain permission to proceed sooner.

**B.** In addition, the owner of the radiation machine and the person possessing the machine while in the state shall:
1. Comply with all applicable rules of the Agency;
2. Upon request, supply the Agency with a copy of the machine's registration and other information regarding the safe operation of the machine while it is in the state; and
3. Upon request, supply the Agency with the work authorization from the Agency, machine registration, operating and emergency procedures, utilization log, survey instrument and associated calibration record, and training records for all users.

**C.** A radiation machine shall not be operated within the state on a temporary basis in excess of 180 calendar days per year.

**Historical Note**
Adopted effective June 30, 1977 (Supp. 77-3). Former Section R12-1-210 renumbered as Section R12-1-207 and amended effective November 22, 1988 (Supp. 88-4). Amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

**R12-1-208. Certification of Mammography Facilities**

An applicant seeking certification of a facility according to A.R.S. § 30-672(J) shall:
1. Provide evidence with the application that a quality assurance program has been established and is in use under R12-1-614(B)(1) and (2),
2. Provide evidence with the application that physicians reading mammographic images have the training and experience required in A.R.S. § 32-2842, and
3. Provide evidence with the application that physicians reading mammographic images have met the minimum criteria established by their respective licensing boards, as required in A.R.S. § 32-2842(C).

**Historical Note**
Adopted effective June 30, 1977 (Supp. 77-3). Repealed effective November 22, 1988 (Supp. 88-4). New Section adopted effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). Corrected subsection (1) by adding reference to R12-1-614(B)(1) and (2), which was inadvertently omitted in 03-3 rulemaking (Supp. 14-1).

**R12-1-209. Notifications**

**A.** A registrant shall notify the Agency within 30 days of any change to the information contained in the notice of registration or a certificate issued according to R12-1-208.

**B.** A person who possesses a radiation machine registered by the Agency shall notify the Agency within 15 days if the machine is discarded or transferred to another person. In the notice, the person shall provide the name and address of the person who receives the machine, if it is sold, leased, or transferred to another person; the manufacturer, model, and serial number of the machine; and the date the machine was taken out of service.

**Historical Note**
Adopted effective January 2, 1996 (Supp. 96-1). Section repealed; new Section made by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**Appendix A. Application Information**

An application shall contain the following information as required in R12-1-202(B), before a registration will be issued. The Agency shall provide an application form to an applicant with a guide, if available, or shall assist the applicant to ensure that only correct information is provided on the application.

| | |
|---|---|
| Name and mailing address of applicant | Use location |
| Person responsible for radiation safety program | Telephone number |
| Type of facility | Facility subtype |
| Legal structure and ownership | Signature of certifying agent |
| Radiation machine information | Equipment identifiers |
| Shielding information | Scale drawing, if applicable |
| Equipment operator instructions and restrictions | Physicist name and training, if applicable |
| Classification of professional in charge | |
| Record of calibration for therapy units | Type of request: amendment, new, or renewal |
| Protection survey results, if applicable | |
| Type of industrial radiography program, if applicable | |
| Radiation Safety Officer name, if applicable | Contact person |
| Other registration requirements listed in Articles 2, 6, 8, 9, and 11 | Appropriate fee listed in Article 13 schedule |

**Historical Note**
Appendix repealed; new Appendix made 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. 4302, effective November 14, 2003 (Supp. 03-3). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

**ARRA-4. Repealed**

**Historical Note**
Appendix A, Form ARRA-4 adopted effective November 22, 1988 (Supp. 88-4). Appendix A, Form ARRA-4 repealed, new Form ARRA-4 adopted effective April 17, 1996 (Supp. 96-2). Repealed by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

**ARRA-4X. Repealed**

**Historical Note**
Form ARRA-4X adopted effective April 17, 1996 (Supp.

96-2). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Repealed by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

**ARRA-4XT. Repealed**

**Historical Note**
Form ARRA-4XT adopted effective April 17, 1996 (Supp. 96-2). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Repealed by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

**ARRA-4PAT. Repealed**

**Historical Note**
Form ARRA-4PAT adopted effective April 17, 1996 (Supp. 96-2). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Repealed by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

**ARRA-4IG. Repealed**

**Historical Note**
Form ARRA-4IG adopted effective April 17, 1996 (Supp. 96-2). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Repealed by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

**ARRA-4IR. Repealed**

**Historical Note**
Form ARRA-4IR adopted effective April 17, 1996 (Supp. 96-2). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Repealed by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

**ARRA-4PAR. Repealed**

**Historical Note**
Form ARRA-PAR adopted effective April 17, 1996 (Supp. 96-2). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Repealed by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

**ARRA-4PA. Repealed**

**Historical Note**
Form ARRA-4PA adopted effective April 17, 1996 (Supp. 96-2). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2).

**ARRA-13. Repealed**

**Historical Note**
Form ARRA-13 adopted effective April 17, 1996 (Supp. 96-2). Repealed by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

**ARRA-1004. Repealed**

**Historical Note**
Form ARRA-1004 adopted effective April 17, 1996 (Supp. 96-2). Repealed by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

**ARRA-1005. Repealed**

**Historical Note**
Form ARRA-1005 adopted effective April 17, 1996 (Supp. 96-2). Repealed by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

**ARRA-1030. Repealed**

**Historical Note**
Form ARRA-1030 adopted effective April 17, 1996 (Supp. 96-2). Repealed by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

**ARRA-1050. Repealed**

**Historical Note**
Form ARRA-1050 adopted effective April 17, 1996 (Supp. 96-2). Repealed by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

**ARRA-1070. Repealed**

**Historical Note**
Form ARRA-1070 adopted effective April 17, 1996 (Supp. 96-2). Repealed by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

**ARRA-1090. Repealed**

**Historical Note**
Form 1090 adopted effective April 17, 1996 (Supp. 96-2). Repealed by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

## 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, provided that the glaze contains not more than 20 percent source material by weight;
   b. Glassware, 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 1, 2009 (Supp. 09-2).

**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 standard-

ization, 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, produce, initially transfer for sale or distribution self-luminous products containing tritium, krypton-85, or promethium-147, and except as provided in paragraph (c) of this subsection, 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.

b. Any person who desires to manufacture, process, or produce, or initially transfer for sale or distribution self-luminous products containing tritium, krypton-85, or promethium-147 for use under paragraph (a) of this subsection, should apply for a license described in R12-1-311.

c. The exemption in paragraph (a) of this subsection does not apply to tritium, krypton-85, or promethium-147 used in products for primarily frivolous purposes or in toys or adornments.

d. 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 material

a. Except for persons who manufacture, process, produce, or initially transfer for sale or distribution 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. Any person who desires to manufacture, process, or produce gas and aerosol detectors containing byproduct material, or to initially transfer such products for use under paragraph (a) of this subsection, should apply for a license described in R12-1-311.

c. 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.

**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 incorpora-

tion 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). Amended by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

**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.** 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 (A)(4)(k).
3. A general license in subsection (A)(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 (A)(1) or through a transfer made under subsection (A)(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 (A)(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 (A)(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 (A)(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 (A)(4)(g), transfer to another general licensee as authorized in subsection (A)(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 (A)(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 (A)(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 (A)(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 (A)(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 (A)(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 (A)(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 addi-

tion, a general licensee holding devices meeting the criteria of subsection (A)(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 (A)(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 (A)(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 (A)(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 (A)(4)(o).
6. The general license granted under subsection (A)(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 (A)(1) does not authorize the manufacture or import of devices containing byproduct material.

**B.** 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 (B)(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.

**C.** 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 (C)(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 (C) or (C)(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 (C) or (C)(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 calibration 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 (C) or (C)(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 (C) or (C)(1) does not authorize the manufacture or export of calibration or reference sources that contain americium-241, plutonium, or radium-226.

**D.** 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 (D)(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.

**E.** 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 lab-

oratory, 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 (E).
   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 (E)(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 (E)(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 (E) 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 (E):
   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 (E)(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 (E), a licensed veterinary care facility is considered a "clinical laboratory."

**F.** 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 (F):

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.

**G.** This subsection grants a general license that authorizes a person to acquire, receive, possess, use, or transfer, in accordance with the provisions of subsections (H) and (I), 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.

**H.** Persons who acquire, receive, possess, use, or transfer byproduct material under the general license issued in subsection (G) 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 (G):

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.

**I.** The general license in subsection (G) 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). Amended by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

**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 revised January 1, 2015, 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.

**H.** A certificate holder or licensee who no longer manufactures or initially transfers any of the sealed source(s) or device(s) covered by a particular certificate issued with the Agency, NRC, or with an Agreement State shall request inactivation of the registration or license with the Agency, NRC, or with an Agreement State program that the device is currently registered by in accordance with 10 CFR 32.211 revised January 1, 2015, incorporated by reference, and available under R12-1-101. This incorporated material 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 R12-1-308 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). Amended by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

**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(A).

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(A) 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.

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

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(A), 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(A), 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(A),
      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 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(A), and all receipts of devices from persons licensed under R12-1-306(A) 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(A), 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(A) 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(A).

**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(B), 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, 2015, 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(C) 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, 2015, 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(D) if:
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, 2015, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

**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(E) 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(F) 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, 2015, 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, 2015, 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). Amended by final rulemaking at 22 A.A.R. 603, effective February 2, 2016; correction made to subsection R12-1-311(D)(2) removing (a) and (b) to reflect renumbering scheme as submitted in Supp. 09-2 (Supp. 16-1).

**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. An application for transfer of license must include:
1. The identity, technical and financial qualifications of the proposed transferee; and
2. Financial assurance for decommissioning information required by R12-1-323.

**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 license issued pursuant to the rules in Articles 3, 5, 7, and 15 of this Chapter shall be deemed to contain the provisions set forth in the Act, whether or not these provisions are expressly set forth in the license.

**E.** The Agency may incorporate, in any license issued pursuant to the rules in this Chapter, at the time of issuance, or thereafter by appropriate rule, regulation or order, such additional requirements and conditions with respect to the licensee's receipt, possession, use and transfer of byproduct material as it deems appropriate or necessary in order to:
1. Promote the common defense and security;
2. Protect health or to minimize danger to life or property;
3. Protect restricted data; or
4. Require such reports and the keeping of such records, and to provide for such inspections of activities under the license as may be necessary or appropriate to effectuate the purposes of the Act and rules thereunder.

**F.** Licensees required to submit emergency plans in accordance with R12-1-322 shall follow the emergency plan approved by the Agency. The licensee may change the approved plan without Agency approval only if the changes do not reduce the commitment of the plan. The licensee shall furnish the change to the Agency and to affected offsite response organizations within six months after the change is made. Proposed changes that reduce, or potentially reduce, the commitment of the approved emergency plan may not be implemented without prior application to and prior approval by the Agency.

**G.** Each person licensed under this Section and each general licensee that is required to register under R12-1-306(A)(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.

**H.** 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.

**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). Amended by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

**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(A)(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(A)(1), 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). Amended by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

**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, 2015, 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. An adequate contingency factor.

2. Identification of and justification for using the key assumptions contained in the DCE;
3. A description of the method of assuring funds for decommissioning from subsection (F), including means for adjusting cost estimates and associated funding levels periodically over the life of the facility;
4. A certification by the licensee that financial assurance for decommissioning has been provided in the amount of the cost estimate for decommissioning; and
5. 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, 2015, 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, 2015, 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, 2015, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

**F.** Each person licensed under this Article shall keep records of information important to the decommissioning of a facility in an identified location until the site is released for unrestricted use. Before licensed activities are transferred or assigned in accordance with R12-1-318, licensees shall transfer all records described in this paragraph to the new licensee. In this case, the new licensee will be responsible for maintaining these records until the license is terminated. If records important to the decommissioning of a facility are kept for other purposes, reference to these records and their locations may be used. Information the Agency considers important to decommissioning consists of:

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

mation on identification of involved nuclides, quantities, forms, and concentrations.

2. As-built drawings and modifications of structures and equipment in restricted areas where radioactive materials are used and/or stored, and of locations of possible inaccessible contamination such as buried pipes which may be subject to contamination. If required drawings are referenced, each relevant document need not be indexed individually. If drawings are not available, the licensee shall substitute appropriate records of available information concerning these areas and locations.
3. Except for areas containing depleted uranium used only for shielding or as penetrators in unused munitions, a list contained in a single document and updated every 2 years, of the following:
   a. All areas designated and formerly designated as restricted areas as defined under R12-1-102;
   b. All areas outside of restricted areas that require documentation under R12-1-323(F)(1);
   c. All areas outside of restricted areas where current and previous wastes have been buried as documented under R12-1-441; and
   d. All areas outside of restricted areas that contain material such that, if the license expired, the licensee would be required to either decontaminate the area to meet the criteria for decommissioning in R12-1-451, or R12-1-452; or apply for approval for disposal under R12-1-435.
4. Records of the cost estimate performed for the decommissioning funding plan or of the amount certified for decommissioning, and records of the funding method used for assuring funds if either a funding plan or certification is used.

**G.** In providing financial assurance under this section, each licensee shall use the financial assurance funds only for decommissioning activities and each licensee shall monitor the balance of funds held to account for market variations. The licensee shall replenish the funds, and report such actions to the Agency, as follows:

1. If, at the end of a calendar quarter, the fund balance is below the amount necessary to cover the cost of decommissioning, but is not below 75 percent of the cost, the licensee shall increase the balance to cover the cost, and shall do so within 30 days after the end of the calendar quarter.
2. If, at any time, the fund balance falls below 75 percent of the amount necessary to cover the cost of decommissioning, the licensee shall increase the balance to cover the cost, and shall do so within 30 days of the occurrence.
3. Within 30 days of taking the actions required by subsection (G)(1) or (G)(2), the licensee shall provide a written report of such actions to the Director of the Agency, and state the new balance of the fund.

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

1. Prepayment. Prepayment is the deposit before the start of operation into an account segregated from licensee assets and outside the licensee's administrative control of cash or liquid assets such that the amount of funds would be sufficient to pay decommissioning costs. Prepayment must be made into a trust account, and the trustee and the trust must be acceptable to the Agency.
2. A surety method, insurance, or other guarantee method. These methods guarantee that decommissioning costs will be paid. A surety method may be in the form of a surety bond, or letter of credit. A parent company guarantee of funds for decommissioning costs based on a financial test may be used if the guarantee and test are approved by the Agency. For commercial corporations that issue bonds, a guarantee of funds by the applicant or licensee for decommissioning costs based on a financial test may be used if the guarantee and test are approved by the Agency. For commercial companies that do not issue bonds, a guarantee of funds by the applicant or licensee for decommissioning costs may be used if the guarantee and test are approved by the Agency. For nonprofit entities, such as colleges, universities, and nonprofit hospitals, a guarantee of funds by the applicant or licensee may be used if the guarantee and test are approved by the Agency. Except for an external sinking fund, a parent company guarantee or a guarantee by the applicant or licensee may not be used in combination with any other financial methods used to satisfy the requirements of this section. A guarantee by the applicant or licensee may not be used in any situation where the applicant or licensee has a parent company holding majority control of the voting stock of the company. Any surety method or insurance used to provide financial assurance for decommissioning must contain the following conditions:
   a. The surety method or insurance must be open-ended or, if written for a specified term, such as five years, must be renewed automatically unless 90 days or more prior to the renewal date, the issuer notifies the Agency, the beneficiary, and the licensee of its intention not to renew. The surety method or insurance must also provide that the full face-value amount be paid to the beneficiary automatically prior to the expiration without proof of forfeiture if the licensee fails to provide a replacement acceptable to the Agency within 30 days after receipt of notification of cancellation.
   b. The surety method or insurance must be payable to a trust established for decommissioning costs. The trustee and trust must be acceptable to the Agency. An acceptable trustee includes an appropriate State or Federal government agency or an entity which has the authority to act as a trustee and whose trust operations are regulated and examined by a Federal or State agency.
   c. The surety method or insurance must remain in effect until the Agency has terminated the license.
3. An external sinking fund in which deposits are made at least annually, coupled with a surety method, insurance, or other guarantee method, the value of which may reduce by the amount being accumulated in the sinking fund. An external sinking fund is a fund established and maintained by setting aside funds periodically in an account segregated from licensee assets and outside the licensee's administrative control in which the total amount of funds would be sufficient to pay decommissioning costs at the time termination of operation is expected. An external sinking fund must be in the form of a trust. If the other guarantee method is used, no surety or

insurance may be combined with the external sinking fund. The surety, insurance, or other guarantee provisions must be as stated in subsection (H)(2).

4. In the case of Federal, State, or local government licensees, a statement of intent containing a cost estimate for decommissioning, and indicating that funds for decommissioning will be obtained when necessary.
5. When a governmental entity is assuming custody and ownership of a site, an arrangement that is deemed acceptable by such governmental entity.

**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). Amended by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

**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 ($\mu$Ci/ml)[1]/ | Column II Liquid and Solid Concentration ($\mu$Ci/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.

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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 | Material | Microcuries |
|---|---|---|---|
| Antimony-122 (Sb-122) | 100 | Barium-133 (Ba-133) | 10 |
| Antimony-124 (Sb-124) | 10 | Barium-140 (Ba-140) | 10 |
| Antimony-125 (Sb-125) | 10 | Bismuth-210 (Bi-210) | 1 |
| Arsenic-73 (As-73) | 100 | Bromine-82 (Br-82) | 10 |
| Arsenic-74 (As-74) | 10 | Cadmium-109 (Cd-109) | 10 |
| Arsenic-76 (As-76) | 10 | Cadmium-115m (Cd-115m) | 10 |
| Arsenic-77 (As-77) | 100 | Cadmium-115 (Cd-115) | 100 |
| Barium-131 (Ba-131) | 10 | 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)**

| Radioactive Material | Col. I curies | Col. 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 | Scandium-47 | 10 | 0.1 |
| Iodine-131 | 0.1 | 0.001 | Scandium-48 | 1 | 0.01 |
| Iodine-132 | 10 | 0.1 | Selenium-75 | 1 | 0.01 |
| Iodine-133 | 1 | 0.1 | Silicon-31 | 10 | 0.1 |
| Iodine-134 | 10 | 0.1 | Silver-105 | 1 | 0.01 |
| Iodine-135 | 1 | 0.1 | Silver-110m | 0.1 | 0.001 |
| Iridium-192 | 1 | 0.1 | Silver-111 | 10 | 0.1 |
| Iridium-194 | 10 | 0.1 | Sodium-22 | 0.1 | 0.001 |
| Iron-55 | 10 | 0.1 | Sodium-24 | 1 | 0.01 |
| Iron-59 | 1 | 0.1 | Strontium-85 | 1,000 | 10 |
| Krypton-85 | 100 | 1. | Strontium-85 | 1 | 0.01 |
| Krypton-87 | 10 | 0.1 | Strontium-89 | 1 | 0.01 |
| Lanthanum-140 | 1 | 0.1 | Strontium-90 | 0.01 | 0.0001 |
| Lutetium-177 | 10 | 0.1 | Strontium-91 | 10 | 0.1 |
| Manganese-52 | 1 | 0.1 | Strontium-92 | 10 | 0.1 |
| Manganese-54 | 1 | 0.1 | Sulfur-35 | 100 | 0.1 |
| Manganese-56 | 10 | 0.1 | Tantalum-182 | 1 | 0.01 |
| Mercury-197m | 10 | 0.1 | Technetium-96 | 10 | 0.1 |
| Mercury-197 | 10 | 0.1 | Technetium-97m | 10 | 0.1 |
| Mercury-203 | 1 | 0.1 | Technetium-97 | 10 | 0.1 |
| Molybdenum-99 | 10 | 0.1 | Technetium-99m | 100 | 1. |
| Neodymium-147 | 10 | 0.1 | Technetium-99 | 1 | 0.01 |
| Neodymium-149 | 10 | 0.1 | Tellurium-125m | 1 | 0.01 |
| Nickel-59 | 10 | 0.1 | Tellurium-127m | 1 | 0.01 |
| Nickel-63 | 1 | 0.1 | Tellurium-127 | 10 | 0.1 |
| Nickel-65 | 10 | 0.1 | Tellurium-129m | 1 | 0.01 |
| Niobium-93m | 1 | 0.1 | Tellurium-129 | 100 | 1. |
| Niobium-95 | 1 | 0.1 | Tellurium-131m | 10 | 0.1 |
| Niobium-97 | 100 | 1. | Tellurium-132 | 1 | 0.01 |
| Osmium-185 | 1 | 0.1 | Terbium-160 | 1 | 0.01 |
| Osmium-191m | 100 | 1. | Thallium-200 | 10 | 0.1 |
| Osmium-191 | 10 | 0.1 | Thallium-201 | 10 | 0.1 |
| Osmium-193 | 10 | 0.1 | Thallium-202 | 10 | 0.1 |
| Palladium-103 | 10 | 0.1 | Thallium-204 | 1 | 0.01 |
| Palladium-109 | 10 | 0.1 | Thulium-170 | 1 | 0.01 |
| Phosphorus-32 | 1 | 0.01 | Thulium-171 | 1 | 0.01 |
| Platinum-191 | 10 | 0.1 | Tin-113 | 1 | 0.01 |
| Platinum-193m | 100 | 1. | Tin-125 | 1 | 0.01 |
| Platinum-193 | 10 | 0.1 | Tungsten-181 | 1 | 0.01 |
| Platinum-197m | 100 | 1. | Tungsten-185 | 1 | 0.01 |
| Platinum-197 | 10 | 0.1 | Tungsten-197 | 10 | 0.1 |
| Polonium-210 | 0.01 | 0.0001 | Vanadium-43 | 1 | 0.01 |
| Potassium-42 | 1 | 0.01 | Xenon-131m | 1,000 | 10 |
| Praseodymium-142 | 10 | 0.1 | Xenon-133 | 100 | 1. |
| Praseodymium-143 | 10 | 0.1 | Xenon-135 | 100 | 1. |
| Promethium-147 | 1 | 00.1 | Ytterbium-175 | 10 | 0.1 |
| Promethium-149 | 10 | 0.1 | Yttrium-90 | 1 | 0.01 |
| Radium-226 | 0.01 | 0.0001 | Yttrium-91 | 1 | 0.01 |
| Rhenium-186 | 10 | 0.1 | Yttrium-92 | 10 | 0.1 |
| Rhenium-188 | 10 | 0.1 | Yttrium-93 | 1 | 0.01 |
| Rhodium-103m | 1,000 | 10 | Zinc-65 | 1 | 0.01 |
| Rhodium-105 | 10 | 0.1 | Zinc-69m | 10 | 0.1 |
| Rubidium-86 | 1 | 0.01 | Zinc-69 | 100 | 1. |
| Rubidium-87 | 1 | 0.01 | Zirconium-93 | 1 | 0.01 |
| Ruthenium-97 | 100 | 1. | Zirconium-95 | 1 | 0.01 |
| Ruthenium-103 | 1 | 0.01 | Zirconium-97 | 1 | 0.01 |
| Ruthenium-105 | 10 | 0.1 | Any radioactive material | | |
| Ruthenium-106 | 0.1 | 0.001 | other than source material, | | |
| Samarium-151 | 1 | 0.01 | special nuclear material, | | |
| Samarium-153 | 10 | 0.1 | or alpha emitting radioactive | | |
| Scandium-46 | 1 | 0.01 | 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 noncombustible | .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.

**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.

**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;
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), on Agency Form Z (available from the Agency), in accordance with the instructions for Agency Form Z, or in clear and legible records containing 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.

**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).

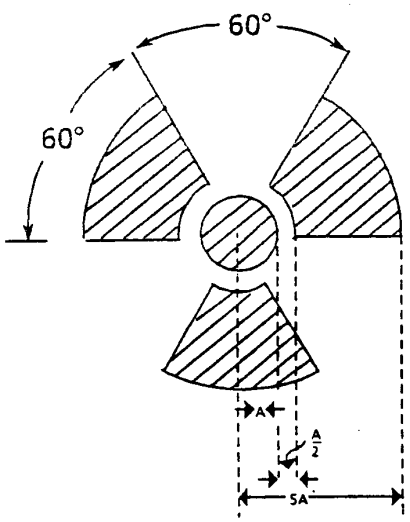
**R12-1-428. Caution Signs**

**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 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 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.

**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 contami-

nant 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/ 100$cm^2$ | 1,000 dpm/100 $cm^2$ |
| Transuranics, Ra-226, Ra-228, Th-230, Pa-231, Ac-227, I-125, I-129 | 100dpm/ 100$cm^2$ | 300 dpm/ 100$cm^2$ | 20dpm/100$cm^2$ |
| Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133 | 1000 dpm/ 100$cm^2$ | 3000 dpm/ 100$cm^2$ | 200 dpm/ 100$cm^2$ |
| Beta-gamma (Exceptions noted above) | 5,000 dpm/100 $cm^2$ | 15,000 dpm/ 100$cm^2$ | 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 pro-

tection 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).

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**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 x $10^{-2}$ or 0.06, 6E+2 represents 6 x $10^{2}$ or 600, and 6E+0 represents 6 x $10^{0}$ 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, $\Sigma$ (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 $2.4 \times 10^9$, 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 $7.3 \times 10^7$. The factor of $7.3 \times 10^7$ (ml) includes the following components: the factors of 50 and 2 described above and a factor of $7.3 \times 10^5$ (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 $7.3 \times 10^6$ (ml). The factor of $7.3 \times 10^6$ (ml) is composed of a factor of $7.3 \times 10^5$ (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 |
| 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 |

| Atomic No. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (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 those given for Y | 4E+4 | 2E+4 | 9E-6 | 3E-8 | 6E-4 | 6E-3 |
| | | Y, oxides, halides, and nitrates | - | 2E+4 | 8E-6 | 3E-8 | - | - |
| 4 | Beryllium-10 | W, see $^{7}$Be | 1E+3 | 2E+2 | 6E-8 | 2E-10 | - | -- |
| | | | LLI wall (1E+3) | - | - | - | 2E-5 | 2E-4 |
| | | Y, see $^{7}$Be | - | 1E+1 | 6E-9 | 2E-11 | - | - |
| 6 | Carbon-11[2] | Monoxide | - | 1E+6 | 5E-4 | 2E-6 | - | - |
| | | Dioxide | - | 6E+5 | 3E-4 | 9E-7 | - | - |
| | | Compounds | 4E+5 | 4E+ 5 | 2E-4 | 6E-7 | 6E-3 | 6E-2 |
| 6 | Carbon-14 | Monoxide | - | 2E+6 | 7E-4 | 2E-6 | - | - |
| | | Dioxide | - | 2E+5 | 9E-5 | 3E-7 | - | - |
| | | Compounds | 2E+3 | 2E+3 | 1E-6 | 3E-9 | 3E-5 | 3E-4 |
| 7 | Nitrogen-13[2] | Submersion[1] | - | - | 4E-6 | 2E-8 | - | - |
| 8 | Oxygen-15[2] | Submersion[1] | - | - | 4E-6 | 2E-8 | - | - |
| 9 | Fluorine-18[2] | D, fluorides of H, Li, Na, K, Rb, Cs, and Fr | 5E+4 | 7E+4 | 3E-5 | 1E-7 | - | - |
| | | | St wall (5E+4) | - | - | - | 7E-4 | 7E-3 |
| | | W, fluorides of Be, Mg, Ca, Sr, Ba, Ra, Al, Ga, In, Tl, As, Sb, Bi, Fe, Ru, Os, Co, Ni, Pd, Pt, Cu, Ag, Au, Zn, Cd, Hg, Sc, Y, Ti, Zr, V, Nb, Ta, Mn, Tc, and Re | - | 9E+4 | 4E-5 | 1E-7 | - | - |
| | | Y, Lanthanum fluoride | - | 8E+-4 | 3E-5 | 1E-7 | - | - |
| 11 | Sodium-22 | D, all compounds | 4E+2 | 6E+2 | 3E-7 | 9E-10 | 6E-6 | 6E-5 |
| 11 | Sodium-24 | D, all compounds | 4E+3 | 5E+3 | 2E-6 | 7E-9 | 5E-5 | 5E-4 |
| 12 | Magnesium-28 | D, all compounds except those given for W | 7E+2 | 2E+3 | 7E-7 | 2E-9 | 9E-6 | 9E-5 |
| | | W, oxides, hydroxides, carbides, halides, and nitrates | - | 1E+3 | 5E-7 | 2E-9 | - | - |
| 13 | Aluminum-26 | D, all compounds except those given for W | 4E+2 | 6E+1 | 3E-8 | 9E-11 | 6E-6 | 6E-5 |
| | | W, oxides, hydroxides, carbides, halides, and nitrates | - | 9E+1 | 4E-8 | 1E-10 | - | - |
| 14 | Silicon-31 | D, all compounds except those given for W and Y | 9E+3 | 3E+4 | 1E-5 | 4E-8 | 1E-4 | 1E-3 |
| | | W, oxides, hydroxides, carbides, and nitrates | - | 3E+4 | 1E-5 | 5E-8 | - | - |
| | | Y, aluminosilicate glass | - | 3E+4 | 1E-5 | 4E-8 | - | - |
| 14 | Silicon-32 | D. see $^{31}$Si | 2E+3 | 2E+2 | 1E-7 | 3E-10 | - | - |
| | | LLI wall | (3E+3) | - | - | - | 4E-5 | 4E-4 |

| | | | | | | |
|---|---|---|---|---|---|---|
| W, see $^{31}$Si | - | 1E+2 | 5E-8 | 2E-10 | - | - |
| Y, see $^{31}$Si | - | 5E+0 | 2E-9 | 7E-12 | - | - |

| Atomic No. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (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 $Zn^{2+}$, $S^{3+}$, $Mg^{2+}$, $Fe^{3+}$, $Bi^{3+}$, and Lanthanides | - | 4E+2 | 2E-7 | 5E-10 | - | - |
| 15 | Phosphorus-33 | D, see $^{32}P$ | 6E+3 | 8E+3 | 4E-6 | 1E-8 | 8E-5 | 8E-4 |
| | | W, see $^{32}P$ | - | 3E+3 | 1E-6 | 4E-9 | - | - |
| 16 | Sulfur-35 | Vapor | 1E+4 | 6E-6 | 2E-8 | - | - | |
| | | D, sulfides and sulfates except those given for W | 1E+4 | 2E+4 | 7E-6 | 2E-8 | - | - |
| | | | LLI wall (8E+3) | - | - | - | 1E-4 | 1E-3 |
| | | W, elemental sulfur, sulfides of Sr, Ba, Ge, Sn, Pb, As, Sb, Bi, Cu, Ag, Au, Zn, Cd, Hg, W, and Mo. Sulfates of Ca, Sr, Ba, Ra, As, Sb, and Bi | 6E+3 - | 2E+3 | 9E-7 | 3E-9 | - | - |
| 17 | Chlorine-36 | D, chlorides of H, Li, Na, K, Rb, Cs, and Fr | 2E+3 | 2E+3 | 1E-6 | 3E-9 | 2E-5 | 2E-4 |
| | | W, chlorides of Lanthanides, Be, Mg, Ca, Sr, Ba, Ra, Al, Ga, In, Tl, Ge, Sn, Pb, As, Sb, Bi, Fe, Ru, Os, Co, Rh, Ir, Ni, Pd, Pt, Cu, Ag, Au, Zn, Cd, Hg, Sc, Y, Ti, Zr, Hf, V, Nb, Ta, Cr, Mo, W, Mn, Tc, and Re | - | 2E+2 | 1E-7 | 3E-10- | - | |
| 17 | Chlorine-38[2] | D, see $^{36}Cl$ | 2E+4 | 4E+4 | 2E-5 | 6E-8- | - | |
| | | | St wall (3E+4) | - | - | -3E-4 | 3E-3 | |
| | | W, see $^{36}Cl$ | - | 5E+4 | 2E-5 | 6E-8- | - | |
| 17 | Chlorine-39[2] | D, see $^{36}Cl$ | 2E+4 | 5E+4 | 2E-5 | 7E-8- | | - |
| | | | St wall (4E+4) | - | - | -5E-4 | 5E-3 | |
| | | W, see $^{36}Cl$ | - | 6E+4 | 2E-5 | 8E-8- | - | |
| 18 | Argon-37 | Submersion[1] | - | - | 1E+0 | 6E-3- | - | |
| 18 | Argon-39 | Submersion[1] | - | - | 2E-4 | 8E-7- | - | |
| 18 | Argon-41 | Submersion[1] | - | - | 3E-6 | 1E-8- | - | |
| 19 | Potassium-40 | D, all compounds | 3E+2 | 4E+2 | 2E-7 | 6E-10 | 4E-6 | 4E-5 |
| 19 | Potassium-42 | D, all compounds | 5E+3 | 5E+3 | 2E-6 | 7E-9 | 6E-5 | 6E-4 |
| 19 | Potassium-43 | D, all compounds | 6E+3 | 9E+3 | 4E-6 | 1E-8 | 9E-5 | 9E-4 |
| 19 | Potassium-44[2] | D, all compounds | 2E+4 | 7E+4 | 3E-5 | 9E-8 | - | - |
| | | | St wall (4E+4) | - | - | - | 5E-4 | 5E-3 |
| 19 | Potassium-45[2] | D, all compounds | 3E+4 | 1E+5 | 5E-5 | 2E-7 | - | - |
| | | | St watt (5E+4) | - | - | - | 7E-4 | 7E-3 |

| Atomic No. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (μCi/ml) |
|---|---|---|---|---|---|---|---|---|
| 20 | Calcium-41 | W, all compounds | 3E+3 | 4E+3 | 2E-6 | - | - | - |
| | | | Bone surf (4E+3) | Bone surf (4E+3) | - | 5E-9 | 6E-5 | 6E-4 |
| 20 | Calcium-45 | W, all compounds | 2E+3 | 8E+2 | 4E-7 | 1E-9 | 2E-5 | 2E-4 |
| 20 | Calcium-47 | W, all compounds | 8E+2 | 9E+2 | 4E-7 | 1E-9 | 1E-5 | 1E-4 |
| 21 | Scandium-43 | Y, all compounds | 7E+3 | 2E+4 | 9E-6 | 3E-8 | 1E-4 | 1E-3 |
| 21 | Scandium-44m | Y, all compounds | 5E+2 | 7E+2 | 3E-7 | 1E-9 | 7E-6 | 7E-5 |
| 21 | Scandium-44 | Y, all compounds | 4E+3 | 1E+4 | 5E-6 | 2E-8 | 5E-5 | 5E-4 |
| 21 | Scandium-46 | Y, all compounds | 9E+2 | 2E+2 | 1E-7 | 3E-10 | 1E-5 | 1E-4 |
| 21 | Scandium-47 | Y, all compounds | 2E+3 | 3E+3 | 1E-6 | 4E-9 | - | - |
| | | | LLI wall (3E+3) | - | - | - | 4E-5 | 4E-4 |
| 21 | Scandium-48 | Y, all compounds | 8E+2 | 1E+3 | 6E-7 | 2E-9 | 1E-5 | 1E-4 |
| 21 | Scandium-49[2] | Y, all compounds | 2E+4 | 5E+4 | 2E-5 | 8E-8 | 3E-4 | 3E-3 |
| 22 | Titanium-44 | D, all compounds except those given for W and Y | 3E+2 | 1E+1 | 5E-9 | 2E-11 | 4E-6 | 4E-5 |
| | | W, oxides, hydroxides, carbides, halides, and nitrates | - | 3E+1 | 1E-8 | 4E-11 | - | - |
| | | Y, SrTiO | - | 6E+0 | 2E-9 | 8E-12 | - | - |
| 22 | Titanium-45 | D, see $^{44}$Ti | 9E+3 | 3E+4 | 1E-5 | 3E-8 | 1E-4 | 1E-3 |
| | | W, see $^{44}$Ti | - | 4E+4 | 1E-5 | 5E-8 | - | - |
| | | Y, see $^{44}$Ti | - | 3E+4 | 1E-5 | 4E-8 | - | - |
| 23 | Vanadium-47[2] | D, all compounds except those given for W | 3E+4 | 8E+4 | 3E-5 | 1E-7 | - | - |
| | | | St wall (3E+4) | - | - | - | 4E-4 | 4E-3 |
| | | W, oxides, hydroxides, carbides, and halides | - | 1E+5 | 4E-5 | 1E-7 | - | - |
| 23 | Vanadium-48 | D, see $^{47}$V | 6E+2 | 1E+3 | 5E-7 | 2E-9 | 9E-6 | 9E-5 |
| | | W, see $^{47}$V | - | 6E+2 | 3E-7 | 9E-10 | - | - |
| 23 | Vanadium-49 | D, see $^{47}$V | 7E+4 | 3E+4 | 1E-5 | - | - | - |
| | | | LLI wall (9E+4) | Bone surf (3E+4) | - | 5E-8 | 1E-3 | 1E-2 |
| | | W, see $^{47}$V | - | 2E+4 | 8E-6 | 2E-8 | - | - |
| 24 | Chromium-48 | D, all compounds except those given for W and Y | 6E+3 | 1E+4 | 5E-6 | 2E-8 | 8E-5 | 8E-4 |
| | | W, halides and nitrates | - | 7E+3 | 3E-6 | 1E-8 | - | - |
| | | Y, oxides and hydroxides | - | 7E+3 | 3E-6 | 1E-8 | - | - |
| 24 | Chromium-49[2] | D, see $^{48}$Cr | 3E+4 | 8E+4 | 4E-5 | 1E-7 | 4E-4 | 4E-3 |
| | | W, see $^{48}$Cr | - | 1E+5 | 4E-5 | 1E-7 | - | - |
| | | Y, see $^{48}$Cr | - | 9E+4 | 4E-5 | 1E-7 | - | - |
| 24 | Chromium-51 | D, see $^{48}$Cr | 4E+4 | 5E+4 | 2E-5 | 6E-8 | 5E-4 | 5E-3 |
| | | W, see $^{48}$Cr | - | 2E+4 | 1E-5 | 3E-8 | - | - |
| | | Y, see $^{48}$Cr | - | 2E+4 | 8E-6 | 3E-8 | - | - |
| 25 | Manganese-51[2] | D, all compounds except those given for W | 2E+4 | 5E+4 | 2E-5 | 7E-8 | 3E-4 | 3E-3 |
| | | W, oxides, hydroxides, halides, and nitrates | - | 6E+4 | 3E-5 | 8E-8 | - | - |

| Atomic No. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (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 compounds except those given for Y | 1E+3 | 3E+3 | 1E-6 | 4E-9 | 2E-5 | 2E-4 |
| | | Y, oxides, hydroxides, halides, and nitrates | - | 3E+3 | 1E-6 | 4E-9 | - | - |
| 27 | Cobalt-56 | W, see $^{55}$Co | 5E+2 | 3E+2 | 1E-7 | 4E-10 | 6E-6 | 6E-5 |
| | | Y, see $^{55}$Co | 4E+2 | 2E+2 | 8E-8 | 3E-10 | - | - |
| 27 | Cobalt-57 | W, see $^{55}$Co | 8E+3 | 3E+3 | 1E-6 | 4E-9 | 6E-5 | 6E-4 |
| | | Y, see $^{55}$Co | 4E+3 | 7E+2 | 3E-7 | 9E-10 | - | - |
| 27 | Cobalt-58m | W, see $^{55}$Co | 6E+4 | 9E+4 | 4E-5 | 1E-7 | 8E-4 | 8E-3 |
| | | Y, see $^{55}$Co | - | 6E+4 | 3E-5 | 9E-8 | - | - |
| 27 | Cobalt-58 | W, see $^{55}$Co | 2E+3 | 1E+3 | 5E-7 | 2E-9 | 2E-5 | 2E-4 |
| | | Y, see $^{55}$Co | 1E+3 | 7E+2 | 3E-7 | 1E-9 | - | - |
| 27 | Cobalt-60m[2] | W, see $^{55}$Co | 1E+6 | 4E+6 | 2E-3 | 6E-6 | - | - |
| | | | St wall (1E+6) | - | - | - | 2E-2 | 2E-1 |
| | | Y, see $^{55}$Co | - | 3E+6 | 1E-3 | 4E-6 | - | - |
| 27 | Cobalt-60 | W, see $^{55}$Co | 5E+2 | 2E+2 | 7E-8 | 2E-10 | 3E-6 | 3E-5 |
| | | Y, see $^{55}$Co | 2E+2 | 3E+1 | 1E-8 | 5E-11 | - | - |
| 27 | Cobalt-61[2] | W, see $^{55}$Co | 2E+4 | 6E+4 | 3E-5 | 9E-8 | 3E-4 | 3E-3 |
| | | Y, see $^{55}$Co | 2E+4 | 6E+4 | 2E-5 | 8E-8 | - | - |

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

| Atomic No. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (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. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (μCi/ml) |
|---|---|---|---|---|---|---|---|---|
| | | W, Bromides of lanthanides, Be, Mg, Ca, Sr, Ba, Ra, Al, Ga, In, Tl, Ge, Sn, Pb, As, Sb, Bi, Fe, Ru, Os, Co, Rh, Ir, Ni, Pd, Pt, Cu, Ag, Au, Zn, Cd, Hg, Sc, Y, Ti, Zr, Hf, V, Nb, Ta, Mn, Tc, and Re | - | 4E+4 | 2E-5 | 6E-8 | - | - |
| 35 | Bromine-74[2] | D, see $^{74m}$Br | 2E+4 | 7E+4 | 3E-5 | 1E-7 | - | - |
| | | | St wall (4E+4) | - | - | - | 5E-4 | 5E-3 |
| | | W, see $^{74m}$Br | - | 8E+4 | 4E-5 | 1E-7 | - | - |
| 35 | Bromine-75[2] | D, see $^{74m}$Br | 3E+4 | 5E+4 | 2E-5 | 7E-8 | - | - |
| | | | St wall (4E+4) | - | - | - | 5E-4 | 5E-3 |
| | | W, see $^{74m}$Br | - | 5E+4 | 2E-5 | 7E-8 | - | - |
| 35 | Bromine-76 | D, see $^{74m}$Br | 4E+3 | 5E+3 | 2E-6 | 7E-9 | 5E-5 | 5E-4 |
| | | W, see $^{74m}$Br | - | 4E+3 | 2E-6 | 6E-9 | - | - |
| 35 | Bromine-77 | D, see $^{74m}$Br | 2E+4 | 2E+4 | 1E-5 | 3E-8 | 2E-4 | 2E-3 |
| | | W, see $^{74m}$Br | - | 2E+4 | 8E-6 | 3E-8 | - | - |
| 35 | Bromine-80m | D, see $^{74m}$Br | 2E+4 | 2E+4 | 7E-6 | 2E-8 | 3E-4 | 3E-3 |
| | | W, see $^{74m}$Br | - | 1E+4 | 6E-6 | 2E-8 | - | - |
| 35 | Bromine-80[2] | D, see $^{74m}$Br | 5E+4 | 2E+5 | 8E-5 | 3E-7 | - | - |
| | | | St wall (9E+4) | - | - | - | 1E-3 | 1E-2 |
| | | W, see $^{74m}$Br | - | 2E+5 | 9E-5 | 3E-7 | - | - |
| 35 | Bromine-82 | D, see $^{74m}$Br | 3E+3 | 4E+3 | 2E-6 | 6E-9 | 4E-5 | 4E-4 |
| | | W, see $^{74m}$Br | - | 4E+3 | 2E-6 | 5E-9 | - | - |
| 35 | Bromine-83 | D, see $^{74m}$Br | 5E+4 | 6E+4 | 3E-5 | 9E-8 | - | - |
| | | | St wall (7E+4) | - | - | - | 9E-4 | 9E-3 |
| | | W, see $^{74m}$Br | - | 6E+4 | 3E-5 | 9E-8 | - | - |
| 35 | Bromine-84[2] | D, see $^{74m}$Br | 2E+4 | 6E+4 | 2E-5 | 8E-8 | - | - |
| | | | St wall (3E+4) | - | - | - | 4E-4 | 4E-3 |
| | | W, see $^{74m}$Br | - | 6E+4 | 3E-5 | 9E-8 | - | - |
| 36 | Krypton-74[2] | Submersion[1] | - | - | 3E-6 | 1E-8 | - | - |
| 36 | Krypton-76 | Submersion[1] | - | - | 9E-6 | 4E-8 | - | - |
| 36 | Krypton-77[2] | Submersion[1] | - | - | 4E-6 | 2E-8 | - | - |
| 36 | Krypton-79 | Submersion[1] | - | - | 2E-5 | 7E-8 | - | - |
| 36 | Krypton-81 | Submersion[1] | - | - | 7E-4 | 3E-6 | - | - |
| 36 | Krypton-83m[2] | Submersion[1] | - | - | 1E-2 | 5E-5 | - | - |
| 36 | Krypton-85m | Submersion[1] | - | - | 2E-5 | 1E-7 | - | - |
| 36 | Krypton-85 | Submersion[1] | - | - | 1E-4 | 7E-7 | - | - |
| 36 | Krypton-87[2] | Submersion[1] | - | - | 5E-6 | 2E-8 | - | - |
| 36 | Krypton-88 | Submersion[1] | - | - | 2E-6 | 9E-9 | - | - |

| Atomic No. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (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 | D, all compounds | 4E+4 | 5E+4 | 2E-5 | 7E-8 | 5E-4 | 5E-3 |
| 37 | Rubidium 82m | D, all compounds | 1E+4 | 2E+4 | 7E-6 | 2E-8 | 2E-4 | 2E-3 |
| 37 | Rubidium-83 | D, all compounds | 6E+2 | 1E+3 | 4E-7 | 1E-9 | 9E-6 | 9E-5 |
| 37 | Rubidium-84 | D, all compounds | 5E+2 | 8E+2 | 3E-7 | 1E-9 | 7E-6 | 7E-5 |
| 37 | Rubidium-86 | D, all compounds | 5E+2 | 8E+2 | 3E-7 | 1E-9 | 7E-6 | 7E-5 |
| 37 | Rubidium-87 | D, all compounds | 1E+3 | 2E+3 | 6E-7 | 2E-9 | 1E-5 | 1E-4 |
| 37 | Rubidium-88[2] | D, all compounds | 2E+4 | 6E+4 | 3E-5 | 9E-8 | - | - |
| | | | St wall (3E+4) | - | - | - | 4E-4 | 4E-3 |
| 37 | Rubidium-89[2] | D, all compounds | 4E+4 | 1E+5 | 6E-5 | 2E-7 | - | - |
| | | | St wall (6E+4) | - | - | - | 9E-4 | 9E-3 |
| 38 | Strontium-80[2] | D, all soluble compounds except SrTi0 | 4E+3 | 1E+4 | 5E-6 | 2E-8 | 6E-5 | 6E-4 |
| | | Y, all insoluble compounds and SrTi0 | - | 1E+4 | 5E-6 | 2E-8 | - | - |
| 38 | Strontium-81[2] | D, see $^{80}$Sr | 3E+4 | 8E+4 | 3E-5 | 1E-7 | 3E-4 | 3E-3 |
| | | Y, see $^{80}$Sr | 2E+4 | 8E+4 | 3E-5 | 1E-7 | - | - |
| 38 | Strontium-82 | D, see $^{80}$Sr | 3E+2 | 4E+2 | 2E-7 | 6E-10 | - | - |
| | | | LLI wall (2E+2) | - | - | - | 3E-6 | 3E-5 |
| | | Y, see $^{80}$Sr | 2E+2 | 9E+1 | 4E-8 | 1E-10 | - | - |
| 38 | Strontium-83 | D, see $^{80}$Sr | 3E+3 | 7E+3 | 3E-6 | 1E-8 | 3E-5 | 3E-4 |
| | | Y, see $^{80}$Sr | 2E+3 | 4E+3 | 1E-6 | 5E-9 | - | - |
| 38 | Strontium-85m[2] | D, see $^{80}$Sr | 2E+5 | 6E+5 | 3E-4 | 9E-7 | 3E-3 | 3E-2 |
| | | Y, see $^{80}$Sr | - | 8E+5 | 4E-4 | 1E-6 | - | - |
| 38 | Strontium-85 | D, see $^{80}$Sr | 3E+3 | 3E+3 | 1E-6 | 4E-9 | 4E-5 | 4E-4 |
| | | Y, see $^{80}$Sr | - | 2E+3 | 6E-7 | 2E-9 | - | - |
| 38 | Strontium-87m | D, see $^{80}$Sr | 5E+4 | 1E+5 | 5E-5 | 2E-7 | 6E-4 | 6E-3 |
| | | Y, see $^{80}$Sr | 4E+4 | 2E+5 | 6E-5 | 2E-7 | - | - |
| 38 | Strontium-89 | D, see $^{80}$Sr | 6E+2 | 8E+2 | 4E-7 | 1E-9 | - | - |
| | | | LLI wall (6E+2) | - | - | - | 8E-6 | 8E-5 |
| | | Y, see $^{80}$Sr | 5E+2 | 1E+2 | 6E-8 | 2E-10 | - | - |
| 38 | Strontium-90 | D, see $^{80}$Sr | 3E+1 | 2E+1 | 8E-9 | - | - | - |
| | | | Bone surf (4E+1) | Bone surf (2E+1) | - | 3E-11 | 5E-7 | 5E-6 |
| | | 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 | - | - |

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|---|---|---|---|---|---|---|---|---|
| 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 LLI wall (5E+2) | 7E+2 - | 3E-7 - | 9E-10 - | - 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 LLI wall (6E+2) | 2E+2 - | 7E-8 - | 2E-10 - | - 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 St wall (3E+4) | 8E+4 - | 3E-5 - | 1E-7 - | - 4E-4 | - 4E-3 |
| | | Y, see $^{86m}Y$ | - | 8E+4 | 3E-5 | 1E-7 | - | - |
| 39 | Yttrium-95[2] | W, see $^{86m}Y$ | 4E+4 St wall (5E+4) | 2E+5 - | 6E-5 - | 2E-7 - | - 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 | - | - |

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|---|---|---|---|---|---|---|---|---|
| 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 Bone surf (3E+3) | 6E+0 Bone surf (2E+1) | 3E-9 - | - 2E-11 | - 4E-5 | - 4E-4 |
| | | W, see $^{86}$Zr | - - | 2E+1 Bone surf (6E+1) | 1E-8 - | - 9E-11 | - - | - - |
| | | Y, see $^{86}$Zr | - - | 6E+1 Bone surf (7E+1) | 2E-8 - | - 9E-11 | - - | - - |
| 40 | Zirconium-95 | D, see $^{86}$Zr | 1E+3 - | 1E+2 Bone surf (3E+2) | 5E-8 - | - 4E-10 | 2E-5 - | 2E-4 - |
| | | 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 St wall (7E+4) | 2E+5 - | 9E-5 - | 3E-7 - | - 1E-3 | - 1E-2 |
| | | Y, oxides and hydroxides | - | 2E+5 | 9E-5 | 3E-7 | - | - |
| 41 | Niobium-89[2] (66 min) | W, see $^{88}$Nb | 1E+4 | 4E+4 | 2E-5 | 6E-8 | 1E-4 | 1E-3 |
| | | Y, see $^{88}$Nb | - | 4E+4 | 2E-5 | 5E-8 | - | - |
| 41 | Niobium-89 (122 min) | W, see $^{88}$Nb | 5E+3 | 2E+4 | 8E-6 | 3E-8 | 7E-5 | 7E-4 |
| | | Y, see $^{88}$Nb | - | 2E+4 | 6E-6 | 2E-8 | - | - |
| 41 | Niobium-90 | W, see $^{88}$Nb | 1E+3 | 3E+3 | 1E-6 | 4E-9 | 1E-5 | 1E-4 |
| | | Y, see $^{88}$Nb | - | 2E+3 | 1E-6 | 3E-9 | - | - |
| 41 | Niobium-93m | W, see $^{88}$Nb | 9E+3 LLI wall (1E+4) | 2E+3 - | 8E-7 - | 3E-9 - | - 2E-4 | - 2E-3 |
| | | Y, see $^{88}$Nb | - | 2E+2 | 7E-8 | 2E-10 | - | - |
| 41 | Niobium-94 | W, see $^{88}$Nb | 9E+2 | 2E+2 | 8E-8 | 3E-10 | 1E-5 | 1E-4 |
| | | Y, see $^{88}$Nb | - | 2E+1 | 6E-9 | 2E-11 | - | - |
| 41 | Niobium-95m | W, see $^{88}$Nb | 2E+3 LLI wall (2E+3) | 3E+3 - | 1E-6 - | 4E-9 - | - 3E-5 | - 3E-4 |
| | | Y, see $^{88}$Nb | - | 2E+3 | 9E-7 | 3E-9- | - | |
| 41 | Niobium-95 | W, see $^{88}$Nb | 2E+3 | 1E+3 | 5E-7 | 2E-9 | 3E-5 | 3E-4 |
| | | Y, see $^{88}$Nb | - | 1E+3 | 5E-7 | 2E-9- | - | |

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

| Atomic No. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (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 |
| | | W, halides | - | 6E+4 | 3E-5 | 9E-8 | - | - |
| | | Y, oxides and hydroxides | - | 6E+4 | 2E-5 | 8E-8 | - | - |
| 44 | Ruthenium-97 | D, see $^{94}$Ru | 8E+3 | 2E+4 | 8E-6 | 3E-8 | 1E-4 | 1E-3 |
| | | W, see $^{94}$Ru | - | 1E+4 | 5E-6 | 2E-8 | - | - |
| | | Y, see $^{94}$Ru | - | 1E+4 | 5E-6 | 2E-8 | - | - |
| 44 | Ruthenium-103 | D, see $^{94}$Ru | 2E+3 | 2E+3 | 7E-7 | 2E-9 | 3E-5 | 3E-4 |
| | | W, see $^{94}$Ru | - | 1E+3 | 4E-7 | 1E-9 | - | - |
| | | Y, see $^{94}$Ru | - | 6E+2 | 3E-7 | 9E-10 | - | - |
| 44 | Ruthenium-105 | D, see $^{94}$Ru | 5E+3 | 1E+4 | 6E-6 | 2E-8 | 7E-5 | 7E-4 |
| | | W, see $^{94}$Ru | - | 1E+4 | 6E-6 | 2E-8 | - | - |
| | | Y, see $^{94}$Ru | - | 1E+4 | 5E-6 | 2E-8 | - | - |
| 44 | Ruthenium-106 | D, see $^{94}$Ru | 2E+2 | 9E+1 | 4E-8 | 1E-10 | - | - |
| | | | LLI wall (2E+2) | - | - | - | 3E-6 | 3E-5 |
| | | W, see $^{94}$Ru | - | 5E+1 | 2E-8 | 8E-11 | - | - |
| | | Y, see $^{94}$Ru | - | 1E+1 | 5E-9 | 2E-11 | - | - |
| 45 | Rhodium-99m | D, all compounds except those given for W and Y | 2E+4 | 6E+4 | 2E-5 | 8E-8 | 2E-4 | 2E-3 |
| | | W, halides | - | 8E+4 | 3E-5 | 1E-7 | - | - |
| | | Y, oxides and hydroxides | - | 7E+4 | 3E-5 | 9E-8 | - | - |
| 45 | Rhodium-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. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (μCi/ml) |
|---|---|---|---|---|---|---|---|---|
| 45 | Rhodium-100 | D, see $^{99m}$Rh | 2E+3 | 5E+3 | 2E-6 | 7E-9 | 2E-5 | 2E-4 |
| | | W, see $^{99m}$Rh | - | 4E+3 | 2E-6 | 6E-9 | - | - |
| | | Y, see $^{99m}$Rh | - | 4E+ 3 | 2E-6 | 5E-9 | - | - |
| 45 | Rhodium-101m | D, see $^{99m}$Rh | 6E+3 | 1E+4 | 5E-6 | 2E-8 | 8E-5 | 8E-4 |
| | | W, see $^{99m}$Rh | - | 8E+3 | 4E-6 | 1E-8 | - | - |
| | | Y, see $^{99m}$Rh | - | 8E+3 | 3E-6 | 1E-8 | - | - |
| 45 | Rhodium-101 | D, see $^{99m}$Rh | 2E+3 | 5E+2 | 2E-7 | 7E-10 | 3E-5 | 3E-4 |
| | | W, see $^{99m}$Rh | - | 8E+2 | 3E-7 | 1E-9 | - | - |
| | | Y, see $^{99m}$Rh | - | 2E+2 | 6E-8 | 2E-10 | - | - |
| 45 | Rhodium-102m | D, see $^{99m}$Rh | 1E+3 | 5E+2 | 2E-7 | 7E-10 | - | - |
| | | | LLI wall (1E+3) | - | - | - | 2E-5 | 2E-4 |
| | | W, see $^{99m}$Rh | - | 4E+2 | 2E-7 | 5E-10 | - | - |
| | | Y, see $^{99m}$Rh | - | 1E+2 | 5E-8 | 2E-10 | - | - |
| 45 | Rhodium-102 | D, see $^{99m}$Rh | 6E+2 | 9E+1 | 4E-8 | 1E-10 | 8E-6 | 8E-5 |
| | | W, see $^{99m}$Rh | - | 2E+2 | 7E-8 | 2E-10 | - | - |
| | | Y, see $^{99m}$Rh | - | 6E+1 | 2E-8 | 8E-11 | - | - |
| 45 | Rhodium-103m[2] | D, see $^{99m}$Rh | 4E+5 | 1E+6 | 5E-4 | 2E-6 | 6E-3 | 6E-2 |
| | | W, see $^{99m}$Rh | - | 1E+6 | 5E-4 | 2E-6 | - | - |
| | | Y, see $^{99m}$Rh | - | 1E+6 | 5E-4 | 2E-6 | - | - |
| 45 | Rhodium-105 | D, see $^{99m}$Rh | 4E+3 | 1E+4 | 5E-6 | 2E-8 | - | - |
| | | | LLI wall (4E+3) | - | - | - | 5E-5 | 5E-4 |
| | | W, see $^{99m}$Rh | - | 6E+3 | 3E-6 | 9E-9 | - | - |
| | | Y, see $^{99m}$Rh | - | 6E+3 | 2E-6 | 8E-9 | - | - |
| 45 | Rhodium-106m | D, see $^{99m}$Rh | 8E+3 | 3E+4 | 1E-5 | 4E-8 | 1E-4 | 1E-3 |
| | | W, see $^{99m}$Rh | - | 4E+4 | 2E-5 | 5E-8 | - | - |
| | | Y, see $^{99m}$Rh | - | 4E+4 | 1E-5 | 5E-8 | - | - |
| 45 | Rhodium-107[2] | D, see $^{99m}$Rh | 7E+4 | 2E+5 | 1E-4 | 3E-7 | - | - |
| | | | St wall (9E+4) | - | - | - | 1E-3 | 1E-2 |
| | | W, see $^{99m}$Rh | - | 3E+5 | 1E-4 | 4E-7 | - | - |
| | | Y, see $^{99m}$Rh | - | 3E+5 | 1E-4 | 3E-7 | - | - |
| 46 | Palladium-100 | D, all compounds except those given for W and Y | 1E+3 | 1E+3 | 6E-7 | 2E-9 | 2E-5 | 2E-4 |
| | | W, nitrates | - | 1E+3 | 5E-7 | 2E-9 | - | - |
| | | Y, oxides and hydroxides | - | 1E+3 | 6E-7 | 2E-9 | - | - |
| 46 | Palladium-101 | D, see $^{100}$Pd | 1E+4 | 3E+4 | 1E-5 | 5E-8 | 2E-4 | 2E-3 |
| | | W, see $^{100}$Pd | - | 3E+4 | 1E-5 | 5E-8 | - | - |
| | | Y, see $^{100}$Pd | - | 3E+4 | 1E-5 | 4E-8 | - | - |

| Atomic No. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (μCi/ml) |
|---|---|---|---|---|---|---|---|---|
| 46 | Palladium-103 | D, see $^{100}$Pd | 6E+3 | 6E+3 | 3E-6 | 9E-9 | - | - |
| | | | LLI wall (7E+3) | - | - | - | 1E-4 | 1E-3 |
| | | W, see $^{100}$Pd | - | 4E+3 | 2E-6 | 6E-9 | - | - |
| | | Y, see $^{100}$Pd | - | 4E+3 | 1E-6 | 5E-9 | - | - |
| 46 | Palladium-107 | D, see $^{100}$Pd | 3E+4 | 2E+4 | 9E-6 | - | - | - |
| | | | LLI wall (4E+4) | Kidneys (2E+4) | - | 3E-8 | 5E-4 | 5E-3 |
| | | W, see $^{100}$Pd | - | 7E+3 | 3E-6 | 1E-8 | - | - |
| | | Y, see $^{100}$Pd | - | 4E+2 | 2E-7 | 6E-10 | - | - |
| 46 | Palladium-109 | D, see $^{100}$Pd | 2E+3 | 6E+3 | 3E-6 | 9E-9 | 3E-5 | 3E-4 |
| | | W, see $^{100}$Pd | - | 5E+3 | 2E-6 | 8E-9 | - | - |
| | | Y, see,$^{100}$Pd | - | 5E+3 | 2E-6 | 6E-9 | - | - |
| 47 | Silver-102[2] | D, all compounds except those given for W and Y | 5E+4 | 2E+5 | 8E-5 | 2E-7 | - | - |
| | | | St wall (6E+4) | - | - | - | 9E-4 | 9E-3 |
| | | W, nitrates and sulfides | - | 2E+5 | 9E-5 | 3E-7 | - | - |
| | | Y, oxides and hydroxides | - | 2E+5 | 8E-5 | 3E-7 | - | - |
| 47 | Silver-103[2] | D, see $^{102}$Ag | 4E+4 | 1E+5 | 4E-5 | 1E-7 | 5E-4 | 5E-3 |
| | | W, see $^{102}$Ag | - | 1E+5 | 5E-5 | 2E-7 | - | - |
| | | Y, see $^{102}$Ag | - | 1E+5 | 5E-5 | 2E-7 | - | - |
| 47 | Silver-104m[2] | D, see $^{102}$Ag | 3E+4 | 9E+4 | 4E-5 | 1E-7 | 4E-4 | 4E-3 |
| | | W, see $^{102}$Ag | - | 1E+5 | 5E-5 | 2E-7 | - | - |
| | | Y, see $^{102}$Ag | - | 1E+5 | 5E-5 | 2E-7 | - | - |
| 47 | Silver-104[2] | D, see $^{102}$Ag | 2E+4 | 7E+4 | 3E-5 | 1E-7 | 3E-4 | 3E-3 |
| | | 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. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (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 LLI wall (1E+3) | 2E+3 Liver (2E+3) | 6E-7 - | - 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 St wall (3E+4) | 9E+4 - | 4E-5 - | 1E-7 - | - 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 Kidneys (4E+2) | 4E+1 Kidneys (5E+1) | 1E-8 - | - 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 Kidneys (4E+1) | 2E+0 Kidneys (4E+0) | 1E-9 - | - 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 Kidneys (3E+1) | 2E+0 Kidneys (3E+0) | 9E-10 - | - 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. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (μCi/ml) |
|---|---|---|---|---|---|---|---|---|
| 48 | Cadmium-115m | D, see $^{104}$Cd | 3E+2 | 5E+1 Kidneys | 2E-8 | - | 4E-6 | 4E-5 |
| | | | - | (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. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (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. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (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] (16 min) | D, see $^{115}$Sb | 1E+5 | 4E+5 | 2E-4 | 6E-7 | - | - |
| | | | St wall (2E+5) | - | - | - | 2E-3 | 2E-2 |
| | | W, see $^{115}$Sb | - | 5E+5 | 2E-4 | 7E-7 | - | - |
| 51 | Antimony-120 | D, see $^{115}$Sb | 1E+3 | 2E+3 | 9E-7 | 3E-9 | 1E-5 | 1E-4 |
| | (5.76 d) | W, see $^{115}$Sb | 9E+2 | 1E+3 | 5E-7 | 2E-9 | - | - |
| 51 | Antimony-122 | D, see $^{115}$Sb | 8E+2 | 2E+3 | 1E-6 | 3E-9 | - | - |
| | | | LLI wall (8E+2) | - | - | - | 1E-5 | 1E-4 |
| | | W, see $^{115}$Sb | 7E+2 | 1E+3 | 4E-7 | 2E-9 | - | - |
| 51 | Antimony-124m[2] | D, see $^{115}$Sb | 3E+5 | 8E+5 | 4E-4 | 1E-6 | 3E-3 | 3E-2 |
| | | W, see $^{115}$Sb | 2E+5 | 6E+5 | 2E-4 | 8E-7 | - | - |
| 51 | Antimony-124 | D, see $^{115}$Sb | 6E+2 | 9E+2 | 4E-7 | 1E-9 | 7E-6 | 7E-5 |
| | | W, see $^{115}$Sb | 5E+2 | 2E+2 | 1E-7 | 3E-10 | - | - |
| 51 | Antimony-125 | D, see $^{115}$Sb | 2E+3 | 2E+3 | 1E-6 | 3E-9 | 3E-5 | 3E-4 |
| | | W, see $^{115}$Sb | - | 5E+2 | 2E-7 | 7E-10 | - | - |
| 51 | Antimony-126m[2] | D, see $^{115}$Sb | 5E+4 | 2E+5 | 8E-5 | 3E-7 | - | - |
| | | | St wall (7E+4) | - | - | - | 9E-4 | 9E-3 |
| | | W, see $^{115}$Sb | - | 2E+5 | 8E-5 | 3E-7 | - | - |
| 51 | Antimony-126 | D, see $^{115}$Sb | 6E+2 | 1E+3 | 5E-7 | 2E-9 | 7E-6 | 7E-5 |
| | | W, see $^{115}$Sb | 5E+2 | 5E+2 | 2E-7 | 7E-10 | - | - |
| 51 | Antimony-127 | D, see $^{115}$Sb | 8E+2 | 2E+3 | 9E-7 | 3E-9 | - | - |
| | | | LLI wall (8E+2) | - | - | - | 1E-5 | 1E-4 |
| | | W, see $^{115}$Sb | 7E+2 | 9E+2 | 4E-7 | 1E-9 | - | - |

| Atomic No. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (μCi/ml) |
|---|---|---|---|---|---|---|---|---|
| 51 | Antimony-128[2] (10.4 min) | D, see $^{115}$Sb | 8E+4 St wall (1E+5) | 4E+5 - | 2E-4 - | 5E-7 - | - 1E-3 | - 1E-2 |
| | | W, see $^{115}$Sb | - | 4E+5 | 2E-4 | 6E-7 | - | - |
| 51 | Antimony-128 | D, see $^{115}$Sb | 1E+3 | 4E+3 | 2E-6 | 6E-9 | 2E-5 | 2E-4 |
| | (9.01 h) | 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 Thyroid (2E+4) | 2E+4 Thyroid (4E+4) | 1E-5 - | - 6E-8 | - 2E-4 | - 2E-3 |
| | | W, see $^{115}$Sb | - - | 2E+4 Thyroid (4E+4) | 1E-5 - | 6E-8 | - - | - - |
| 52 | Tellurium-116 | D, all compounds except those given for W | 8E+3 | 2E+4 | 9E-6 | 3E-8 | 1E-4 | 1E-3 |
| | | W, oxides, hydroxides, and nitrates | - | 3E+4 | 1E-5 | 4E-8 | - | - |
| 52 | Tellurium-121m | D, see $^{116}$Te | 5E+2 Bone surf (7E+2) | 2E+2 Bone surf (4E+2) | 8E-8 - | - 5E-10 | - 1E-5 | - 1E-4 |
| | | W, see $^{116}$Te | - | 4E+2 | 2E-7 | 6E-10 | - | - |
| 52 | Tellurium-121 | D, see $^{116}$Te | 3E+3 | 4E+3 | 2E-6 | 6E-9 | 4E-5 | 4E-4 |
| | | W, see $^{116}$Te | - | 3E+3 | 1E-6 | 4E-9 | - | - |
| 52 | Tellurium-123m | D, see $^{116}$Te | 6E+2 Bone surf (1E+3) | 2E+2 Bone surf (5E+2) | 9E-8 - | - 8E-10 | - 1E-5 | - 1E-4 |
| | | W, see $^{116}$Te | - | 5E+2 | 2E-7 | 8E-10 | - | - |
| 52 | Tellurium-123 | D, see $^{116}$Te | 5E+2 Bone surf (1E+3) | 2E+2 Bone surf (5E+2) | 8E-8 - | - 7E-10 | - 2E-5 | - 2E-4 |
| | | W, see $^{116}$Te | - - | 4E+2 Bone surf (1E+3) | 2E-7 - | - 2E-9 | - - | - - |
| 52 | Tellurium-125m | D, see $^{116}$Te | 1E+3 Bone surf (1E+3) | 4E+2 Bone surf (1E+3) | 2E-7 - | - 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 Bone surf (4E+2) | 1E-7 - | - 6E-10 | 9E-6 - | 9E-5 - |
| | | W, see $^{116}$Te | - | 3E+2 | 1E-7 | 4E-10 | - | - |
| 52 | Tellurium-127 | D, see $^{116}$Te | 7E+3 | 2E+4 | 9E-6 | 3E-8 | 1E-4 | 1E-3 |
| | | W, see $^{116}$Te | - | 2E+4 | 7E-6 | 2E-8 | - | - |

| Atomic No. | Radionuclide | Class | Table I Occupational Values: Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values: Col. 2 Inhalation ALI (μCi) | Table I Occupational Values: Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations: Col. 1 Air (μCi/ml) | Table II Effluent Concentrations: Col. 2 Water (μCi/ml) | Table III Releases to Sewers: Monthly Average Concentration (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 Thyroid (6E+2) | 4E+2 Thyroid (1E+3) | 2E-7 - | - 2E-9 | - 8E-6 | - 8E-5 |
| | | W, see $^{116}$Te | - | 4E+2 Thyroid (9E+2) | 2E-7 - | - 1E-9 | - - | - - |
| 52 | Tellurium-131[2] | D, see $^{116}$Te | 3E+3 Thyroid (6E+3) | 5E+3 Thyroid (1E+4) | 2E-6 - | - 2E-8 | - 8E-5 | - 8E-4 |
| | | W, see $^{116}$Te | - | 5E+3 Thyroid (1E+4) | 2E-6 - | - 2E-8 | - - | - - |
| 52 | Tellurium-132 | D, see $^{116}$Te | 2E+2 Thyroid (7E+2) | 2E+2 Thyroid (8E+2) | 9E-8 - | - 1E-9 | - 9E-6 | - 9E-5 |
| | | W, see $^{116}$Te | - | 2E+2 Thyroid (6E+2) | 9E-8 - | - 9E-10 | - - | - - |
| 52 | Tellurium-133m[2] | D, see $^{116}$Te | 3E+3 Thyroid (6E+3) | 5E+3 Thyroid (1E+4) | 2E-6 - | - 2E-8 | - 9E-5 | - 9E-4 |
| | | W, see $^{116}$Te | - | 5E+3 Thyroid (1E+4) | 2E-6 - | - 2E-8 | - - | - - |
| 52 | Tellurium-133[2] | D, see $^{116}$Te | 1E+4 Thyroid (3E+4) | 2E+4 Thyroid (6E+4) | 9E-6 - | - 8E-8 | - 4E-4 | - 4E-3 |
| | | W, see $^{116}$Te | - | 2E+4 Thyroid (6E+4) | 9E-6 - | - 8E-8 | - - | - - |
| 52 | Tellurium-134[2] | D, see $^{116}$Te | 2E+4 Thyroid (2E+4) | 2E+4 Thyroid (5E+4) | 1E-5 - | - 7E-8 | - 3E-4 | - 3E-3 |
| | | W, see $^{116}$Te | - | 2E+4 Thyroid (5E+4) | 1E-5 - | - 7E-8 | - - | - - |
| 53 | Iodine-120m[2] | D, all compounds | 1E+4 Thyroid (1E+4) | 2E+4 - | 9E-6 - | 3E-8 - | - 2E-4 | - 2E-3 |
| 53 | Iodine-120[2] | D, all compounds | 4E+3 Thyroid (8E+3) | 9E+3 Thyroid (1E+4) | 4E-6 - | - 2E-8 | - 1E-4 | - 1E-3 |

| Atomic No. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (μCi/ml) |
|---|---|---|---|---|---|---|---|---|
| 53 | Iodine-121 | D, all compounds | 1E+4 Thyroid (3E+4) | 2E+4 Thyroid (5E+4) | 8E-6 - | - 7E-8 | - 4E-4 | - 4E-3 |
| 53 | Iodine-123 | D, all compounds | 3E+3 Thyroid (1E+4) | 6E+3 Thyroid (2E+4) | 3E-6 - | - 2E-8 | - 1E-4 | - 1E-3 |
| 53 | Iodine-124 | D, all compounds | 5E+1 Thyroid (2E+2) | 8E+1 Thyroid (3E+2) | 3E-8 - | - 4E-10 | - 2E-6 | - 2E-5 |
| 53 | Iodine-125 | D, all compounds | 4E+1 Thyroid (1E+2) | 6E+1 Thyroid (2E+2) | 3E-8 - | - 3E-10 | - 2E-6 | - 2E-5 |
| 53 | Iodine-126 | D, all compounds | 2E+1 Thyroid (7E+1) | 4E+1 Thyroid (1E+2) | 1E-8 - | - 2E-10 | - 1E-6 | - 1E-5 |
| 53 | Iodine-128[2] | D, all compounds | 4E+4 St wall (6E+4) | 1E+5 - | 5E-5 - | 2E-7 - | - 8E-4 | - 8E-3 |
| 53 | Iodine-129 | D, all compounds | 5E+0 Thyroid (2E+1) | 9E+0 Thyroid (3E+1) | 4E-9 - | - 4E-11 | - 2E-7 | - 2E-6 |
| 53 | Iodine-130 | D, all compounds | 4E+2 Thyroid (1E+3) | 7E+2 Thyroid (2E+3) | 3E-7 - | - 3E-9 | - 2E-5 | - 2E-4 |
| 53 | Iodine-131 | D, all compounds | 3E+1 Thyroid (9E+1) | 5E+1 Thyroid (2E+2) | 2E-8 - | - 2E-10 | - 1E-6 | - 1E-5 |
| 53 | Iodine-132m[2] | D, all compounds | 4E+3 Thyroid (1E+4) | 8E+3 Thyroid (2E+4) | 4E-6 - | - 3E-8 | - 1E-4 | - 1E-3 |
| 53 | Iodine-132 | D, all compounds | 4E+3 Thyroid (9E+3) | 8E+3 Thyroid (1E+4) | 3E-6 - | - 2E-8 | - 1E-4 | - 1E-3 |
| 53 | Iodine-133 | D, all compounds | 1E+2 Thyroid (5E+2) | 3E+2 Thyroid (9E+2) | 1E-7 - | - 1E-9 | - 7E-6 | - 7E-5 |
| 53 | Iodine-134[2] | D, all compounds | 2E+4 Thyroid (3E+4) | 5E+4 - | 2E-5 - | 6E-8 - | - 4E-4 | - 4E-3 |
| 53 | Iodine-135 | D, all compounds | 8E+2 Thyroid (3E+3) | 2E+3 Thyroid (4E+3) | 7E-7 - | - 6E-9 | - 3E-5 | - 3E-4 |
| 54 | Xenon-120[2] | Submersion[1] | - | - | 1E-5 | 4E-8 | - | - |
| 54 | Xenon-121[2] | Submersion[1] | - | - | 2E-6 | 1E-8 | - | - |
| 54 | Xenon-122 | Submersion[1] | - | - | 7E-5 | 3E-7 | - | - |
| 54 | Xenon-123 | Submersion[1] | - | - | 6E-6 | 3E-8 | - | - |
| 54 | Xenon-125 | Submersion[1] | - | - | 2E-5 | 7E-8 | - | - |
| 54 | Xenon-127 | Submersion[1] | - | - | 1E-5 | 6E-8 | - | - |
| 54 | Xenon-129m | Submersion[1] | - | - | 2E-4 | 9E-7 | - | - |

| Atomic No. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (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 | - | - |
| | | | St wall (9E+4) | - | - | - | 1E-3 | 1E-2 |
| 55 | Cesium-127 | D, all compounds | 6E+4 | 9E+4 | 4E-5 | 1E-7 | 9E-4 | 9E-3 |
| 55 | Cesium-129 | D, all compounds | 2E+4 | 3E+4 | 1E-5 | 5E-8 | 3E-4 | 3E-3 |
| 55 | Cesium-130[2] | D, all compounds | 6E+4 | 2E+5 | 8E-5 | 3E-7 | - | - |
| | | | St wall (1E+5) | - | - | - | 1E-3 | 1E-2 |
| 55 | Cesium-131 | D, all compounds | 2E+4 | 3E+4 | 1E-5 | 4E-8 | 3E-4 | 3E-3 |
| 55 | Cesium-132 | D, all compounds | 3E+3 | 4E+3 | 2E-6 | 6E-9 | 4E-5 | 4E-4 |
| 55 | Cesium-134m | D, all compounds | 1E+5 | 1E+5 | 6E-5 | 2E-7 | - | - |
| | | | St wall (1E+5) | - | - | - | 2E-3 | 2E-2 |
| 55 | Cesium-134 | D, all compounds | 7E+1 | 1E+2 | 4E-8 | 2E-10 | 9E-7 | 9E-6 |
| 55 | Cesium-135m[2] | D, all compounds | 1E+5 | 2E+5 | 8E-5 | 3E-7 | 1E-3 | 1E-2 |
| 55 | Cesium-135 | D, all compounds | 7E+2 | 1E+3 | 5E-7 | 2E-9 | 1E-5 | 1E-4 |
| 55 | Cesium-136 | D, all compounds | 4E+2 | 7E+2 | 3E-7 | 9E-10 | 6E-6 | 6E-5 |
| 55 | Cesium-137 | D, all compounds | 1E+2 | 2E+2 | 6E-8 | 2E-10 | 1E-6 | 1E-5 |
| 55 | Cesium-138[2] | D, all compounds | 2E+4 | 6E+4 | 2E-5 | 8E-8 | - | - |
| | | | St wall (3E+4) | - | - | - | 4E-4 | 4E-3 |
| 56 | Barium-126[2] | D, all compounds | 6E+3 | 2E+4 | 6E-6 | 2E-8 | 8E-5 | 8E-4 |
| 56 | Barium-128 | D, all compounds | 5E+2 | 2E+3 | 7E-7 | 2E-9 | 7E-6 | 7E-5 |
| 56 | Barium-131m[2] | D, all compounds | 4E+5 | 1E+6 | 6E-4 | 2E-6 | - | - |
| | | | St wall (5E+5) | - | - | - | 7E-3 | 7E-2 |
| 56 | Barium-131 | D, all compounds | 3E+3 | 8E+3 | 3E-6 | 1E-8 | 4E-5 | 4E-4 |
| 56 | Barium-133m | D, all compounds | 2E+3 | 9E+3 | 4E-6 | 1E-8 | - | - |
| | | | LLI wall (3E+3) | - | - | - | 4E-5 | 4E-4 |
| 56 | Barium-133 | D, all compounds | 2E+3 | 7E+2 | 3E-7 | 9E-10 | 2E-5 | 2E-4 |
| 56 | Barium-135m | D, all compounds | 3E+3 | 1E+4 | 5E-6 | 2E-8 | 4E-5 | 4E-4 |
| 56 | Barium-139[2] | D, all compounds | 1E+4 | 3E+4 | 1E-5 | 4E-8 | 2E-4 | 2E-3 |
| 56 | Barium-140 | D, all compounds | 5E+2 | 1E+3 | 6E-7 | 2E-9 | - | - |
| | | | LLI wall (6E+2) | - | - | - | 8E-6 | 8E-5 |
| 56 | Barium-141[2] | D, all compounds | 2E+4 | 7E+4 | 3E-5 | 1E-7 | 3E-4 | 3E-3 |
| 56 | Barium-142[2] | D, all compounds | 5E+4 | 1E+5 | 6E-5 | 2E-7 | 7E-4 | 7E-3 |
| 57 | Lanthanum-131[2] | D, all compounds except those given for W | 5E+4 | 1E+5 | 5E-5 | 2E-7 | 6E-4 | 6E-3 |
| | | W, oxides and hydroxides | - | 2E+5 | 7E-5 | 2E-7 | - | - |

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

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

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

| Atomic No. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (μCi/ml) |
|---|---|---|---|---|---|---|---|---|
| 62 | Samarium-141[2] | W, all compounds | 5E+4 | 2E+5 | 8E-5 | 2E-7 | - | - |
| | | | St wall (6E+4) | - | - | - | 8E-4 | 8E-3 |
| 62 | Samarium-142[2] | W, all compounds | 8E+3 | 3E+4 | 1E-5 | 4E-8 | 1E-4 | 1E-3 |
| 62 | Samarium-145 | W, all compounds | 6E+3 | 5E+2 | 2E-7 | 7E-10 | 8E-5 | 8E-4 |
| 62 | Samarium-146 | W, all compounds | 1E+1 | 4E2 | 1E-11 | - | - | - |
| | | | Bone surf (3E+1) | Bone surf (6E-2) | - | 9E-14 | 3E-7 | 3E-6 |
| 62 | Samarium-147 | W, all compounds | 2E+1 | 4E2 | 2E-11 | - | - | - |
| | | | Bone surf (3E+1) | Bone surf (7E-2) | - | 1E-13 | 4E-7 | 4E-6 |
| 62 | Samarium-151 | W, all compounds | 1E+4 | 1E+2 | 4E-8 | - | - | - |
| | | | LLI wall (1E+4) | Bone surf (2E+2) | - | 2E-10 | 2E-4 | 2E-3 |
| 62 | Samarium-153 | W, all compounds | 2E+3 | 3E+3 | 1E-6 | 4E-9 | - | - |
| | | | LLI wall (2E+3) | - | - | - | 3E-5 | 3E-4 |
| 62 | Samarium-155[2] | W, all compounds | 6E+4 | 2E+5 | 9E-5 | 3E-7 | - | - |
| | | | St wall (8E+4) | - | - | - | 1E-3 | 1E-2 |
| 62 | Samarium-156 | W, all compounds | 5E+3 | 9E+3 | 4E-6 | 1E-8 | 7E-5 | 7E-4 |
| 63 | Europium-145 | W, all compounds | 2E+3 | 2E+3 | 8E-7 | 3E-9 | 2E-5 | 2E-4 |
| 63 | Europium-146 | W, all compounds | 1E+3 | 1E+3 | 5E-7 | 2E-9 | 1E-5 | 1E-4 |
| 63 | Europium-147 | W, all compounds | 3E+3 | 2E+3 | 7E-7 | 2E-9 | 4E-5 | 4E-4 |
| 63 | Europium-148 | W, all compounds | 1E+3 | 4E+2 | 1E-7 | 5E-10 | 1E-5 | 1E-4 |
| 63 | Europium-149 | W, all compounds | 1E+4 | 3E+3 | 1E-6 | 4E-9 | 2E-4 | 2E-3 |
| 63 | Europium-150 (12.62 h) | W, all compounds | 3E+3 | 8E+3 | 4E-6 | 1E-8 | 4E-5 | 4E-4 |
| 63 | Europium-150 (34.2 y) | W, all compounds | 8E+2 | 2E+1 | 8E-9 | 3E-11 | 1E-5 | 1E-4 |
| 63 | Europium-152m | W, all compounds | 3E+3 | 6E+3 | 3E-6 | 9E-9 | 4E-5 | 4E-4 |
| 63 | Europium-152 | W, all compounds | 8E+2 | 2E+1 | 1E-8 | 3E-11 | 1E-5 | 1E-4 |
| 63 | Europium-154 | W, all compounds | 5E+2 | 2E+1 | 8E-9 | 3E-11 | 7E-6 | 7E-5 |
| 63 | Europium-155 | W, all compounds | 4E+3 | 9E+1 | 4E-8 | - | 5E-5 | 5E-4 |
| | | | - | Bone surf (1E+2) | - | 2E-10 | - | - |
| 63 | Europium-156 | W, all compounds | 6E+2 | 5E+2 | 2E-7 | 6E-10 | 8E-6 | 8E-5 |
| 63 | Europium-157 | W, all compounds | 2E+3 | 5E+3 | 2E-6 | 7E-9 | 3E-5 | 3E-4 |
| 63 | Europium-158[2] | W, all compounds | 2E+4 | 6E+4 | 2E-5 | 8E-8 | 3E-4 | 3E-3 |
| 64 | Gadolinium-145[2] | D, all compounds except those given for W | 5E+4 | 2E+5 | 6E-5 | 2E-7 | - | - |
| | | | St wall (5E+4) | - | - | - | 6E-4 | 6E-3 |
| | | W, oxides, hydroxides, and fluorides | - | 2E+5 | 7E-5 | 2E-7 | - | - |
| 64 | Gadolinium-146 | D, see $^{145}$Gd | 1E+3 | 1E+2 | 5E-8 | 2E-10 | 2E-5 | 2E-4 |
| | | W, see $^{145}$Gd | - | 3E+2 | 1E-7 | 4E-10 | - | - |
| 64 | Gadolinium-147 | D, see $^{145}$Gd | 2E+3 | 4E+3 | 2E-6 | 6E-9 | 3E-5 | 3E-4 |
| | | W, see $^{145}$Gd | - | 4E+3 | 1E-6 | 5E-9 | - | - |

| Atomic No. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (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 (5.0 h) | W, all compounds | 2E+4 | 3E+4 | 1E-5 | 4E-8 | 2E-4 | 2E-3 |
| 65 | Terbium-156m (24.4 h) | W, all compounds | 7E+3 | 8E+3 | 3E-6 | 1E-8 | 1E-4 | 1E-3 |
| 65 | Terbium-156 | W, all compounds | 1E+3 | 1E+3 | 6E-7 | 2E-9 | 1E-5 | 1E-4 |
| 65 | Terbium-157 | W, all compounds | 5E+4 | 3E+2 | 1E-7 | - | - | - |
| | | | LLI wall (5E+4) | Bone surf (6E+2) | - | 8E-10 | 7E-4 | 7E-3 |
| 65 | Terbium-158 | W, all compounds | 1E+3 | 2E+1 | 8E-9 | 3E-11 | 2E-5 | 2E-4 |
| 65 | Terbium-160 | W, all compounds | 8E+2 | 2E+2 | 9E-8 | 3E-10 | 1E-5 | 1E-4 |
| 65 | Terbium-161 | W, all compounds | 2E+3 | 2E+3 | 7E-7 | 2E-9 | - | - |
| | | | LLI wall (2E+3) | - | - | - | 3E-5 | 3E-4 |
| 66 | Dysprosium-155 | W, all compounds | 9E+3 | 3E+4 | 1E-5 | 4E-8 | 1E-4 | 1E-3 |
| 66 | Dysprosium-157 | W, all compounds | 2E+4 | 6E+4 | 3E-5 | 9E-8 | 3E-4 | 3E-3 |
| 66 | Dysprosium-159 | W, all compounds | 1E+4 | 2E+3 | 1E-6 | 3E-9 | 2E-4 | 2E-3 |
| 66 | Dysprosium-165 | W, all compounds | 1E+4 | 5E+4 | 2E-5 | 6E-8 | 2E-4 | 2E-3 |

| Atomic No. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (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. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (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. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (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-5 | 4E-4 |
| | | Y, see $^{169}$Lu | - | 2E+3 | 9E-7 | 3E-9 | - | - |
| 71 | Lutetium-178m[2] | W, see $^{169}$Lu | 5E+4 | 2E+5 | 8E-5 | 3E-7 | - | - |
| | | | St. wall (6E+4) | - | - | - | 8E-4 | 8E-3 |
| | | Y, see $^{169}$Lu | - | 2E+5 | 7E-5 | 2E-7 | - | - |
| 71 | Lutetium-178[2] | W, see $^{169}$Lu | 4E+4 | 1E+5 | 5E-5 | 2E-7 | - | - |
| | | | St wall (4E+4) | - | - | - | 6E-4 | 6E-3 |
| | | Y, see $^{169}$Lu | - | 1E+5 | 5E-5 | 2E-7 | - | - |
| 71 | Lutetium-179 | W, see $^{169}$Lu | 6E+3 | 2E+4 | 8E-6 | 3E-8 | 9E-5 | 9E-4 |
| | | Y, see $^{169}$Lu | - | 2E+4 | 6E-6 | 3E-8 | - | - |
| 72 | Hafnium-170 | D, all compounds except those given for W | 3E+3 | 6E+3 | 2E-6 | 8E-9 | 4E-5 | 4E-4 |
| | | W, oxides, hydroxides, carbides, and nitrates | - | 5E+3 | 2E-6 | 6E-9 | - | - |
| 72 | Hafnium-172 | D, see $^{170}$Hf | 1E+3 | 9E+0 | 4E-9 | - | 2E-5 | 2E-4 |
| | | | - | Bone surf (2E+1) | - | 3E-11 | - | - |
| | | W, see $^{170}$Hf | - | 4E+1 | 2E-8 | - | - | - |
| | | | - | Bone surf (6E+1) | - | 8E-11 | - | - |
| 72 | Hafnium-173 | D, see $^{170}$Hf | 5E+3 | 1E+4 | 5E-6 | 2E-8 | 7E-5 | 7E-4 |
| | | W, see $^{170}$Hf | - | 1E+4 | 5E-6 | 2E-8 | - | - |
| 72 | Hafnium-175 | D, see $^{170}$Hf | 3E+3 | 9E+2 | 4E-7 | - | 4E-5 | 4E-4 |
| | | | - | Bone surf (1E+3) | - | 1E-9 | - | - |
| | | W, see $^{170}$Hf | - | 1E+3 | 5E-7 | 2E-9 | - | - |
| 72 | Hafnium-177m[2] | D, see $^{170}$Hf | 2E+4 | 6E+4 | 2E-5 | 8E-8 | 3E-4 | 3E-3 |
| | | W, see $^{170}$Hf | - | 9E+4 | 4E-5 | 1E-7 | - | - |
| 72 | Hafnium-178m | D, see $^{170}$Hf | 3E+2 | 1E+0 | 5E-10 | - | 3E-6 | 3E-5 |
| | | | - | Bone surf (2E+0) | - | 3E-12 | - | - |
| | | W, see $^{170}$Hf | - | 5E+0 | 2E-9 | - | - | - |
| | | | - | Bone surf (9E+0) | - | 1E-11 | - | - |
| 72 | Hafnium-179m | D, see $^{170}$Hf | 1E+3 | 3E+2 | 1E-7 | - | 1E-5 | 1E-4 |
| | | | - | Bone surf (6E+2) | - | 8E-10 | - | - |
| | | W, see $^{170}$Hf | - | 6E+2 | 3E-7 | 8E-10 | - | - |

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

| Atomic No. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (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 | W, see $^{172}$Ta | 8E+2 | 3E+2 | 1E-7 | 5E-10 | 1E-5 | 1E-4 |
| | | Y, see $^{172}$Ta | - | 1E+2 | 6E-8 | 2E-10 | - | - |
| 73 | Tantalum-183 | W, see $^{172}$Ta | 9E+2 | 1E+3 | 5E-7 | 2E-9 | - | - |
| | | | LLI wall (1E+3) | - | - | - | 2E-5 | 2E-4 |
| | | Y, see $^{172}$Ta | - | 1E+3 | 4E-7 | 1E-9 | - | - |
| 73 | Tantalum-184 | W, see $^{172}$Ta | 2E+3 | 5E+3 | 2E-6 | 8E-9 | 3E-5 | 3E-4 |
| | | Y, see $^{172}$Ta | - | 5E+3 | 2E-6 | 7E-9 | - | - |
| 73 | Tantalum-185[2] | W, see $^{172}$Ta | 3E+4 | 7E+4 | 3E-5 | 1E-7 | 4E-4 | 4E-3 |
| | | Y, see $^{172}$Ta | - | 6E+4 | 3E-5 | 9E-8 | - | - |
| 73 | Tantalum-186[2] | W, see $^{172}$Ta | 5E+4 | 2E+5 | 1E-4 | 3E-7 | - | - |
| | | | St wall (7E+4) | - | - | - | 1E-3 | 1E-2 |
| | | Y, see $^{172}$Ta | - | 2E+5 | 9E-5 | 3E-7 | - | - |
| 74 | Tungsten-176 | D, all compounds | 1E+4 | 5E+4 | 2E-5 | 7E-8 | 1E-4 | 1E-3 |
| 74 | Tungsten-177 | D, all compounds | 2E+4 | 9E+4 | 4E-5 | 1E-7 | 3E-4 | 3E-3 |
| 74 | Tungsten-178 | D, all compounds | 5E+3 | 2E+4 | 8E-6 | 3E-8 | 7E-5 | 7E-4 |
| 74 | Tungsten-179[2] | D, all compounds | 5E+5 | 2E+6 | 7E-4 | 2E-6 | 7E-3 | 7E-2 |
| 74 | Tungsten-181 | D, all compounds | 2E+4 | 3E+4 | 1E-5 | 5E-8 | 2E-4 | 2E-3 |
| 74 | Tungsten-185 | D, all compounds | 2E+3 | 7E+3 | 3E-6 | 9E-9 | - | - |
| | | | LLI wall (3E+3) | - | - | - | 4E-5 | 4E-4 |
| 74 | Tungsten-187 | D, all compounds | 2E+3 | 9E+3 | 4E-6 | 1E-8 | 3E-5 | 3E-4 |
| 74 | Tungsten-188 | D, all compounds | 4E+2 | 1E+3 | 5E-7 | 2E-9 | - | - |
| | | | LLI wall (5E+2) | - | - | - | 7E-6 | 7E-5 |
| 75 | Rhenium-177[2] | D, all compounds except those given for W | 9E+4 | 3E+5 | 1E-4 | 4E-7 | - | - |
| | | | St wall (1E+5) | - | - | - | 2E-3 | 2E-2 |
| | | W, oxides, hydroxides, and nitrates | - | 4E+5 | 1E-4 | 5E-7 | - | - |
| 75 | Rhenium-178[2] | D, see $^{177}$Re | 7E+4 | 3E+5 | 1E-4 | 4E-7 | - | - |
| | | | St wall (1E+5) | - | - | - | 1E-3 | 1E-2 |
| | | W, see $^{177}$Re | - | 3E+5 | 1E-4 | 4E-7 | - | - |
| 75 | Rhenium-181 | D, see $^{177}$Re | 5E+3 | 9E+3 | 4E-6 | 1E-8 | 7E-5 | 7E-4 |
| | | W, see $^{177}$Re | - | 9E+3 | 4E-6 | 1E-8 | - | - |
| 75 | Rhenium-182 | 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 | - | - |

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

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

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

| Atomic No. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (μCi/ml) |
|---|---|---|---|---|---|---|---|---|
| 82 | Lead-212 | D, all compounds | 8E+1 Bone surf (1E+2) | 3E+1 - | 1E-8 - | 5E-11 - | - 2E-6 | - 2E-5 |
| 82 | Lead-214[2] | D, all compounds | 9E+3 | 8E+2 | 3E-7 | 1E-9 | 1E-4 | 1E-3 |
| 83 | Bismuth-200[2] | D, nitrates | 3E+4 | 8E+4 | 4E-5 | 1E-7 | 4E-4 | 4E-3 |
| | | W, all other compounds | - | 1E+5 | 4E-5 | 1E-7 | - | - |
| 83 | Bismuth-201[2] | D, see $^{200}$Bi | 1E+4 | 3E+4 | 1E-5 | 4E-8 | 2E-4 | 2E-3 |
| | | W, see $^{200}$Bi | - | 4E+4 | 2E-5 | 5E-8 | - | - |
| 83 | Bismuth-202[2] | D, see $^{200}$Bi | 1E+4 | 4E+4 | 2E-5 | 6E-8 | 2E-4 | 2E-3 |
| | | W, see $^{200}$Bi | - | 8E+4 | 3E-5 | 1E-7 | - | - |
| 83 | Bismuth-203 | D, see $^{200}$Bi | 2E+3 | 7E+3 | 3E-6 | 9E-9 | 3E-5 | 3E-4 |
| | | W, see $^{200}$Bi | - | 6E+3 | 3E-6 | 9E-9 | - | - |
| 83 | Bismuth-205 | D, see $^{200}$Bi | 1E+3 | 3E+3 | 1E-6 | 3E-9 | 2E-5 | 2E-4 |
| | | W, see $^{200}$Bi | - | 1E+3 | 5E-7 | 2E-9 | - | - |
| 83 | Bismuth-206 | D, see $^{200}$Bi | 6E+2 | 1E+3 | 6E-7 | 2E-9 | 9E-6 | 9E-5 |
| | | W, see $^{200}$Bi | - | 9E+2 | 4E-7 | 1E-9 | - | - |
| 83 | Bismuth-207 | D, see $^{200}$Bi | 1E+3 | 2E+3 | 7E-7 | 2E-9 | 1E-5 | 1E-4 |
| | | W, see $^{200}$Bi | - | 4E+2 | 1E-7 | 5E-10 | - | - |
| 83 | Bismuth-210m | D, see $^{200}$Bi | 4E+1 Kidneys (6E+1) | 5E+0 Kidneys (6E+0) | 2E-9 - | - 9E-12 | - 8E-7 | - 8E-6 |
| | | W, see $^{200}$Bi | - | 7E-1 | 3E-10 | 9E-13 | | |
| 83 | Bismuth-210 | D, see $^{200}$Bi | 8E+2 - | 2E+2 Kidneys (4E+2) | 1E-7 - | - 5E-10 | 1E-5 - | 1E-4 - |
| | | W, see $^{200}$Bi | - | 3E+1 | 1E-8 | 4E-11 | - | - |
| 83 | Bismuth-212[2] | D, see $^{200}$Bi | 5E+3 | 2E+2 | 1E-7 | 3E-10 | 7E-5 | 7E-4 |
| | | W, see $^{200}$Bi | - | 3E+2 | 1E-7 | 4E-10 | - | - |
| 83 | Bismuth-213[2] | D, see $^{200}$Bi | 7E+3 | 3E+2 | 1E-7 | 4E-10 | 1E-4 | 1E-3 |
| | | W, see $^{200}$Bi | - | 4E+2 | 1E-7 | 5E-10 | - | - |
| 83 | Bismuth-214[2] | D, see $^{200}$Bi | 2E+4 St wall (2E+4) | 8E+2 - | 3E-7 - | 1E-9 - | - 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. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (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 (or 12 working level months) | 9E-9 | 3E-11 (or 1.0 working level) | - | - |
| 86 | Radon-222 | With daughters removed | - | 1E+4 | 4E-6 | 1E-8 | - | - |
| | | With daughters present | - | 1E+2 (or 4 working level months) | 3E-8 | 1E-10 (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 Bone surf (9E+0) | 7E-1 | 3E-10 | 9E-13 | - | - |
| | | | | - | - | - | 1E-7 | 1E-6 |
| 88 | Radium-224 | W, all compounds | 8E+0 Bone surf (2E+1) | 2E+0 | 7E-10 | 2E-12 | - | - |
| | | | | - | - | - | 2E-7 | 2E-6 |
| 88 | Radium-225 | W, all compounds | 8E+0 Bone surf (2E+1) | 7E-1 | 3E-10 | 9E-13 | - | - |
| | | | | - | - | - | 2E-7 | 2E-6 |
| 88 | Radium-226 | W, all compounds | 2E+0 Bone surf (5E+0) | 6E-1 | 3E-10 | 9E-13 | - | - |
| | | | | - | - | - | 6E-8 | 6E-7 |
| 88 | Radium-227[2] | W, all compounds | 2E+4 Bone surf (2E+4) | 1E+4 Bone surf (2E+4) | 6E-6 | - | - | - |
| | | | | | - | 3E-8 | 3E-4 | 3E-3 |
| 88 | Radium-228 | W, all compounds | 2E+0 Bone surf (4E+0) | 1E+0 | 5E-10 | 2E-12 | - | - |
| | | | | - | - | - | 6E-8 | 6E-7 |
| 89 | Actinium-224 | D, all compounds except those given for W and Y | 2E+3 LLI wall (2E+3) | 3E+1 Bone surf (4E+1) | 1E-8 | - | - | - |
| | | | | | - | 5E-11 | 3E-5 | 3E-4 |
| | | W, halides and nitrates | - | 5E+1 | 2E-8 | 7E-11 | - | - |
| | | Y, oxides and hydroxides | - | 5E+1 | 2E-8 | 6E-11 | - | - |
| 89 | Actinium-225 | | | | | | | |
| | | D, see $^{224}$Ac | 5E+1 LLI wall (5E+1) | 3E-1 Bone surf (5E-1) | 1E-10 | - | - | - |
| | | | | | - | 7E-13 | 7E-7 | 7E-6 |
| | | W, see $^{224}$Ac | - | 6E-1 | 3E-10 | 9E-13 | - | - |
| | | Y, see $^{224}$Ac | - | 6E-1 | 3E-10 | 9E-13 | - | - |

| Atomic No. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (μCi/ml) |
|---|---|---|---|---|---|---|---|---|
| 89 | Actinium-226 | D, see $^{224}$Ac | 1E+2 | 3E+0 | 1E-9 | - | - | - |
| | | | LLI wall (1E+2) | Bone surf (4E+0) | - | 5E-12 | 2E-6 | 2E-5 |
| | | W, see $^{224}$Ac | - | 5E+0 | 2E-9 | 7E-12 | - | - |
| | | Y, see $^{224}$Ac | - | 5E+0 | 2E-9 | 6E-12 | - | - |
| 89 | Actinium-227 | D, see $^{224}$Ac | 2E-1 | 4E-4 | 2E-13 | - | - | - |
| | | | Bone surf (4E-1) | Bone surf (8E-4) | - | 1E-15 | 5E-9 | 5E-8 |
| | | W, see $^{224}$Ac | - | 2E-3 | 7E-13 | - | - | - |
| | | | - | Bone surf (3E-3) | - | 4E-15 | - | - |
| | | Y, see $^{224}$Ac | - | 4E-3 | 2E-12 | 6E-15 | - | - |
| 89 | Actinium-228 | D, see $^{224}$Ac | 2E+3 | 9E+0 | 4E-9 | - | 3E-5 | 3E-4 |
| | | | - | Bone surf (2E+1) | - | 2E-11 | - | - |
| | | W see $^{224}$Ac | - | 4E+1 | 2E-8 | - | - | - |
| | | | - | Bone surf (6E+1) | - | 8E-11 | - | - |
| | | Y see $^{224}$Ac | - | 4E+1 | 2E-8 | 6E-11 | - | - |
| 90 | Thorium-226[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-141E-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- | - | |

| Atomic No. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (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 (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 (6E+0) | Bone surf (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. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (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 (4E+0) | Bone surf (4E-1) | - | 6E-13 | 6E-8 | 6E-7 |
| | | W, see $^{230}$U | - | 4E-1 | 2E-10 | 5E-13 | - | - |
| | | Y, see $^{230}$U | - | 8E-3 | 3E-12 | 1E-14 | - | - |
| 92 | Uranium-233 | D, see $^{230}$U | 1E+1 | 1E+0 | 5E-10 | - | - | |
| | | | Bone surf (2E+1) | Bone surf (2E+0) | - | 3E-12 | 3E-7 | 3E-6 |
| | | 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 (2E+1) | Bone surf (2E+0) | - | 3E-12 | 3E-7 | 3E-6 |
| | | W, see $^{230}$U | - | 7E-1 | 3E-10 | 1E-12 | - | - |
| | | Y, see $^{230}$U | - | 4E-2 | 2E-11 | 5E-14 | - | - |
| 92 | Uranium-235[3] | D, see $^{230}$U | 1E+1 | 1E+0 | 6E-10 | - | - | - |
| | | | Bone surf (2E+1) | Bone surf (2E+0) | - | 3E-12 | 3E-7 | 3E-6 |
| | | W, see $^{230}$U | - | 8E-1 | 3E-10 | 1E-12 | - | - |
| | | 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 | - | - |

| Atomic No. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values Col. 2 Inhalation ALI (μCi) | Table I Occupational Values Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Table II Effluent Concentrations Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (μCi/ml) |
|---|---|---|---|---|---|---|---|---|
| 92 | Uranium-240 | D, see $^{230}$U | 1E+3 | 4E+3 | 2E-6 | 5E-9 | 2E-5 | 2E-4 |
| | | W, see $^{230}$U | - | 3E+3 | 1E-6 | 4E-9 | - | - |
| | | Y, see $^{230}$U | - | 2E+3 | 1E-6 | 3E-9 | - | - |
| 92 | Uranium-natural[3] | D, see $^{230}$U | 1E+1 Bone surf (2E+1) | 1E+0 Bone surf (2E+0) | 5E-10 - | - 3E-12 | - 3E-7 | - 3E-6 |
| | | W, see $^{230}$U | - | 8E-1 | 3E-10 | 9E-13 | - | - |
| | | Y, see $^{230}$U | - | 5E-2 | 2E-11 | 9E-24 | - | - |
| 93 | Neptunium-232[2] | W, all compounds | 1E+5 - | 2E+3 Bone surf (5E+2) | 7E-7 - | - 6E-9 | 2E-3 - | 2E-2 - |
| 93 | Neptunium-233[2] | W, all compounds | 8E+5 | 3E+6 | 1E-3 | 4E-6 | 1E-2 | 1E-1 |
| 93 | Neptunium-234 | W, all compounds | 2E+3 | 3E+3 | 1E-6 | 4E-9 | 3E-5 | 3E-4 |
| 93 | Neptunium-235 | W, all compounds | 2E+4 LLI wall (2E+4) | 8E+2 Bone surf (1E+3) | 3E-7 - | - 2E-9 | - 3E-4 | - 3E-3 |
| 93 | Neptunium-236 (1.15E+5 y) | W, all compounds | 3E+0 Bone surf (6E+0) | 2E-2 Bone surf (5E-2) | 9E-12 - | - 8E-14 | - 9E-8 | - 9E-7 |
| 93 | Neptunium-236 (22.5 h) | W, all compounds | 3E+3 Bone surf (4E+3) | 3E+1 Bone surf (7E+1) | 1E-8 - | - 1E-10 | - 5E-5 | - 5E-4 |
| 93 | Neptunium-237 | W, all compounds | 5E-1 Bone surf (1E+0) | 4E-3 Bone surf (1E-2) | 2E-12 - | - 1E-14 | - 2E-8 | - 2E-7 |
| 93 | Neptunium-238 | W, all compounds | 1E+3 - | 6E+1 Bone surf (2E+2) | 3E-8 - | - 2E-10 | 2E-5 - | 2E-4 - |
| 93 | Neptunium-239 | W, all compounds | 2E+3 LLI wall (2E+3) | 2E+3 - | 9E-7 - | 3E-9 - | - 2E-5 | - 2E-4 |
| 93 | Neptunium-240[2] | W, all compounds | 2E+4 | 8E+4 | 3E-5 | 1E-7 | 3E-4 | 3E-3 |
| 94 | Plutonium-234 | W, all compounds except PuO | 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 Bone surf (4E+0) | 2E-2 Bone surf (4E-2) | 8E-12 - | - 5E-14 | - 6E-8 | - 6E-7 |
| | | Y, see $^{234}$Pu | - | 4E-2 | 2E-11 | 6E-14 | - | - |
| 94 | Plutonium-237 | W, see $^{234}$Pu | 1E+4 | 3E+3 | 1E-6 | 5E-9 | 2E-4 | 2E-3 |
| | | Y, see $^{234}$Pu | - | 3E+3 | 1E-6 | 4E-9 | - | - |
| 94 | Plutonium-238 | W, see $^{234}$Pu | 9E-1 Bone surf (2E+0) | 7E-3 Bone surf (1E-2) | 3E-12 - | - 2E-14 | - 2E-8 | - 2E-7 |
| | | Y, see $^{234}$Pu | - | 2E-2 | 8E-12 | 2E-14 | - | - |

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

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

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

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

| Atomic No. | Radionuclide | Class | Table I Occupational Values Col. 1 Oral Ingestion ALI (μCi) | Col. 2 Inhalation ALI (μCi) | Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations Col. 1 Air (μCi/ml) | Col. 2 Water (μCi/ml) | Table III Releases to Sewers Monthly Average Concentration (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 exceed8E-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 = $[0.4 + 0.38 (\text{enrichment}) + 0.0034 (\text{enrichment})^2] E\text{-}6$, 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

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

| Atomic No. | Radionuclide | Class | Table I Occupational Values: Col. 1 Oral Ingestion ALI (μCi) | Table I Occupational Values: Col. 2 Inhalation ALI (μCi) | Table I Occupational Values: Col.3 Inhalation DAC (μCi/ml) | Table II Effluent Concentrations: Col. 1 Air (μCi/ml) | Table II Effluent Concentrations: Col. 2 Water (μCi/ml) | Table III Releases to Sewers: Monthly Average Concentration (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) | Radionuclide | Quantity (μCi) |
|---|---|---|---|
| Hydrogen-3 | 1,000 | Nickel-56 | 100 |
| Beryllium-7 | 1,000 | Nickel-57 | 100 |
| Beryllium-10 | 1 | Nickel-59 | 100 |
| Carbon-11 | 1,000 | Nickel-63 | 100 |
| Carbon-14 | 1,000 | Nickel-65 | 1,000 |
| Fluorine-18 | 1,000 | Nickel-66 | 10 |
| Sodium-22 | 10 | Copper-60 | 1,000 |
| Sodium-24 | 100 | Copper-61 | 1,000 |
| Magnesium-28 | 100 | Copper-64 | 1,000 |
| Aluminum-26 | 10 | Copper-67 | 1,000 |
| Silicon-31 | 1,000 | Zinc-62 | 100 |
| Silicon-32 | 1 | Zinc-63 | 1,000 |
| Phosphorus-32 | 10 | Zinc-65 | 10 |
| Phosphorus-33 | 100 | Zinc-69m | 100 |
| Sulfur-35 | 100 | Zinc-69 | 1,000 |
| Chlorine-36 | 10 | Zinc-71m | 1,000 |
| Chlorine-38 | 1,000 | Zinc-72 | 100 |
| Chlorine-39 | 1,000 | Gallium-65 | 1,000 |
| Argon-39 | 1,000 | Gallium-66 | 100 |
| Argon-41 | 1,000 | Gallium-67 | 1,000 |
| Potassium-40 | 100 | Gallium-68 | 1,000 |
| Potassium-42 | 1,000 | Gallium-70 | 1,000 |
| Potassium-43 | 1,000 | Gallium-72 | 100 |
| Potassium-44 | 1,000 | Gallium-73 | 1,000 |
| Potassium-45 | 1,000 | Germanium-66 | 1,000 |
| Calcium-41 | 100 | Germanium-67 | 1,000 |
| Calcium-45 | 100 | Germanium-68 | 10 |
| Calcium-47 | 100 | Germanium-69 | 1,000 |
| Scandium-43 | 1,000 | Germanium-71 | 1,000 |
| Scandium-44m | 100 | Germanium-75 | 1,000 |
| Scandium-44 | 100 | Germanium-77 | 1,000 |
| Scandium-46 | 10 | Germanium-78 | 1,000 |
| Scandium-47 | 100 | Arsenic-69 | 1,000 |
| Scandium-48 | 100 | Arsenic-70 | 1,000 |
| Scandium-49 | 1,000 | Arsenic-71 | 100 |
| Titanium-44 | 1 | Arsenic-72 | 100 |
| Titanium-45 | 1,000 | Arsenic-73 | 100 |
| Vanadium-47 | 1,000 | Arsenic-74 | 100 |
| Vanadium-48 | 100 | Arsenic-76 | 100 |
| Vanadium-49 | 1,000 | Arsenic-77 | 100 |
| Chromium-48 | 1,000 | Arsenic-78 | 1,000 |
| Chromium-49 | 1,000 | Selenium-70 | 1,000 |
| Chromium-51 | 1,000 | Selenium-73m | 1,000 |
| Manganese-51 | 1,000 | Selenium-73 | 100 |
| Manganese-52m | 1,000 | Selenium-75 | 100 |
| Manganese-52 | 100 | Selenium-79 | 100 |
| Manganese-53 | 1,000 | Selenium-81m | 1,000 |
| Manganese-54 | 100 | Selenium-81 | 1,000 |
| Manganese-56 | 1,000 | Selenium-83 | 1,000 |
| Iron-52 | 100 | Bromine-74m | 1,000 |
| Iron-55 | 100 | Bromine-74 | 1,000 |
| Iron-59 | 10 | Bromine-75 | 1,000 |
| Iron-60 | 1 | Bromine-76 | 100 |
| Cobalt-55 | 100 | Bromine-77 | 1,000 |
| Cobalt-56 | 10 | Bromine-80m | 1,000 |
| Cobalt-57 | 100 | Bromine-80 | 1,000 |
| Cobalt-58m | 1,000 | Bromine-82 | 100 |
| Cobalt-58 | 100 | Bromine-83 | 1,000 |
| Cobalt-60m | 1,000 | Bromine-84 | 1,000 |
| Cobalt-60 | 1 | Krypton-74 | 1,000 |
| Cobalt-61 | 1,000 | Krypton-76 | 1,000 |
| Cobalt-62m | 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 |
| 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 |
| 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 |
| 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 |
| 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 |
| 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 |
| 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.

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.

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 | Material | Microcurie |
|---|---|---|---|
| Americium-241 | 0.01 | Iodine-134 | 10 |
| Antimony-122 | 100 | Iodine-135 | 10 |
| Antimony-124 | 10 | Iridium-192 | 10 |
| Antimony-125 | 10 | Iridium-194 | 100 |
| Arsenic-73 | 100 | Iron-55 | 100 |
| Arsenic-74 | 10 | Iron-59 | 10 |
| Arsenic-76 | 10 | Krypton-85 | 100 |
| Arsenic-77 | 100 | Krypton-87 | 10 |
| Barium-131 | 10 | Lanthanum-140 | 10 |
| Barium-133 | 10 | Lutetium-177 | 100 |
| Barium-140 | 10 | Manganese-52 | 10 |
| Bismuth-210 | 1 | Manganese-54 | 10 |
| Bromine-82 | 10 | Manganese-56 | 10 |
| Cadmium-109 | 10 | Mercury-197m | 100 |
| Cadmium-115m | 10 | Mercury-197 | 100 |
| Cadmium-115 | 100 | Mercury-203 | 10 |
| Calcium-45 | 10 | Molybdenum-99 | 100 |
| Calcium-47 | 10 | Neodymium-147 | 100 |
| Carbon-14 | 100 | Neodymium-149 | 100 |
| Cerium-141 | 100 | Nickel-59 | 100 |
| Cerium-143 | 100 | Nickel-63 | 10 |
| Cerium-144 | 1 | Nickel-65 | 100 |
| Cesium-131 | 1,000 | Niobium-93m | 10 |
| Cesium-134m | 100 | Niobium-95 | 10 |
| Cesium-134 | 1 | Niobium-97 | 10 |
| Cesium-135 | 10 | Osmium-185 | 10 |
| Cesium-136 | 10 | Osmium-191m | 100 |
| Cesium-137 | 10 | Osmium-191 | 100 |
| Chlorine-36 | 10 | Osmium-193 | 100 |
| Chlorine-38 | 10 | Palladium-103 | 100 |
| Chromium-51 | 1,000 | Palladium-109 | 100 |
| Cobalt-58m | 10 | Phosphorus-32 | 10 |
| Cobalt-58 | 10 | Platinum-191 | 100 |
| Cobalt-60 | 1 | Platinum-193m | 100 |
| Copper-64 | 100 | Platinum-193 | 100 |
| Dysprosium-165 | 10 | Platinum-197m | 100 |
| Dysprosium-166 | 100 | Platinum-197 | 100 |
| Erbium-169 | 100 | Plutonium-239 | 0.01 |
| Erbium-171 | 100 | Polonium-210 | 0.1 |
| Europium-152 (9.2 h) | 100 | Potassium-42 | 10 |
| Europium-152 (13 yr) | 1 | Praseodymium-142 | 100 |
| Europium-154 | 1 | Praseodymium-143 | 100 |
| Europium-155 | 10 | Promethium-147 | 10 |
| Fluorine-18 | 1,000 | Promethium-149 | 10 |
| Gadolinium-153 | 10 | Radium-226 | 0.01 |
| Gadolinium-159 | 100 | Rhenium-186 | 100 |
| Gallium-72 | 10 | Rhenium-188 | 100 |
| Germanium-71 | 100 | Rhodium-103m | 100 |
| Gold-198 | 100 | Rhodium-105 | 100 |
| Gold-199 | 100 | Rubidium-86 | 10 |
| Hafnium-181 | 10 | Rubidium-87 | 10 |
| Holmium-166 | 100 | Ruthenium-97 | 100 |
| Hydrogen-3 | 1,000 | Ruthenium-103 | 10 |
| Indium-113m | 100 | Ruthenium-105 | 10 |
| Indium-114m | 10 | Ruthenium-106 | 1 |
| Indium-115m | 100 | Samarium-151 | 10 |
| Indium-115 | 10 | Samarium-153 | 100 |
| Iodine-125 | 1 | Scandium-46 | 10 |
| Iodine-126 | 1 | Scandium-47 | 100 |
| Iodine-129 | 0.1 | Scandium-48 | 10 |
| Iodine-131 | 1 | Selenium-75 | 10 |
| Iodine-132 | 10 | Silicon-31 | 100 |
| Iodine-133 | 1 | 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 |
| 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 5. SEALED SOURCE INDUSTRIAL RADIOGRAPHY

**R12-1-501. Definitions**

"Access panel" means any panel that is designed to be removed or opened for maintenance or service purposes, opened using tools, and used to provide access to the interior of the cabinet x-ray unit.

"Annual refresher safety training" means a review conducted or provided by the licensee for its employees on radiation safety aspects of industrial radiography. The review shall include, as applicable, the results of internal inspections, new procedures or equipment, new or revised state rules, accidents or errors that have occurred, and provide opportunities for employees to ask safety questions.

"Aperture" means any opening in the outside surface of the cabinet x-ray unit, other than a port, which remains open during generation of x-radiation.

"Associated equipment" means equipment used in conjunction with a radiographic exposure device that drives, guides, or comes in contact with the source.

"Certifying entity" means an independent certifying organization that complies with the requirements in Appendix A of this Article, or requirements of the NRC or another Agreement State, that are equivalent to the requirements in parts II and III of Appendix A.

"Collimator" means a radiation shield that is placed on the end of the guide tube or directly onto a radiographic exposure device to restrict the size of the radiation beam when the sealed source is positioned to make a radiographic exposure.

"Control (drive) cable" means the cable that is connected to the source assembly and used to drive the source to and from the exposure location.

"Control (drive) mechanism" means a device that enables the source assembly to be moved to and from the exposure device.

"Control tube" means a protective sheath for guiding the control cable. The control tube connects the control drive mechanism to the radiographic exposure device.

"Door" means any barrier that is designed to be movable or opened for routine operation purposes, not opened using tools, and used to provide access to the interior of the cabinet x-ray unit.

"Exposure head" means a device that places the gamma radiography sealed source in a selected working position.

"Ground fault" means an accidental electrical grounding of an electrical conductor.

"Guide tube (projection sheath)" means a flexible or rigid tube (i.e., "J" tube) for guiding the source assembly and the attached control cable from the exposure device to the exposure head. The guide tube may also include the connections necessary for attachment to the exposure device and to the exposure head.

"Hands-on experience" means accumulation of knowledge or skill in any area relevant to radiography.

"Independent certifying organization" means an independent organization that meets all of the requirements in Appendix A.

"Lay-barge radiography" means industrial radiography performed on any water vessel used for laying pipe.

"Port" means any opening in the outside surface of the cabinet x-ray unit that is designed to remain open, during generation of x-rays, for conveying material being irradiated into and out of the cabinet, or for partial insertion of an object for irradiation whose dimensions do not permit complete insertion into the cabinet x-ray unit.

"Practical examination" means a demonstration, through practical application of safety rules and principles of industrial radiography, including use of all radiography equipment and knowledge of radiography procedures.

"Radiographer certification" means written approval received from a certifying entity stating that an individual has satisfactorily met certain established radiation safety, testing, and experience criteria.

"Radiographic exposure device" means any x-ray machine used for purposes of making an industrial radiographic exposure or a device that contains a sealed source, and the sealed source or its shielding may be moved or otherwise changed from a shielded to an unshielded position for purposes of making an industrial radiographic exposure.

"Radiographic operations" means all activities associated with the presence of radiation sources in a radiographic exposure device during use of the device or transport (except when the device is being transported by a common or contract carrier). This includes performing surveys to confirm the adequacy of boundaries, setting up equipment, and conducting any activity inside restricted area boundaries.

"S-tube" means a tube through which a radioactive source travels when the source is inside a radiographic exposure device.

"Source assembly" means an assembly that consists of a sealed source and a connector that attaches the source to a control cable. The source assembly may also include a stop ball used to secure the source in the shielded position.

"Underwater radiography" means industrial radiography performed when a radiographic exposure device is beneath the surface of water.

**Historical Note**

Former Rule Section E.1; Former Section R12-1-501 repealed, new Section R12-1-501 adopted effective June 30, 1977 (Supp. 77-3). Former Section R12-1-501 repealed, new Section adopted effective April 2, 1990 (Supp. 90-2). Amended effective August 10, 1994 (Supp. 94-3). Amended 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 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 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4).

**R12-1-502. License Requirements**

**A.** The Agency shall review an application for a specific license for the use of radioactive material in industrial radiography and approve the license if an applicant meets all of the following requirements:

1. The applicant satisfies the general requirements in R12-1-309 and any special requirements contained in this Article; and
2. The applicant submits a program for training radiographers and radiographers' assistants that complies with R12-1-543, except that:
   a. After the effective date of this Section, an applicant is not required to describe its initial training and examination program for radiographers;
   b. An applicant shall affirm that an individual who is acting as an industrial radiographer is certified in radiation safety by a certifying organization, as required in R12-1-543, before permitting the individual to act as a radiographer. This affirmation substitutes for a description of the applicant's initial training and examination program for radiographers in the subjects outlined in R12-1-543(G); and
   c. An applicant shall submit procedures for verifying and documenting the certification status of each radiographer and for ensuring that the certification remains valid.

**B.** The applicant shall submit written operating and emergency procedures as prescribed in R12-1-522.

**C.** The applicant shall submit a description of a program for review of job performance of each radiographer and radiographers' assistant at intervals that do not exceed six months as prescribed in R12-1-543(E).

**D.** The applicant shall submit a description of the applicant's overall organizational structure as it applies to radiation safety

responsibilities in industrial radiography, including specified delegation of authority and responsibility.

**E.** The applicant shall submit a list of the qualifications of each individual designated as an RSO under R12-1-512 and indicate which designee is responsible for ensuring that the licensee's radiation safety program is implemented in accordance with approved procedures.

**F.** If an applicant intends to perform leak testing on any sealed source or exposure device that contains depleted uranium (DU) shielding, the applicant shall submit a description of the procedures for performing the leak testing and the qualifications of each person authorized to perform leak testing. If the applicant intends to analyze its own wipe samples, the application shall include a description of the procedures to be followed. The description shall include the:
1. Instruments to be used,
2. Methods of performing the analysis, and
3. Relevant experience of the person who will analyze the wipe samples.

**G.** If the applicant intends to perform "in-house" calibrations of survey instruments, the applicant shall describe each calibration method to be used and the relevant experience of each person who will perform a calibration. A licensee shall perform all calibrations according to the procedures prescribed in R12-1-504.

**H.** The applicant shall identify and describe the location of all field stations and permanent radiographic installations.

**I.** The applicant shall identify each location where records required by this Chapter will be maintained.

**Historical Note**

Former Rule Section E.2; Former Section R12-1-502 repealed, new Section R12-1-502 adopted effective June 30, 1977 (Supp. 77-3). Former Section R12-1-502 repealed, new Section adopted effective April 2, 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). Section repealed; new Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-503. Performance Requirements for Equipment**

**A.** A licensee shall ensure that equipment used in industrial radiographic operations meets the following minimum criteria:
1. Each radiographic exposure device, source assembly or sealed source, and all associated equipment meet the requirements in American National Standards Institute, N432-1980 "Radiological Safety for the Design and Construction of Apparatus for Gamma Radiography" (published as NBS Handbook 136, issued January 1981) by the American National Standards Institute, which is incorporated by reference and on file with the Agency. This incorporation by reference contains no future editions or amendments. This publication may be purchased from the American National Standards Institute, Inc., 25 West 43rd Street, New York, New York 10036 Telephone (212) 642-4900. A copy of the document is also on file at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call (202) 741-6030, or go to: *http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html*; or
2. An engineering safety analysis demonstrates the applicability of previously performed testing on similar individual radiography equipment components. Based on a review of the analysis, the Agency may find that previously performed testing can be substituted for testing of the component under the standards in subsection (A)(1).

**B.** In addition to the requirements in subsection (A), the following requirements apply to each radiographic exposure device, source changer, source assembly, and sealed source:
1. A licensee shall ensure that each radiographic exposure device has attached to it a durable, legible, and clearly visible label bearing:
   a. The chemical symbol and mass number of the radionuclide in the device;
   b. The activity of the source and the date on which this activity was last measured;
   c. The model (or product code) and serial number of the sealed source;
   d. The manufacturer's description of the sealed source; and
   e. The licensee's name, address, and telephone number.
2. A licensee shall ensure that each radiographic exposure device intended for use as a Type B transport container meets the applicable requirements of 10 CFR 71, revised January 1, 2015, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.
3. A licensee shall not modify any radiographic exposure device, source changer, source assembly, or associated equipment, unless the design of the replacement component, including source holder, source assembly, controls, or guide tubes is consistent with and does not compromise the design safety features of the system.

**C.** In addition to the requirements in subsections (A) and (B), the following requirements apply to each radiographic exposure device, source assembly, and associated equipment that allows the source to be moved out of the device for radiographic operations or to a source changer:
1. The license shall ensure that the coupling between the source assembly and the control cable is designed so that the source assembly does not become disconnected if it is positioned outside of the guide tube and is constructed so that an unintentional disconnect will not occur under normal and reasonably foreseeable abnormal conditions;
2. The device automatically secures the source assembly if it is retracted into the fully shielded position within the device and the securing system is released from the exposure device only by means of a deliberate operation;
3. The outlet fittings, lock box, and drive cable fittings on each radiographic exposure device are equipped with safety plugs or covers installed for storage and transportation to protect the source assembly from water, mud, sand, or other foreign matter;
4. Each sealed source or source assembly has attached to it or is engraved with a durable, legible, and visible label with the words: "DANGER--RADIOACTIVE." The licensee shall ensure that the label does not interfere with safe operation of the equipment;
5. The guide tube is able to withstand a crushing test that closely approximates the crushing forces that are likely to be encountered during use, and a kinking resistance test that closely approximates the kinking forces that are likely to be encountered during use;
6. A guide tube is used if a person moves the source out of the device;
7. An exposure head or similar device, designed to prevent the source assembly from passing out of the end of the guide tube, is attached to the outermost end of the guide tube during industrial radiography operations;

8. The guide tube exposure head connection is able to withstand the tensile test for control units specified in ANSI N432-1980, incorporated by reference in subsection (A); and
9. Source changers provide a system for ensuring that the source is not accidentally withdrawn from the changer when a person is connecting or disconnecting the drive cable to or from the source assembly.

**D.** A licensee shall ensure that radiographic exposure devices and associated equipment in use after January 10, 1996 comply with the requirements of this Section.

**E.** Notwithstanding subsection (A), a licensee with equipment used in industrial radiographic operations need not comply with Sec. 8.92(C) of the Endurance Test in American National Standards Institute N432-1980 if the prototype equipment has been tested using a torque value representative of the torque that an individual using the radiography equipment can realistically exert on the lever or crankshaft of the drive mechanism.

**Historical Note**

Former Rule Section E.3; Former Section R12-1-503 repealed, new Section R12-1-503 adopted effective June 30, 1977 (Supp. 77-3). Amended effective December 20, 1985 (Supp. 85-6). Former Section R12-1-503 repealed, new Section adopted effective April 2, 1990 (Supp. 90-2). Section repealed; 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).

**R12-1-504. Radiation Survey Instruments**

**A.** A licensee shall maintain at least two calibrated and operable radiation survey instruments at each location where sources of radiation are present to make radiation surveys required by this Article and Article 4 of this Chapter. Instrumentation required by this Section shall be capable of measuring a range from 0.02 millisieverts (2 millirems) per hour through 0.01 sievert (1 rem) per hour.

**B.** A licensee shall ensure that each radiation survey instrument required under subsection (A) is calibrated:
1. At intervals that do not exceed six months, and after instrument servicing, except for battery changes;
2. For linear scale instruments, at two points located approximately one-third and two-thirds of full-scale on each scale; for logarithmic scale instruments, at mid-range of each decade, and at two points of at least one decade; and for digital instruments, at 3 points between 0.02 and 10 millisieverts (2 and 1000 millirems) per hour; and
3. So that an accuracy within plus or minus 20% of the calibration source can be demonstrated at each point checked.

**C.** A licensee shall maintain calibration records for each radiation survey instrument, and maintain each record for three years after it is made.

**Historical Note**

Former Rule Section E.4; Former Section R12-1-504 repealed, new Section R12-1-504 adopted effective June 30, 1977 (Supp. 77-3). Former Section R12-1-504 repealed, new Section R12-1-504 adopted effective December 20, 1985 (Supp. 85-6). Former Section R12-1-504 repealed, new Section adopted effective April 2, 1990 (Supp. 90-2). Amended 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).

**R12-1-505. Leak Testing and Replacement of Sealed Sources**

**A.** A licensee shall ensure that replacement of any sealed source fastened to or contained in a radiographic exposure device and leak testing of any sealed source is performed by a person authorized to do so by the Agency, NRC, or another Agreement State.

**B.** A licensee shall ensure that opening, repairing, or modifying any sealed source is performed by a person specifically authorized to do so by the Agency, NRC, or another Agreement State.

**C.** A licensee that uses a sealed source shall have the source tested for leakage by a qualified person at intervals that do not exceed six months. The person who performs leak testing of the source shall use a method approved by the Agency, NRC, or by another Agreement State. A wipe sample shall be taken from the nearest accessible point to the sealed source where contamination might accumulate. The wipe sample shall be analyzed for radioactive contamination. The licensee shall ensure that the analysis is capable of detecting the presence of 185 Bq (0.005 microcurie) of radioactive material on the test sample and a person specifically authorized by the Agency, NRC, or another Agreement State performs the analysis. The licensee shall maintain records of the leak tests in accordance with this Section.

**D.** Unless a sealed source is accompanied by a certificate from the transferor that shows that the sealed source has been leak tested within six months before the transfer, a licensee shall not use the sealed source until it is tested for leakage. A licensee is not required to test a sealed source that is in storage, but shall test each sealed source before use or transfer to another person if the interval of storage exceeds six months.

**E.** A licensee shall immediately withdraw equipment containing a leaking source from use and have it decontaminated and repaired or dispose of the source in accordance with this Chapter. The licensee shall file a report with the Director of the Agency within five days of any test with results that exceed the threshold in this subsection, and describe the equipment involved, the test results, and corrective action taken. If a leak test conducted under this Section reveals the presence of 185 Bq (0.005 microcurie) or more of removable radioactive material the Agency classifies the sealed source as leaking.

**F.** A licensee shall test for DU contamination at intervals that do not to exceed 12 months a radiographic exposure device that uses depleted uranium (DU) shielding and an "S" tube configuration. The licensee shall ensure that the analysis is capable of detecting the presence of 185 Bq (0.005 microcuries) of radioactive material on the test sample and a person specifically authorized by the Agency, NRC, or another Agreement State performs the analysis. If the testing reveals the presence of 185 Bq (0.005 microcuries) or more of removable DU contamination, the licensee shall remove the exposure device from use until an evaluation of the wear on the S-tube is completed. If the evaluation reveals that the S-tube is worn through, the licensee shall ensure that the device is not used again. The licensee is not required to test for DU contamination if the radiographic exposure device is in storage. Before using or transferring the radiographic exposure device, the licensee shall test the device for DU contamination if the interval of storage exceeds 12 months. The licensee shall maintain records of the DU leak test in accordance with subsection (G).

**G.** A licensee shall maintain records of leak test results for each sealed source and for each device that contains DU. The licensee shall ensure results are in Becquerels (microcuries), and retain each record for three years after it is made or until the source is removed from storage and tested, which ever is longer.

**Historical Note**
Former Rule Section E.5; Former Section R12-1-505 repealed, new Section R12-1-505 adopted effective June 30, 1977 (Supp. 77-3). Former Section R12-1-505 repealed, new Section R12-1-505 adopted effective December 20, 1985 (Supp. 85-6). Amended subsections (A), (F) and (G) effective May 2, 1988 (Supp. 88-2). Former Section R12-1-505 repealed, new Section adopted effective April 2, 1990 (Supp. 90-2). Amended effective August 10, 1994 (Supp. 94-3). Amended 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 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-506. Quarterly Inventory**

**A.** A licensee shall conduct a quarterly physical inventory to account for all sealed sources and devices that contain depleted uranium.

**B.** A licensee shall maintain a record of the quarterly inventory required under subsection (A) for three years after it is made.

**C.** The record required in subsection (B) shall include the date of the inventory, name of the individual who conducted the inventory, radionuclide, number of becquerels (curies) or mass (for DU) in each device, location of sealed source and associated devices, and manufacturer, model, and serial number of each sealed source and device as applicable.

**Historical Note**
Former Rule Section E.6; Former Section R12-1-506 repealed, new Section R12-1-506 adopted effective June 30, 1977 (Supp. 77-3). Former Section R12-1-506 repealed, new Section R12-1-506 adopted effective December 20, 1985 (Supp. 85-6). Amended subsection (A) effective May 2, 1988 (Supp. 88-2). Former Section R12-1-506 repealed, new Section adopted effective April 2, 1990 (Supp. 90-2). Amended effective June 13, 1997 (Supp. 97-2). Amended by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-507. Utilization Logs**

**A.** A licensee shall maintain for each sealed source a utilization log that provides all of the following information:
1. A description, including the make, model, and serial number of each radiographic exposure device, and each sealed source transport and storage container that contains a sealed source;
2. The identity and signature of the radiographer using the source; and
3. The plant or site where the source is used and dates of use, including the date each source is removed from and returned to storage.

**B.** A licensee shall retain the log required by subsection (A) for three years after the log is made.

**Historical Note**
Former Section R12-1-507 repealed effective December 20, 1985 (Supp. 85-6). New Section adopted effective April 2, 1990 (Supp. 90-2). 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).

**R12-1-508. Inspection and Maintenance of Radiographic Exposure Devices, Transport and Storage Containers, Source Changers, Survey Instruments, and Associated Equipment**

**A.** A licensee shall perform visual and operability checks on each survey instrument, radiographic exposure device, transport and storage container, source changer, and associated equipment before use on each day the equipment is to be used to ensure that the equipment is in good working condition, the source is adequately shielded, and required labeling is present. A survey instrument operability check shall be performed using a check source or other authorized means. If an equipment problem is found, the licensee shall remove the equipment from service until it is repaired.

**B.** A licensee shall have written inspection and maintenance procedures to ensure that:
1. Radiographic exposure devices, source changers, transport and storage containers, survey instruments, and associated equipment that require inspection and maintenance at intervals that do not exceed three months or before first use of the equipment are functioning properly and safely. Replacement components shall meet design specifications. If an equipment problem is discovered, the licensee shall remove the equipment from service until it is repaired; and
2. Type B packages are shipped and maintained in accordance with the certificate of compliance or other approval.

**C.** A licensee shall maintain records of daily checks and quarterly inspections of radiographic exposure devices, transport and storage containers, source changers, survey instruments, and associated equipment, and retain each record for three years after it is made. The record shall include the date of the check or inspection, name of the inspector, equipment involved, any problems found, and any repair or needed maintenance performed.

**Historical Note**
Former Section R12-1-508 repealed effective December 20, 1985 (Supp. 85-6). New Section adopted effective April 2, 1990 (Supp. 90-2). Heading amended 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).

**R12-1-509. Surveillance**

During each radiographic operation, a radiographer or the radiographer's assistant, as permitted by R12-1-510, shall maintain continuous direct visual surveillance of the operation to protect against unauthorized entry into a high radiation area, except at permanent radiographic installations where all entrances are locked and the licensee is in compliance with R12-1-539.

**Historical Note**
Former Section R12-1-509 repealed effective December 20, 1985 (Supp. 85-6). New Section adopted effective April 2, 1990 (Supp. 90-2). Amended effective August 10, 1994 (Supp. 94-3). Amended 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 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-510. Radiographic Operations**

**A.** If industrial radiography is performed at a location other than a permanent radiographic installation, a licensee shall ensure that the radiographer is accompanied by at least one other radiographer or radiographer's assistant, qualified under R12-1-543. The additional radiographer or radiographer's assistant shall observe the operations and be capable of providing immediate assistance to prevent unauthorized entry. Industrial radiography is prohibited if only one qualified individual is present.

**B.** A licensee shall ensure that each industrial radiographic operation is conducted at a location of use authorized on the license

in a permanent radiographic installation, unless another permanent location is specifically authorized by the Agency.

**Historical Note**
Repealed effective December 20, 1985 (Supp. 85-6). 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). Section repealed; new Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-511. Repealed**

**Historical Note**
Repealed effective December 20, 1985 (Supp. 85-6). New Section adopted 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). Section repealed by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-512. Radiation Safety Officer (RSO)**

**A.** A licensee shall have a radiation safety officer (RSO) who is responsible for implementing procedures and regulatory requirements in the daily operation of the radiation safety program.

**B.** Except as provided in subsection (C), the licensee shall ensure that the RSO satisfies the following minimum requirements:
1. The training and testing requirements in R12-1-543,
2. Two thousand hours of hands-on experience as a qualified radiographer for an industrial radiographic operation, and
3. Formal training in the establishment and maintenance of a radiation safety program.

**C.** If the licensee uses an individual in the position of RSO who does not have the training and experience required in subsection (B), the licensee shall provide the Agency with a description of the individual's training and experience in the field of ionizing radiation and training with respect to the establishment and maintenance of a radiation safety protection program so the Agency can determine whether the individual is qualified to perform under subsection (D).

**D.** The specific duties and authorities of the RSO include, but are not limited to:
1. Establishing and overseeing operating, emergency, and ALARA procedures as required in Article 4 of this Chapter and reviewing them every year to ensure that the procedures in use conform to current Agency rules and license conditions;
2. Overseeing and approving all phases of the training program for radiographic personnel, ensuring that appropriate and effective radiation protection practices are taught;
3. Overseeing radiation surveys, leak tests, and associated documentation to ensure that the surveys and tests are performed in accordance with the rules and taking corrective measures if levels of radiation exceed established action limits;
4. Overseeing the personnel monitoring program to ensure that devices are calibrated and used properly by occupationally exposed personnel and ensuring that records are kept of the monitoring results and timely notifications are made as required in R12-1-444; and
5. Overseeing operations to ensure that they are conducted safely and instituting corrective actions, which may include ceasing operations if necessary.

**Historical Note**
Repealed effective December 20, 1985 (Supp. 85-6). 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 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-513. Form of Records**

A licensee shall maintain records in accordance with R12-1-405.

**Historical Note**
Repealed effective December 20, 1985 (Supp. 85-6). New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-514. Limits on External Radiation Levels from Storage Containers and Source Changers**

The maximum rate limits for storage containers and source changers are 2 millisieverts (200 mRem/hr) at any exterior surface and 0.1 millisieverts (10 mRem/hr) at 1 meter from any exterior surface with the sealed source in the shielded position.

**Historical Note**
Repealed effective December 20, 1985 (Supp. 85-6). New Section made by final rulemaking at 9 A.A.R. 1126, effective May 9, 2003 (Supp. 03-1).

**R12-1-515. Locking Radiographic Exposure Devices, Storage Containers, and Source Changers**

**A.** Except at permanent radiographic installations governed by R12-1-539, a licensee shall ensure that each radiographic exposure device has a lock or an outer container with a lock designed to prevent unauthorized or accidental removal of the sealed source from its shielded position. The licensee shall ensue that the exposure device or its container, if applicable, is locked (and if a keyed lock, with the key removed) if the device or container is not under the direct surveillance of a radiographer or a radiographer's assistant. During radiographic operations, the radiographer or radiographer's assistant shall secure the sealed source assembly in the shielded position each time the source is returned to the shielded position.

**B.** A licensee shall ensure that each sealed source storage container and source changer has a lock or an outer container with a lock designed to prevent unauthorized or accidental removal of the sealed source from its shielded position. The licensee shall ensure that each storage container and source changer is locked (and if a keyed lock, with the key removed) if the storage container or source changer contains a sealed source and is not under the direct surveillance of a radiographer or a radiographer's assistant.

**Historical Note**
Repealed effective December 20, 1985 (Supp. 85-6). New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-516. Records of Receipt and Transfer of Sealed Sources**

**A.** A licensee shall maintain records that show each receipt and transfer of a sealed source or device that uses DU for shielding and retain each record for three years after it is made.

**B.** The records shall contain separate entries for each transaction, including the date, name of the individual making the record, radionuclide, number of Becquerels (curies) or mass (for DU), and manufacturer, model, and serial number of each sealed source or device, as applicable.

**Historical Note**
Repealed effective December 20, 1985 (Supp. 85-6). New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-517. Posting**

A licensee shall post any area in which industrial radiography is performed as required by R12-1-429. Exceptions listed in R12-1-430 do not apply to industrial radiographic operations.

**Historical Note**

Repealed effective December 20, 1985 (Supp. 85-6). New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-518. Labeling, Storage, and Transportation**

**A.** A licensee shall not use a source changer or a storage container to store licensed material unless the source changer or the storage container has securely attached to it a durable, legible, and clearly visible label that bears the standard trefoil radiation caution symbol and the standard colors for the symbol specifically: magenta, purple, or black on a yellow background, and the label has a minimum diameter of 25 mm and the wording "CAUTION (or DANGER), RADIOACTIVE MATERIAL NOTIFY CIVIL AUTHORITIES (or "NAME OF COMPANY")"

**B.** A licensee shall not transport licensed material unless the material is packaged and the package is labeled, marked, and accompanied with appropriate shipping papers in accordance with 10 CFR 71, January 1, 2004, published by the Office of the Federal Register, National Archives and Records Administration, incorporated by reference, and on file with the Agency. This incorporation by reference contains no future editions or amendments.

**C.** A licensee shall physically secure locked radiographic exposure devices and storage containers behind a locked door to prevent tampering or removal by unauthorized personnel. The licensee shall store licensed material in a manner that will minimize danger from explosion or fire.

**D.** A licensee shall lock each transport package that contains licensed material and physically secure the package behind the locked doors of the transporting vehicle to prevent accidental loss, tampering, or unauthorized removal of the licensed material from the vehicle.

**Historical Note**

Repealed effective December 20, 1985 (Supp. 85-6). New Section made by final rulemaking at 10 A.A.R. 4458, effective December 4, 2004 (Supp. 04-4).

**R12-1-519. Repealed**

**Historical Note**

Repealed effective December 20, 1985 (Supp. 85-6).

**R12-1-520. Repealed**

**Historical Note**

Repealed effective December 20, 1985 (Supp. 85-6).

**R12-1-521. Repealed**

**Historical Note**

Adopted 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 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Section repealed by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-522. Operating and Emergency Procedures**

**A.** A licensee shall ensure that the operating and emergency procedures include, at a minimum, instructions in the following, as applicable:

1. Handling and use of sealed sources or radiographic exposure devices, so that persons are not exposed to radiation that exceeds the limits in Article 4 of this Chapter;
2. Methods and occasions for conducting radiation surveys;
3. Methods for controlling access to radiographic areas;
4. Methods and occasions for locking and securing radiographic exposure devices, transport and storage containers, and sealed sources;
5. Personnel monitoring and associated equipment;
6. Transportation of sealed sources to field locations, including packing radiographic exposure devices and storage containers in vehicles, placarding vehicles, and maintaining control of the sealed sources during transportation, as required in 49 CFR 171-173, 2002 edition, published October 1, 2002, 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. This incorporation contains no future editions or amendments;
7. Inspection, maintenance, and operability checks of radiographic exposure devices, survey instruments, transport containers, and storage containers;
8. Actions to be taken immediately by radiography personnel if a pocket dosimeter is found to be off-scale or an alarm rate meter sounds an alarm;
9. Procedures for identifying and reporting defects and noncompliance, as required by R12-1-448 and R12-1-535;
10. Procedures for notifying the RSO and the Agency in the event of an accident;
11. Methods for minimizing exposure of persons in the event of an accident;
12. Procedures for recovering a source if the licensee is responsible for source recovery; and
13. Maintenance of records.

**B.** The licensee shall maintain copies of current operating and emergency procedures until the Agency terminates the license. Superseded procedures shall be maintained for three years after being superceded. Additionally, a copy of the procedures shall be maintained at field stations in accordance with R12-1-540.

**Historical Note**

Adopted effective April 2, 1990 (Supp. 90-2). 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).

**R12-1-523. Personnel Monitoring**

**A.** A licensee shall not permit any individual to act as a radiographer or a radiographer's assistant unless, at all times during radiographic operations, each individual wears, on the trunk of the body, a direct reading dosimeter, an operating alarm rate meter, and a personnel dosimeter that is processed and evaluated by an accredited National Voluntary Laboratory Accreditation Program (NVLAP) processor. At permanent radiography installations where other appropriate alarming or warning devices are in routine use, the wearing of an alarm rate meter is not required. A licensee shall:

1. Use a pocket dosimeter with a range from zero to 2 millisieverts (200 millirems). The licensee shall ensure that each dosimeter is recharged at the start of each shift. Electronic personal dosimeters are permitted in place of ion-chamber pocket dosimeters.
2. Assign a personnel dosimeter to each individual, who shall wear the assigned equipment.
3. Replace film badges at least monthly and ensure that other personnel dosimeters are processed and evaluated

by an accredited NVLAP processor and replaced at periods that do not exceed three months.

4. After replacement, ensure that each personnel dosimeter is processed as soon as possible.

**B.** A licensee shall record exposures noted from direct reading dosimeters, such as pocket dosimeters or electronic personal dosimeters, at the beginning and end of each shift. The licensee shall maintain the records for three years after the Agency terminates the license.

**C.** A licensee shall check pocket dosimeters and electronic personal dosimeters for correct response to radiation at periods that do not exceed 12 months. The licensee shall record the results of each check and maintain the records for three years after the dosimeter check is performed. The licensee shall discontinue use of a dosimeter if it is not accurate within plus or minus 20 percent of the true radiation exposure.

**D.** If an individual's pocket dosimeter has an off-scale reading, or the individual's electronic personal dosimeter reads greater than 2 millisieverts (200 millirems), and radiation exposure cannot be ruled out as the cause, a licensee shall process the individual's dosimeter within 24 hours of the suspect exposure. The licensee shall not allow the individual to resume work associated with sources of radiation until the individual's radiation exposure has been determined. Using information from the dosimeter, the licensee's RSO or the RSO's designee shall calculate the affected individual's cumulative radiation exposure as prescribed in Article 4 of this Chapter and include the results of this determination in the personnel monitoring records maintained in accordance with subsection (B).

**E.** If the personnel dosimeter that is required by subsection (A) is lost or damaged, the licensee shall ensure that the worker ceases work immediately until the licensee provides a replacement personnel dosimeter that meets the requirements in subsection (A) and the RSO or the RSO's designee calculates the exposure for the time period from issuance to discovery of the lost or damaged personnel dosimeter. The licensee shall maintain a record of the calculated exposure and the time period for which the personnel dosimeter was lost or damaged in accordance with subsection (B).

**F.** The licensee shall maintain dosimetry reports received from the accredited NVLAP personnel dosimeter processor in accordance with subsection (B).

**G.** For each alarm rate meter a licensee shall ensure that:

1. At the start of each shift, the alarm functions (sounds) properly before an individual uses the device;
2. Each device is set to give an alarm signal at a preset dose rate of 5 mSv/hr (500 mrem/hr); with an accuracy of plus or minus 20 percent of the true radiation dose rate;
3. A special means is necessary to change the preset alarm function on the device; and
4. Each device is calibrated at periods that do not exceed 12 months for correct response to radiation. The licensee shall maintain records of alarm rate meter calibrations in accordance with subsection (B).

**Historical Note**

Adopted effective April 2, 1990 (Supp. 90-2). Amended 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 10 A.A.R. 4458, effective December 4, 2004 (Supp. 04-4).

**R12-1-524. Supervision of a Radiographer's Assistant**

If a radiographer's assistant uses a radiographic exposure device, associated equipment, or a sealed source or conducts a radiation survey required by R12-1-533(B) to determine that the sealed source has returned to the shielded position after an exposure, the licensee shall ensure that the assistant is under the personal supervision of a radiographer. For purposes of this Section "personal supervision" means:

1. The radiographer is physically present at the site where the sealed source is being used,
2. The radiographer is available to give immediate assistance if required, and
3. The radiographer is able to observe the assistant's performance directly.

**Historical Note**

Adopted effective April 2, 1990 (Supp. 90-2). 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).

**R12-1-525. Notification of Field Work**

Each day radioactive material is used for industrial radiography, a licensee shall notify the Agency of any planned field radiography. The notice shall be in writing and specify the location of the field work, the name of the supervising individual at the job site, and the expected duration of the work at the job site listed in the notice. A facsimile that provides the required information is sufficient notice.

**Historical Note**

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

**R12-1-526. Reserved**

**R12-1-527. Reserved**

**R12-1-528. Reserved**

**R12-1-529. Reserved**

**R12-1-530. Reserved**

**R12-1-531. Security**

During each radiographic operation, the radiographer or radiographer's assistant shall maintain continuous direct visual surveillance of the operation to protect against unauthorized entry into a high radiation area, as defined in Article 1, unless:

1. The high radiation area is equipped with a control device or an alarm system as prescribed in R12-1-420(A), or
2. The high radiation area is locked to protect against unauthorized or accidental entry.

**Historical Note**

Adopted effective April 2, 1990 (Supp. 90-2). Amended effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

**R12-1-532. Posting**

Notwithstanding any provisions in R12-1-430, areas in which radiography is being performed shall be conspicuously posted as required by R12-1-429(A) and (B).

**Historical Note**

Adopted effective April 2, 1990 (Supp. 90-2). Amended effective August 10, 1994 (Supp. 94-3).

**R12-1-533. Radiation Surveys**

**A.** A licensee shall conduct surveys with a calibrated and operable radiation survey instrument that meets the requirements of R12-1-504.

**B.** Using a survey instrument that complies with subsection (A), the licensee shall conduct a survey of the radiographic exposure device and the guide tube after each exposure before approaching the device or the guide tube. The survey shall be performed to determine that the sealed source is in the shielded

position before the radiographer or radiographer's assistant exchanges films, repositions the exposure head, or dismantles the equipment.

**C.** The licensee shall conduct a survey of the radiographic exposure device with a calibrated radiation survey instrument any time the source is exchanged or the device is placed in a storage area, as defined in R12-1-102, to ensure that the sealed source is in the shielded position.

**D.** The licensee shall maintain a record of each exposure device survey conducted before the device is placed in storage under subsection (C), if that survey is the last one performed during the workday. Each record shall be maintained for three years after the record is made.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). 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).

**R12-1-534. Repealed**

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Section repealed by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-535. Notifications**

**A.** In addition to the reporting requirements specified in Article 4, each licensee shall provide a written report to the Agency if any of the following incidents involving radiography equipment occur:
1. Unintentional disconnection of the source assembly from the control cable;
2. Inability to retract the source assembly to the fully shielded position or secure it in this position; or
3. Failure of any component (critical to safe operation of the device) to properly perform its intended function;

**B.** A licensee shall include the following information in any report submitted under this Section, regarding radiography equipment, or Article 4, regarding an overexposure, if the report concerns the failure of safety components of radiography equipment:
1. A description of the equipment problem;
2. Cause of the incident, if known;
3. Name of manufacturer and model number of the equipment involved in the incident;
4. Place, date, and time of the incident;
5. Actions taken to establish normal operations;
6. Corrective actions taken or planned to prevent reoccurrence; and
7. Qualifications of personnel involved in the incident.

**C.** Any licensee that conducts radiographic operations, or stores radioactive material at a location not listed on the license or for a period longer than 180 days during a calender year, shall notify the Agency of these activities before the 180 days has elapsed.

**Historical Note**
New Section made by final rulemaking at 9 A.A.R. 1126, effective May 9, 2003 (Supp. 03-1).

**R12-1-536. Reserved**

**R12-1-537. Reserved**

**R12-1-538. Reserved**

**R12-1-539. Permanent Radiographic Installations**

**A.** If a licensee maintains a permanent radiographic installation that does not fall within the definition of "enclosed radiography" in R12-1-102, the licensee shall ensure that each entrance, used for personnel access to the high radiation area, has either:
1. An entrance control device of the type described in R12-1-420(A)(1) that reduces the radiation level upon entry into the area, or
2. Both conspicuous visible and audible alarm signals to warn of the presence of radiation. The licensee shall ensure that the visible signal is actuated by radiation if a source is exposed and the audible signal is actuated if someone attempts to enter the installation while a source is exposed.

**B.** A licensee with an alarm signal shall test the alarm signal for proper operation with a radiation source each day before the installation is used for radiographic operations. The test shall include a check of both the visible and audible signals. A licensee with an entrance control device shall test the device monthly. If an entrance control device or alarm signal is operating improperly, the licensee shall immediately label the device or signal as "defective" and repair the device or signal within seven calendar days. The licensee may continue to use the facility during this seven-day period, if the licensee implements continuous surveillance requirements of R12-1-509 and uses an alarming rate meter.

**C.** A licensee shall maintain each record an alarm system or entrance control device test for three years after the record is made.

**Historical Note**
New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-540. Location of Documents and Records**

**A.** A licensee shall maintain a copy of each record required by this Article and other applicable Articles of this Chapter at a location specified under R12-1-502(I).

**B.** A licensee shall maintain a copy of each record listed below at each field station and temporary job site;
1. The license that authorizes use of radioactive material;
2. A copy of Articles 4, 5, and 10 of this Chapter;
3. Utilization logs for each radiographic exposure device dispatched from that location, as required by R12-1-507;
4. Records of equipment problems identified in daily checks of equipment, as required by R12-1-508(A);
5. Records of alarm system and entrance control checks as required by R12-1-539;
6. Records of direct-reading dosimeters, such as pocket dosimeters and electronic personnel dosimeters as required by R12-1-523;
7. Operating and emergency procedures as required by R12-1-522;
8. A report on the most recent calibration of the radiation survey instruments in use at the site as required by R12-1-504;
9. A report on the most recent calibration of each alarm rate meter, and operability check of each pocket dosimeter and electronic personnel dosimeter as required in R12-1-523;
10. Most recent survey record as required by R12-1-533;

11. The shipping papers for the transportation of radioactive material required by 10 CFR 71.5, 2003 edition, published January 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 (this incorporation contains no future editions or amendments); and
12. If operating under reciprocity in accordance with R12-1-320, a copy of the NRC or Agreement State license authorizing the use of radioactive materials.

**Historical Note**
New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-541. Repealed**

**Historical Note**
Adopted 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 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). Section repealed by final rulemaking at 11 A.A.R. 978, effective April 3, 2005 (05-1).

**R12-1-542. Repealed**

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Repealed effective August 10, 1994 (Supp. 94-3). New Section made by final rulemaking at 9 A.A.R. 1126, effective May 9, 2003 (Supp. 03-1). Section repealed by final rulemaking at 11 A.A.R. 978, effective April 3, 2005 (05-1).

**Appendix A. Repealed**

**Historical Note**
Adopted effective June 30, 1977 (Supp. 77-3). Amended effective December 20, 1985 (Supp. 85-6). Repealed effective April 2, 1990 (Supp. 90-2).

**R12-1-543. Training**

**A.** A licensee shall not allow an individual to act as a radiographer until the individual has received training in the subjects in subsection (G), has participated in a minimum of two months of on-the-job training, and is certified through a radiographer certification program by a independent certifying organization in accordance with the criteria specified in Appendix A.
1. A licensee shall provide the Agency with proof of an individuals's certification and a written request that the individual be added to a license as a certified radiographer.
2. A licensee shall maintain proof of certification at the job site where a radiographer is performing field radiography.
3. A licensee that employs certified radiographers in Arizona shall ensure that:
   a. Each radiographer has obtained initial certification within the last five years, and
   b. An uncertified radiographer works only as a radiographer's assistant until certified.
4. A radiographer shall recertify every five years by:
   a. Taking an approved radiography certification examination in accordance with this subsection; or
   b. Providing written evidence that the radiographer is active in the practice of industrial radiography and has participated in continuing education during the previous five-year period.
5. If an individual cannot provide the written evidence required in subsection (4)(b), the individual shall retake the certification examination.
6. A radiographer shall provide the licensee with proof of certification in the form of a card issued by the certifying organization that contains:
   a. A picture of the certified radiographer,
   b. The radiographer's certification number,
   c. The date the certification expires, and
   d. The radiographer's signature.

**B.** A licensee shall not allow an individual to act as a radiographer until the individual:
1. Has received copies of and instruction in the requirements of this Article; applicable Sections of Articles 4 and 10 and R12-1-107; applicable DOT regulations in 10 CFR 71, January 1, 2003 edition, by the Office of the Federal Register, National Archives and Records Administration, Washington, D.C. 20408, which is incorporated by reference, contains no future editions or amendments, and is on file with Agency; the Agency license or licenses under which the radiographer will perform industrial radiography; and the licensee's operating and emergency procedures;
2. Has demonstrated an understanding of the licensee's license and operating and emergency procedures by successfully completing a written or oral examination that covers the relevant material;
3. Has received training in:
   a. Use of the licensee's radiographic exposure devices and sealed sources,
   b. Daily inspection of devices and associated equipment, and
   c. Use of radiation survey instruments; and
4. Has demonstrated an understanding of the use of radiographic exposure devices, sources, survey instruments, and associated equipment described in subsection (B)(3) by successfully completing a practical examination covering this material.

**C.** A licensee shall not allow an individual to act as a radiographer's assistant until the individual:
1. Has received copies of and instruction in the requirements of this Article; applicable Sections of Articles 4 and 10 and R12-1-107; applicable DOT regulations in 10 CFR 71, January 1, 2003 edition, by the Office of the Federal Register, National Archives and Records Administration, Washington, D.C. 20408, which is incorporated by reference, contains no future editions or amendments, and is on file with Agency; the Agency license or licenses under which the radiographer's assistant will perform industrial radiography; and the licensee's operating and emergency procedures;
2. Has developed competence to use, under the personal supervision of the radiographer, the licensee's radiographic exposure devices, sealed sources, associated equipment, and radiation survey instruments; and
3. Has demonstrated understanding of the instructions provided under subsection (C)(1) by successfully completing a written test on the subjects covered and has demonstrated competence using the hardware described in subsection (C)(2) by successfully completing a practical examination.

**D.** A licensee shall provide refresher safety training for each radiographer and radiographer's assistant at intervals not to exceed 12 months.

**E.** Unless an individual serves as both a radiographer and an RSO, the RSO or the RSO's designee shall design and implement an inspection program to examine the job performance of each radiographer and radiographer's assistant and to ensure that the Agency's rules and license requirements, and the licensee's operating and emergency procedures are followed. The inspection program shall:
1. Include observation of the performance of each radiographer and radiographer's assistant during an actual industrial radiographic operation, at intervals that do not exceed six months; and
2. If a radiographer or a radiographer's assistant has not participated in an industrial radiographic operation for more than six months, the radiographer shall demonstrate knowledge of the training requirements in subsection (B)(3) and the radiographer's assistant shall demonstrate knowledge of the training requirements of subsection (C)(2) by a practical examination before participating in a radiographic operation.

**F.** A licensee shall maintain records of the training required in this Section including certification documents, written and practical examinations, refresher safety training documents, and inspection documents, in accordance with subsection (I).

**G.** A licensee shall include the following subjects in the training required under subsection (A):
1. Fundamentals of radiation safety, including:
   a. Characteristics of gamma radiation,
   b. Units of radiation dose and quantity of radioactivity,
   c. Hazards of exposure to radiation,
   d. Levels of radiation from licensed material, and
   e. Methods of controlling radiation dose (time, distance, and shielding);
2. Radiation detection instruments, including:
   a. Use, operation, calibration, and limitations of radiation survey instruments;
   b. Survey techniques; and
   c. Use of personnel monitoring equipment;
3. Equipment topics, including:
   a. Operation and control of radiographic exposure equipment, use of remote handling equipment, and use of storage containers, using pictures or models of source assemblies (pigtails);
   b. Storage, control, and disposal of licensed material; and
   c. Inspection and maintenance of equipment;
4. The requirements of pertinent Agency rules; and
5. Case histories of accidents in radiography.

**H.** A licensee shall maintain records of radiographer certification in accordance with subsection (I)(1) and provide proof of certification as required in subsection (A)(1).

**I.** A licensee shall maintain the following records for three years after each record is made:
1. Records of training for each radiographer and each radiographer's assistant. For radiographers, the records shall include radiographer certification documents and verification of certification status. All records shall include copies of written tests, dates of oral and practical examinations, and names of individuals who conducted and took the oral and practical examinations; and
2. Records of annual refresher safety training and semi-annual inspections of job performance for each radiographer and each radiographer's assistant. The records for the annual refresher safety training shall list topics discussed during training, the date of training, and names of each instructor and attendee. For inspections of job performance, the records shall include a list of the items checked during the inspection and any non-compliance observed by the RSO.

**Historical Note**
New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**Appendix A. Standards for Organizations that Provide Radiography Certification**

Note: For purposes of this Article an "independent certifying organization" means an organization that meets all of the criteria in this Appendix.

I. Requirements for an Organization that Provides Radiographer Certification

To qualify to provide radiographer certification an organization shall:

**A.** Be a society or association, with members who participate in, or have an interest in, the field of industrial radiography;

**B.** Not restrict membership because of race, color, religion, sex, age, national origin, or disability;

**C.** Have a certification program that is open to nonmembers, as well as members;

**D.** Be an incorporated, nationally recognized organization that is involved in setting national standards of practice within its fields of expertise;

**E.** Have a staff comparable to other nationally recognized organizations, a viable system for financing its operations, and a policy-and decision-making review board;

**F.** Have a set of written, organizational by-laws and policies that address conflicts of interest and provide a system for monitoring and enforcing the by-laws and policies;

**G.** Have a committee, with members who can carry out their responsibilities impartially, review and approve the certification guidelines and procedures, and advise the organization's staff in implementing the certification program;

**H.** Have a committee, with members who can carry out their responsibilities impartially, review complaints against certified individuals and determine sanctions;

**I.** Have written procedures describing all aspects of the organization's certification program;

**J.** Maintain records of the current status of each individual's certification and administration of the certification program;

**K.** Have procedures to ensure that certified individuals are provided due process with respect to administration of the certification program, including a process for becoming certified and a process for imposing sanctions against certified individuals;

**L.** Have procedures for proctoring examinations and qualifying proctors. The organization, through these procedures, shall ensure that an individual who proctors an examination is not employed by the same company or corporation (or a wholly-owned subsidiary of the company or corporation) that employs an examinee;

**M.** Exchange information about certified individuals with the Agency, other independent certifying organizations, the NRC, or Agreement States and allow periodic review of its certification program and related records; and

**N.** Provide a description to the Agency of its procedures for choosing examination sites and providing a favorable examination environment.

II. Requirements for a Certification Program

An independent certifying organization shall ensure that its certification program:

**A.** Requires an applicant for certification to:
1. Obtain training in the subjects listed in R12-1-543(G) or equivalent NRC or Agreement State regulations, and

2. Satisfactorily complete a written examination that covers these subjects;

**B.** Requires an applicant for certification to provide documentation demonstrating that the applicant has:
1. Received training in the subjects listed in R12-1-543(G) or equivalent NRC or Agreement State regulations;
2. Satisfactorily completed the on-the-job training required in R12-1-543(A); and
3. Received verification by an Agreement State or a NRC licensee that the applicant has demonstrated the capability of independently working as a radiographer;

**C.** Provides procedures that protect examination questions from disclosure;

**D.** Provides procedures for denying certification to an applicant and revoking, suspending, and reinstating a certificate;

**E.** Provides a certification period that is not less than three years or more than five years, procedures for renewing certifications and, if the procedures allow renewals without examination, a system for assessing evidence of recent full-time employment and annual refresher training; and

**F.** Provides a timely response to inquiries, by telephone or letter, from members of the public, about an individual's certification status.

III. Requirements for a Written Examination

An independent certifying organization shall ensure that its examination:

**A.** Is designed to test an individual's knowledge and understanding of the subjects listed in R12-1-543(G);

**B.** Is written in a multiple-choice format; and

**C.** Has psychometrically valid questions drawn from a question bank and based on the material in R12-1-543(G).

**Historical Note**

New Appendix made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

## ARTICLE 6. USE OF X-RAYS IN THE HEALING ARTS

**R12-1-601. Repealed**

**Historical Note**

Former Rule Section F.1; Former Section R12-1-601 repealed, new Section R12-1-601 adopted effective June 30, 1977 (Supp. 77-3). Repealed effective August 8, 1986 (Supp. 86-4).

**R12-1-602. Definitions**

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

"Accessible surface" means the external surface of the enclosure or housing provided by the manufacturer.

"Added filter" means the filter added to the inherent filtration.

"Aluminum equivalent" means the thickness of aluminum (type 1100 alloy) that affords equivalent attenuation, under specified conditions, as the material in question. (The nominal chemical composition of type 1100 aluminum alloy is 99.00 percent minimum aluminum, 0.12 percent copper).

"Annual" means annually within two months of the anniversary due date as determined by the original installation date, inspection date, survey date, or a reset date created by conducting a full survey before the anniversary date has arrived.

"Assembler" means any person engaged in the business of assembling, replacing, or installing one or more components into an x-ray system or subsystem.

"Attenuation block" means a block or stack, having dimensions 20 cm by 20 cm by 3.8 cm (7.9 inches by 7.9 inches by 1.5 inches) of type 1100 aluminum alloy or other materials that afford equivalent attenuation.

"Automatic exposure control" means a device that automatically controls one or more technique factors in order to obtain, at a preselected location or locations, a required quantity of radiation.

"Barrier" (See "Protective barrier")

"Beam axis" means a line from the source through the center of the x-ray field.

"Beam-limiting device" means a device that provides a means to restrict the dimensions of the x-ray field.

"C-arm x-ray system" means an x-ray system that has the image receptor and x-ray tube housing assembly connected by a common mechanical support system to maintain a desired spatial relationship. This system is designed to allow a change in the projection of the beam through the patient without a change in the position of the patient.

"Changeable filter" means any filter, exclusive of inherent filtration, which can be removed from the useful beam by an electronic, mechanical, or physical process.

"Cinefluorography" means fluorography that uses a movie camera to record fluorograph images on film for later playback.

"Coefficient of variation" means the ratio of the standard deviation to the mean value of a population of observations.

"Collimator" means an adjustable device, generally made of lead, that is fixed to an x-ray tube housing to intercept or collimate the useful beam and, if not made of lead, has a lead equivalency of not less than that of the tube housing assembly.

"Compression device" means a device used to bring object structures closer to the image plane of a radiograph and make a part of the human body a more uniform thickness so the optical density of the radiograph will be more uniform.

"Computed tomography" means the production of a tomogram by the acquisition and computer processing of x-ray transmission data. For purposes of these rules this term has the same meaning as "CT."

"Contact therapy system" means that the x-ray tube port is put in contact with or within 5 centimeters (2 inches) of the surface being treated.

"Control panel" means that part of the x-ray machine where switches, knobs, push-buttons, or other hardware necessary for manually setting the technique factors are located.

"Cooling curve" means the graphical relationship between heat units stored and cooling time.

"CT gantry" means the tube housing assemblies, beam-limiting devices, detectors, and the supporting structure, frame, and cover which hold or enclose these components.

"Dead-man switch" means a switch constructed so that a circuit-closing contact can be maintained only by continuous pressure on the switch by the operator.

"Diagnostic source assembly" means the tube housing assembly with a beam-limiting device attached.

"Diagnostic x-ray system" means an x-ray system designed for irradiation of any part of a human or animal body for the purpose of diagnosis or visualization.

"Direct scattered radiation" means scattered radiation that has been deviated in direction only by materials irradiated by the useful beam (see "Scattered radiation").

"Electronic brachytherapy" means a method of radiation therapy where an electrically generated source of ionizing radiation is placed in or near the tumor or target tissue to deliver therapeutic radiation dosage.

"Entrance exposure rate" means the roentgens per unit time at the point where the center of the useful beam enters the patient.

"Equipment" (See "X-ray equipment")

"Filter" means material placed in the useful beam to absorb undesirable radiation.

"Fluoroscopic imaging assembly" means a subsystem in which x-ray photons produce a fluoroscopic image. It includes the image receptor or receptors such as the image intensifier and spot-film device, electrical interlocks, if any, and structural material that provides a linkage between the image receptor and diagnostic source assembly.

"Fluoroscopic system" means a radiographic x-ray system used to directly visualize internal structure, the motion of internal structures, and fluids in real time, or near real-time, to aid in the treatment or diagnosis of disease, or the performance of other medical procedures.

"Focal spot" means the region of the anode target in an x-ray tube where electrons from the cathode interact to produce x-rays.

"General purpose radiographic x-ray system" means any radiographic x-ray system that, by design, is not limited to radiographic examination of a specific anatomical region.

"Gonadal shield" means a protective barrier for the testes or ovaries.

"Grid" means a device used to improve the image detail in a radiograph by reducing the intensity of x-ray scatter radiation exiting the film side of the patient.

"Half-value layer" or "HVL" means the thickness of a specified material that attenuates the beam of radiation to an exposure rate that is one-half of its original value. In this definition, the contribution of any scattered radiation, other than that which is present initially in the beam, is excluded.

"Healing arts radiography" means the application of x-radiation to human patients for diagnostic or therapeutic purposes by a licensed practitioner or a person certified in accordance with R12-1-603(B)(1), at the direction of a licensed practitioner. Healing arts radiography includes:

Positioning the x-ray beam with respect to the patient,

Anatomical positioning of the patient,

Selecting exposure factors, or

Initiating the exposure.

"Healing arts screening" means the application of radiation from an x-ray machine to a human for the detection or evaluation of health indications when the tests are not specifically and individually ordered by a licensed practitioner.

"Image intensifier" means an electronic device, installed in an x-ray system housing, which instantaneously converts an x-ray pattern into a corresponding light image of higher intensity.

"Image receptor" means any device, such as a fluorescent screen or radiographic film, which transforms incident x-ray photons either into a visible image or into another form which can be made into a visible image by further transformation.

"Inherent filtration" means the filtration of the useful beam by permanently installed components of the tube housing assembly.

"Kilovolts peak" or "kVp" (See "Peak tube potential")

"Lateral fluoroscope" means the x-ray tube and image receptor combination in a biplane system dedicated to the lateral projection. It consists of the lateral x-ray tube housing assembly and the lateral image receptor that are fixed in position relative to the table with the x-ray beam axis parallel to the plane of the table.

"Lead equivalent" means the thickness of lead affording the same attenuation, under specified conditions, as the material in question.

"Leakage radiation" means all radiation emanating from the tube housing except the useful beam and radiation produced when the exposure switch or timer is not activated.

"Leakage technique factors" means the technique factors associated with the diagnostic source assembly that are used in measuring leakage radiation. Included are:

For capacitor energy storage equipment, the maximum-rated peak tube potential and the maximum-rated number of exposures in an hour for operation at the maximum-rated peak tube potential with the quantity of charge per exposure being 10 millicoulombs (mAs) or the minimum obtainable from the unit, whichever is larger;

For field emission equipment rated for pulsed operation, the maximum-rated peak tube potential and maximum-rated number of x-ray pulses in an hour for operation at the maximum-rated peak tube potential; and

For all other source assemblies, the maximum-rated peak tube potential and maximum-rated continuous tube current for the maximum-rated peak tube potential.

"mA" means milliampere.

"Mammographic x-ray system" means an x-ray system that is specifically engineered to image human breasts.

"mAs" means milliampere second.

"Mobile equipment" (See "X-ray equipment")

"Peak tube potential" means the maximum value of the potential difference across the x-ray tube during an exposure.

"Phantom" means a volume of material that behaves in a manner similar to tissue with respect to the attenuation and scattering of radiation. (i.e. "Breast phantom" means an artificial test object that simulates the average composition of, and various structures in the breast.)

"Phototimer" (See "Automatic exposure control")

"Portable equipment" (See "X-ray equipment")

"Primary protective barrier" (See "Protective barrier")

"Protective apron" means an apron made of radiation, absorbing material used to reduce radiation exposure.

"Protective barrier" means a barrier of radiation-absorbing material used to reduce radiation exposure.

"Primary protective barrier" means the material, excluding filters, placed in the useful beam.

"Secondary protective barrier" means the material which attenuates stray radiation.

"Protective glove" means a glove made of radiation- absorbing material used to reduce radiation exposure.

"Radiologic physicist" means an individual who:

Is certified by the American Board of Radiology, American Board of Medical Physics, or the American Board of Health Physics;

Possesses documentation of state approval;

Holds a master's degree or higher in a physical science; and

Meets the training and certification requirements in R12-1-615(A)(1)(c).

"Scattered radiation" means radiation that, during passage through matter, has been deviated in direction. (See "Direct scattered radiation")

"Screen" or "intensifying screen" means a device that converts the energy of the x-ray beam into visible light that interacts with the radiographic film, forming a latent image, or contains photostimulable phosphor plates that upon exposure, emit visible or nonvisible light to create an image.

"Secondary protective barrier" (See "Protective barrier")

"Shutter" (See "Collimator")

"Source" means the focal spot of the x-ray tube.

"Source-to-image receptor distance" or "SID" means the distance from the source to the center of the input surface of the image receptor.

"Spot check" means an abbreviated calibration procedure which is performed to assure that a previous calibration continues to be valid. Also, a spot film may be taken to improve visualization by arresting motion and to document medical observations. Note that in some cases, a film may not be created.

"Stationary equipment" (See "X-ray equipment")

"Stray radiation" means the sum of leakage and scattered radiation.

"System" (See "X-ray system")

"Technique chart" means a tabulation of technique factors.

"Technique factors" means the following conditions of operation:

For capacitor energy storage equipment, peak tube potential in kV and quantity of charge in mAs;

For field emission equipment rated for pulsed operation, peak tube potential in kV, and number of x-ray pulses;

For CT x-ray systems designed for pulsed operation, peak tube potential in kV, scan time in seconds, and either tube current in mA, x-ray pulse width in seconds, and number of x-ray pulses per scan, or the product of tube current, x-ray pulse width, and number of x-ray pulses in mAs;

For CT x-ray systems not designed for pulsed operation, peak tube potential in kV, and either tube current in mA and scan time in seconds, or the product of tube current, exposure time in mAs, when the scan time and exposure time are equivalent; and

For all other equipment, peak tube potential in kV, and either tube current in mA and exposure time in seconds, or the product of tube current and exposure time in mAs.

"Treatment simulator" means a diagnostic x-ray system that duplicates a medical particle accelerator or other teletherapy in terms of its geometrical, mechanical, and optical qualities; the main function of which, is to display radiation treatment fields so that the target volume may be accurately included in the area of irradiation without delivering excess radiation to surrounding normal tissue.

"Tube" means x-ray tube unless otherwise specified.

"Tube housing assembly" means the tube housing with the tube installed. It includes high-voltage or filament transformers and other elements contained within the tube housing.

"Tube rating chart" means the set of curves that specify the rated limits of operation of the tube in terms of the technique factors.

"Useful beam" means the radiation emanating from the tube housing port or the radiation head and passing through the aperture of the beam-limiting device when the exposure controls are in a mode that causes the system to produce radiation.

"Visible area" means that portion of the input surface on the image receptor over which incident x-ray photons are producing a visible image.

"X-ray equipment" means an x-ray system, subsystem, or component described further by the following terms:

"Hand-held" means x-ray equipment designed to be held by an operator while being used.

"Mobile" means x-ray equipment mounted on a permanent base with wheels or casters for moving while completely assembled.

"Portable" means x-ray equipment designed to be hand-carried, but used with a cord or delayed timer system that allows the operator to be six feet or more away from the useful beam.

"Stationary" means x-ray equipment installed in a fixed location.

"Transportable mobile" means x-ray equipment installed in a vehicle or trailer.

"X-ray system" means an assemblage of components for the controlled production of x-rays. It includes, at minimum, an x-ray high-voltage generator, an x-ray control, a tube housing assembly, a beam-limiting device, and the necessary supporting structures. Additional components that function with the system are considered integral parts of the system.

"X-ray tube" means any electron tube that is designed for the conversion of electrical energy into x-ray energy. For purposes

of the rules contained in 12 A.A.C. 1, this term is synonymous with "tube."

**Historical Note**

Former Rule Section F.2; Former Section R12-1-602 repealed, new Section R12-1-602 adopted effective June 30, 1977 (Supp. 77-3). Amended effective August 8, 1986 (Supp. 86-4). Amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2). Amended by final rulemaking at 19 A.A.R. 3882, effective January 4, 2014 (Supp. 13-4).

**R12-1-603. Operational Standards, Shielding, and Darkroom Requirements**

**A.** A person shall not make, sell, lease, transfer, lend, or install x-ray equipment or the supplies used in connection with the equipment unless the supplies and equipment, when properly placed in operation and properly used, meets the requirements of 12 A.A.C. 1.

**B.** A registrant shall direct the operation of x-ray machines under the registrant's control and assure that all of the following provisions are met in the operation of x-ray machines:

1. The registrant shall not permit any individual to engage in the practice of "Healing Arts Radiography" using equipment under the registrant's control, unless the individual possesses, and displays in the primary employer's facility, an official certificate issued by, or is exempt from, the Medical Radiologic Technology Board of Examiners that contains an original signature of its Director or designee. A copy of the certificate shall be posted at any secondary employment location with documentation that verifies that the employer has physically seen the official certificate and has annotated on the copy the location where the official certificate may be viewed by Agency staff.
2. The registrant shall maintain records documenting compliance with subsection (B)(1) for each individual practicing "Healing Arts Radiography" using equipment under the registrant's control,
3. The registrant shall provide safety rules to each individual operating x-ray equipment under the registrant's control, including any restrictions in operating procedures necessary for the safe use of the equipment and require that the operator demonstrate familiarity with 12 A.A.C. 1.

**C.** Shielding

1. Each registrant shall provide each installation with primary and secondary protective barriers that are necessary to assure compliance with 12 A.A.C. 1, Article 4.
2. A registrant shall ensure that attenuation provided by a protective barrier meets or exceeds the level of protection established in Report No. 147 Structural Shielding Design for Medical X-ray Imaging Facilities, November 19, 2004, by the National Council on Radiation Protection and Measurements, (NCRP), NCRP Publications, 7910 Woodmount Ave., Suite 400, Bethesda, MD 20814-3095. This report is incorporated by reference and available under R12-1-101. The incorporated material contains no future editions or amendments. Copies of the report are available from NCRP Publications: online at http://www.ncrppublications.org; toll free at (800) 229-2652 (Ext. 25); or e-mail at NCRPpubs@NCRPonline.org. Each registrant shall use this incorporated material to provide sufficient shielding to prevent a public exposure that exceeds the limits in R12-1-416.
3. A registrant shall:
   a. Mount each lead barrier so that the barrier will not sag or cold flow because of its own weight and protect the barrier from damage;
   b. Use barriers designed so that joints between different ends of protective material do not impair the overall protection of the barriers;
   c. Use barriers designed so that joints at the floor and ceiling do not impair the overall protection of the barriers;
   d. Use windows, window frames, doors, and door frames that have the same lead equivalence required in the adjacent walls; and
   e. Cover holes in protective barriers so that overall attenuation is not impaired.
4. A registrant shall also meet the structural shielding requirements in R12-1-607(C), if the x-ray system in question is not a mobile fluoroscopic unit, dental panoramic, cephalometric, dental CT, or intraoral radiographic system.

**D.** Film Processing and Darkroom Requirements. A registrant shall:

1. Ensure that the darkroom is light-tight and use proper safe-lighting such that any film type in use exposed in a cassette to x-ray radiation sufficient to produce an optical density from 1 to 2 when processed shall not suffer an increase in density greater than 0.1 (0.05 for mammography) when exposed in the darkroom for two minutes with all safe-lights illuminated. (A processor with a daylight loader satisfies this requirement.);
2. Ensure that film is stored in a cool, dry place and is protected from radiation exposure; and that film located in open packages is stored in a light-tight container;
3. Ensure that film cassettes and intensifying screens are inspected annually, cleaned, and replaced as necessary;
4. Ensure that film cassettes contain film and intensifying screens that have the same sensitivity;
5. Ensure that automatic film processors develop film in accordance with time-temperature relationships recommended by the film manufacturer;
6. Ensure that manually developed film is developed in accordance with the time-temperature relationships recommended by the manufacturer, and that a timer, thermometer, and a time-temperature chart are available and used in the darkroom;
7. Ensure that film processing solutions are prepared and maintained in accordance with the directions of the manufacturer;
8. Ensure that outdated film is not used for diagnostic radiographs.
9. Follow manufacturer's recommendations for cleaning or inspection of computed radiography (CR) cassettes, but not less than annually;
10. Follow manufacturer's recommendations for preventive maintenance on digital radiography panels or cassettes, but not less than annually; and
11. Maintain documentation that demonstrates that requirements of this subsection are being met for three years for agency review from the date of inspection.

**Historical Note**

Former Rule Section F.3; Former Section R12-1-603 repealed, new Section R12-1-603 adopted effective June 30, 1977 (Supp. 77-3). Amended effective August 8, 1986 (Supp. 86-4). Amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3).

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). Amended by final rulemaking at 19 A.A.R. 3882, effective January 4, 2014 (Supp. 13-4).

**R12-1-604. General Procedures**

**A.** Each registrant shall ensure the following procedural requirements are met in the operation of x-ray equipment:
1. An x-ray machine which does not meet the provisions of this Chapter shall not be operated for diagnostic or therapeutic purposes, unless specifically exempted by the Agency.
2. Except for patients who cannot be moved out of the room, only the individuals required for the radiological procedure or in training may be present in the room during radiographic exposure, and all the following requirements apply:
   a. All individuals shall be positioned such that no part of the body, including the extremities not protected by 0.5 mm lead equivalent, will be struck by the useful beam.
   b. Staff and ancillary personnel shall be protected from the direct scatter radiation by protective aprons or whole body protective barriers of not less than 0.25 mm lead equivalent.
   c. Individuals, other than the patient to be examined, who cannot be removed from the room during mobile or portable radiography shall be protected from the direct scatter radiation by whole body protective barriers of 0.25 millimeters lead equivalent or shall be so positioned that the nearest portion of the body is at least 2 meters (6.5 feet) from both the tube head and the nearest edge of the image receptor.
   d. If a portion of the body of any staff or ancillary personnel is potentially subjected to stray radiation that could result in that individual receiving 10 percent of the maximum permissible dose as defined in Article 4 of this Chapter, the registrant shall provide additional protective devices as specified by the Agency.
3. An individual shall not be exposed to the useful beam except for a healing arts purpose authorized by a licensed practitioner of the healing arts. The following acts are prohibited:
   a. Exposure of an individual without meeting the required healing art requirements and without a valid directive from a licensed practitioner;
   b. Exposure of an individual for training, demonstration, or other non-healing arts purpose;
   c. Exposure of an individual for the purpose of healing arts screening, except as authorized by the Agency after submitting to the Agency the information listed in Appendix A of this Article. (If any information submitted to the Agency changes, the registrant shall immediately notify the Agency of the changes.);
   d. Routinely holding film or a patient during an exposure to x-ray radiation; or
   e. Exposure of an individual to fluoroscopy as a positioning method for general purpose radiological procedures.
4. All persons who are associated with the operation of an x-ray system are subject to the occupational exposure limits specified in Article 4. Exposure of a personnel monitoring device to deceptively indicate a dose delivered to an individual is prohibited.
5. The registrant shall check radiation protective equipment for reliability and integrity defects on an annual basis, as follows:
   a. Aprons, gloves, and shields shall be checked for holes, tears, and breaks.
   b. If defects are found in the equipment, the registrant shall replace or remove it from service. Equipment removed from service shall not be put back into service until it is repaired.
   c. A record of the annual reliability and integrity check and any equipment replacement shall be maintained for three years.

**B.** The registrant shall maintain the following records for each x-ray machine:
1. Survey, calibration, maintenance, and modification records regarding the x-ray machine or room, which include the name of the person who performed the service; and
2. Correspondence with the Agency regarding the x-ray machine facility.

**Historical Note**

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective August 8, 1986 (Supp. 86-4). Amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

**R12-1-605. X-ray Machine Standards**

**A.** A registrant shall prevent leakage radiation from the diagnostic source assembly measured at a distance of 1 meter in any direction from the source assembly from exceeding 25.8 μC/kg (100 milliroentgens) in one hour when the x-ray tube is operated at its leakage technique factors. The Agency shall determine compliance by obtaining measurements averaged over an area of 100 square centimeters (15.5 square inches) with no linear dimension greater than 20 centimeters (7.9 inches).

**B.** The registrant shall prevent radiation emitted by a component other than the diagnostic source assembly from exceeding 516 nC/kg (2 milliroentgens) in one hour at 5 centimeters from any accessible surface of the component when it is operated in an assembled x-ray system under any conditions for which it was designed. The Agency shall determine compliance by obtaining measurements averaged over an area of 100 square centimeters (15.5 square inches) with no linear dimension greater than 20 centimeters (7.9 inches).

**C.** Beam quality.
1. The registrant shall prevent the useful beam half-value layer (HVL) for diagnostic x-ray given x-ray tube potential from falling below the values shown in Table I. If it is necessary to determine the HVL at an x-ray tube potential that is not listed in Table I, the registrant shall use linear interpolation or extrapolation to make the determination.

| **Table I** | | | | |
|---|---|---|---|---|
| Design operating range (kilovolts peak) | Measured potential (kilovolts peak) | HVL (millimeters of aluminum) Dental Intraoral Units manufactured after December 1, 1980 | Medical X-ray Units manufactured before June 10, 2006 and Dental Intraoral Units manufactured on or before December 1, 1980 | Medical X-ray Units manufactured on or after June 10, 2006 |
| Below 51 | 30 | 1.5 | 0.3 | 0.3 |
| | 40 | 1.5 | 0.4 | 0.4 |
| | 50 | 1.5 | 0.5 | 0.5 |
| 51 to 70 | 51 | 1.5 | 1.2 | 1.3 |
| | 60 | 1.5 | 1.3 | 1.5 |
| | 70 | 1.5 | 1.5 | 1.8 |
| Above 70 | 71 | 2.1 | 2.1 | 2.5 |
| | 80 | 2.3 | 2.3 | 2.9 |
| | 90 | 2.5 | 2.5 | 3.2 |
| | 100 | 2.7 | 2.7 | 3.6 |
| | 110 | 3.0 | 3.0 | 3.9 |
| | 120 | 3.2 | 3.2 | 4.3 |
| | 130 | 3.5 | 3.5 | 4.7 |
| | 140 | 3.8 | 3.8 | 5.0 |
| | 150 | 4.1 | 4.1 | 5.4 |

2. If the registrant demonstrates that the aluminum equivalent of the total filtration in the primary beam is not less than that shown in Table II, the registrant is considered to have met the criteria in subsection (C)(1).

**Table II - Filtration Required vs. Operating Voltage**

| *Operating Voltage (kVp)* | *Total Filtration (inherent plus added) (millimeters aluminum equivalent)* |
|---|---|
| Below 51 | 0.5 millimeters |
| 51 - 70 | 1.5 millimeters |
| Above 70 | 2.5 millimeters |

3. The registrant shall use beryllium window tubes that have a minimum of 0.5 millimeters aluminum equivalent filtration permanently mounted in the useful beam.
4. For capacitor energy storage equipment, the Agency shall determine compliance with the maximum quantity of charge per exposure.
5. When determining the minimum aluminum equivalent filtration, the registrant shall include the filtration contributed by all materials that are always present between the focal spot of the tube and the patient (for example, a tabletop when the tube is mounted "under the table" and inherent filtration of the tube).

**D.** Multiple tubes. If two or more radiographic tubes are controlled by one exposure switch, the operator shall clearly indicate which tube or tubes have been selected before initiation of the exposure, activating one light on the x-ray control panel and a second light at or near the tube housing assembly, each indicating the tube or tubes that have been selected.

**E.** Mechanical support of tube head. The registrant shall adjust the tube housing assembly supports so that the tube housing assembly will remain stable during an exposure, unless the tube housing movement is a designed function of the x-ray system.

**F.** Exposure reproducibility. The coefficient of variation shall not exceed 0.10 when all technique factors are held constant. This requirement is satisfied if the value of the average exposure (E) is greater than or equal to five times the difference between the maximum exposure (Emax) and minimum exposure (Emin) when four exposures are made at identical technique factors, [$E \geq 5(Emax - Emin)$].

**G.** Accuracy deviation. A registrant shall not use an x-ray machine if the measured technique factors for kVp and time duration are not within the limits specified by the manufacturer. In the absence of the manufacturer's specifications, a registrant shall not use an x-ray machine if the measured kVp is not within 10 percent of the indicated kVp value and the measured time duration is not within 20 percent of the indicated time.

**Historical Note**

Adopted effective June 30, 1977 (Supp. 77-3). Amended subsections (A) and (B) effective August 8, 1986 (Supp. 86-4). Amended effective January 2, 1996 (Supp. 96-1). Amended effective June 13, 1997 (Supp. 97-2). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2). Amended by final rulemaking at 19 A.A.R. 3882, effective January 4, 2014 (Supp. 13-4).

**R12-1-606. Fluoroscopic and Fluoroscopic Treatment Simulator Systems**

**A.** Useful beam limitation. A registrant shall:
1. Provide beam-limiting devices that restrict the entire cross section of the useful beam to less than the area of the primary barrier at any Source-to-Image Receptor Distance (SID);
2. Ensure that the x-ray field size produced by fluoroscopic systems without image intensification does not extend beyond the visible area of the image receptor at any SID;

3. Ensure that the x-ray field size produced by fluoroscopic systems with image intensification and automatic shutter control does not exceed the diameter of the image receptor at any SID;
4. Ensure that the x-ray field size produced by fluoroscopic systems with image intensification and manual shutter control does not exceed the diameter of the image receptor with the fluoroscopic imaging assembly positioned at the maximum usable distance above the table top; and
5. Ensure that the x-ray field size produced by fluoroscopic systems with image intensification and manual shutter control, where the fluoroscopic tube is above the table top, does not exceed the diameter of the image receptor with the shutters open to the fullest extent, and at the maximum SID which the fluoroscopic tube is capable of producing radiation.

**B.** Fluoroscopic primary protective barrier. A registrant shall:
1. Provide the fluoroscopic imaging assembly with a primary protective barrier that always intercepts the entire cross section of the useful beam at any SID.
2. Ensure that the fluoroscopic tube is not capable of producing radiation unless the primary protective barrier is in a position to intercept the entire cross section of the useful beam.
3. Ensure that fluoroscopic radiation production automatically terminates if the primary protective barrier is removed from the useful beam.
4. Ensure that the fluoroscopic primary protective barrier meets the following requirements for attenuation of the useful beam:
   a. For equipment installed before November 15, 1967, the required lead equivalent of the barrier is not less than 1.5 millimeters for fluoroscopes that produce less than 100 kVp, 1.8 millimeters for fluoroscopes that produce at least 100 kVp but less than 125 kVp, and 2.0 millimeters for fluoroscopes that produce 125 or more kVp. (For conventional fluoroscopes, these requirements may be assumed to have been met if the exposure rate measured at the viewing surface of the fluorescent screen does not exceed 12.9 microcoulombs per kilogram (50 milliroentgens) per hour with the screen in the primary beam of the fluoroscope without a patient, under normal operating conditions.) For equipment installed or reinstalled, the required lead equivalent of the barrier is 2.0 millimeters for fluoroscopes that produce less than 125 kVp or 2.7 millimeters for fluoroscopes that produce 125 or more kVp.
   b. For fluoroscopic systems that use image intensification, the exposure rate, due to transmission through the primary protective barrier, does not exceed 516 nC/kg (2 milliroentgens) per hour at 10 centimeters (4 inches) from any accessible surface of the fluoroscopic imaging assembly, beyond the plane of the image receptor for each 258 μC/kg (1 roentgen) per minute of entrance exposure rate.
   c. Compliance with subsections (B)(4)(a) and (b) is determined with the image receptor positioned 35.5 centimeters (14 inches) from the panel or table top, at normal operating technical factors and with the attenuation block in the useful beam for systems with image intensification.

**C.** Entrance exposure rate limits. A registrant shall ensure that:
1. The exposure rate, measured at the point where the center of the useful beam enters the patient does not exceed 2.6 mC/kg (10 roentgens) per minute at any combination of tube potential and current, except during recording of fluoroscopic images or if provided with optional high-level control.
2. If provided with optional high-level control, the equipment is not operable at any combination of tube potential and current that will result in an exposure rate in excess of 2.6 mC/kg (10 roentgens) per minute at the point where the center of the useful beam enters the patient, unless the high-level control is activated, in which case an exposure rate in excess of 5.2 mC/kg (20 roentgens) per minute is prohibited.
   a. Special means of activation of high-level controls, such as additional pressure applied continuously by the operator, are required to avoid accidental use.
   b. A continuous signal audible to the fluoroscopist is required to indicate that the high-level control is being employed.
3. The Agency shall determine compliance with subsections (C)(1) and (2) as follows:
   a. Remove grids and compression devices from the useful beam during the measurement;
   b. If the source is below the table, measure the exposure rate 1 centimeter above the table top or cradle; and
   c. If the source is above the table, measure the exposure rate 30 centimeters (11.8 inches) above the table top with the end of the beam-limiting device or spacer positioned as closely as possible to the point of measurement;
   d. For fluoroscopy involving a mobile C-arm x-ray system, measure the exposure rate 30 centimeters (11.8 inches) from the input surface of the fluoroscopic imaging assembly;
   e. For fluoroscopy involving a C-arm x-ray system, measure the exposure rate 30 centimeters (11.8 inches) from the input surface of the fluoroscope imaging assembly, with the x-ray source positioned at any available SID, provided that the end of the beam-limiting device or spacer is not closer than 30 centimeters (11.8 inches) from the input surface of the fluoroscopic image assembly; and
   f. For a lateral fluoroscope, measure the exposure rate 15 centimeters (5.9 inches) from the centerline of the x-ray table and in the direction of the x-ray source with the end of the beam-limiting device or spacer positioned as closely as possible to the point of measurement. If the tabletop is movable, it shall be positioned as closely as possible to the lateral x-ray source, with the end of the beam-limiting device or spacer no closer than 15 centimeters (5.9 inches) to the centerline of the x-ray table.

**D.** The registrant shall ensure that the source-to-skin distance is not less than:
1. 38 centimeters (15 inches) on stationary fluoroscopes installed after January 2, 1996;
2. 35.5 centimeters (14 inches) on stationary fluoroscopes which are in operation before January 2, 1996;
3. 30 centimeters (11.8 inches) on all mobile fluoroscopes; and
4. 20 centimeters (8 inches) for image-intensified fluoroscopes used for a specific surgical application. The registrant shall follow any precautionary measures in the users operating manual.

**E.** Each fluoroscopic system installation is subject to all of the following requirements for the control of stray radiation. A registrant shall:

1. Provide a shielding device of at least 0.25 millimeter lead equivalent for covering the Bucky-slot during fluoroscopy;
2. Except for fluoroscopy performed using portable or mobile C-arm x-ray systems or during surgical procedures or cardiac catheterization, provide protective drapes, or hinged or sliding panels of at least 0.25 millimeters lead equivalent, between the patient and fluoroscopist to intercept scattered radiation that would otherwise reach the fluoroscopist and others near the machine, but not substitute drapes and panels for a protective apron; and
3. Ensure that protective aprons of at least 0.25 millimeter lead equivalent are worn in the fluoroscopy room by each person, except the patient, whose body is likely to be exposed to 50 μSv/hr (5 mR/hr) or more.

**F.** Exposure control. A registrant shall:
1. Ensure that activation of the fluoroscopic tube is controlled by a "dead-man" switch;
2. Provide a manual reset cumulative timing device, which is activated only during production of radiation in the fluoroscopic mode, to indicate elapsed time by an audible signal or terminate production of radiation;
3. Provide a device for exposure control in the "spot film" mode that terminates exposure either automatically, or after a preset time interval, preset number of pulses, preset product of current and time, or preset exposure; and
4. Ensure that the x-ray tube potential and current are continuously indicated.

**G.** A registrant shall provide systems used for mobile fluoroscopy with image intensification.

**H.** Fluoroscopic treatment simulators. Simulators are exempt from subsections (A) through (G). A registrant shall:
1. Use a beam limiting device that restricts the beam to the area of clinical interest.
2. Include and label devices for settings or physical factors, such as kVp, mA, or exposure time on the control panel;
3. Ensure that the fluoroscopic exposure switch or switches are of the "deadman" type;
4. Ensure that each person whose presence is necessary is in the simulator room during exposure and protected with a lead apron of at least 0.5 millimeter lead equivalent or a portable shield. Any person who places their hands in the useful x-ray beam shall wear leaded gloves; and
5. Ensure that the operator stands behind a barrier and is able to observe the patient during simulator exposures.

**Historical Note**

Adopted effective June 30, 1977 (Supp. 77-3). Former Section R12-1-606 repealed, new Section R12-1-606 adopted effective August 8, 1986 (Supp. 86-4). Amended effective January 2, 1996 (Supp. 96-1). Amended 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. 4302, effective November 14, 2003 (Supp. 03-3). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2). Amended by final rulemaking at 19 A.A.R. 3882, effective January 4, 2014 (Supp. 13-4).

**R12-1-607. Additional X-ray Machine Standards, Shielding Requirements, and Procedures, Except Mobile Fluoroscopic, Dental Panoramic, Cephalometric, Dental CT, or Dental Intraoral Radiographic Systems**

**A.** Useful beam limitation. A registrant shall:
1. Provide a means to restrict the useful beam to the area of clinical interest for any combination of SID and image receptor size employed.
2. Ensure that beam-limiting devices meet the following requirements:
   a. Devices that project a circular radiation field restrict the diameter of the useful beam, not to exceed the diagonal dimension of the image receptor by greater than 2 percent of the SID;
   b. Devices that project a rectangular or square radiation field restrict the useful beam to the longitudinal and transverse dimensions of the image receptor to within 2 percent of the SID;
   c. Beam limiting devices that do not incorporate light beams to define the projected radiation field are clearly labeled, indicating the SID and image receptor size at which each device complies with the applicable requirements of subsection (A)(2)(a) or (b);
   d. Adjustable beam-limiting devices installed after July 31, 1971, incorporate light beams to define the projected dimensions of the useful beam and provide an average illumination of not less than 100 lux (9 footcandles) at 1 meter (3.3 feet) or at the maximum SID, whichever is less. The average illumination shall be based upon measurements made in the approximate center of each quadrant of the light field; and
   e. All beam-limiting devices installed, on general purpose fixed and mobile radiographic systems, provide stepless means of continuous adjustment of the projected radiation field size.
3. Provide a means to align the center of the radiation field to the center of the image receptor to within 2 percent of the SID.

**B.** Radiation exposure control. A registrant shall:
1. Provide a means to terminate the exposure at a preset time interval, preset product of current and time, preset number of pulses, or a preset exposure to the image receptor. The registrant shall ensure that it is not possible to make an exposure when the exposure control device is set to a "zero" or "off" position if either position is provided.
2. Ensure that the exposure switch is a "dead-man" switch, and except for those used with "spot-film" devices in fluoroscopy, is arranged so that it cannot be conveniently operated outside a shielded area.
3. Provide x-ray systems with automatic exposure control, which indicates at the control panel when this mode is selected, and a visual and audible signal, which indicates termination of the exposure.
4. Use a control panel that includes:
   a. A device (usually a milliamp meter) that will give a positive indication during radiation production; and
   b. Control setting indicators or meters that indicate the appropriate technical factors: kVp, mAs, mA, or exposure time, and any special mode selected for the exposure.

**C.** Structural shielding. A registrant shall:
1. Ensure that all wall, floor and ceiling areas struck by the useful beam have primary protective barriers. Primary protective barriers in walls shall extend from the finished floor to a minimum height of 2.13 meters (7 feet);
2. Ensure that secondary protective barriers are provided in all wall, floor, and ceiling areas that do not have primary protective barriers or where the primary protective barrier

requirements are lower than the secondary barrier requirements;

3. Ensure that the operator's station is behind a protective barrier sufficient to ensure compliance with R12-1-408, R12-1-414, and R12-1-416, and the operator is able to communicate with the patient from the operator's station.
4. Provide a window of transparent material equal in attenuation to that required by the adjacent barrier, or a mirror system, that is large enough and placed so that the operator can see the patient during exposure without having to leave the protected area.

**D.** Operating procedures. A registrant shall:

1. Use mechanical supporting or restraining devices, if a patient must be held in position for radiography. If the patient must be held by an individual, the registrant shall ensure that the individual is protected with appropriate shielding devices, such as protective gloves and apron, and is positioned so that no part of the body of the individual holding the patient is struck by the useful beam;
2. Ensure that only individuals required for the radiographic procedure are in the radiographic room during exposure, and, except for the patient, all these individuals are equipped with protective devices;
3. Restrict the useful beam to the clinical area of interest;
4. Provide a chart in the vicinity of the diagnostic x-ray system's control panel that specifies, for all routine examinations performed with the system, the following information:
   a. Patient's anatomical size and technique factors;
   b. Type and size of the film or film screen combination;
   c. Type and focal distance of the grid, if any;
   d. X-ray source-to-image receptor distance; and
   e. Type and location of gonad shielding.
5. Provide documentation of the following items:
   a. The patient's identity;
   b. The x-ray examination, as recorded in a radiographic log;
   c. The date the examination is performed;
   d. The number of projections (if applicable), or on-time, or dose factors depending upon the unit; and
   e. A method of identifying the individual who performed the examination.
6. The registrant shall maintain in chronological order, the documentation required in subsection (D)(5) in written or readily available electronic form. The documentation shall be maintained for three years from the date the examination is performed.

**Historical Note**

Adopted effective June 30, 1977 (Supp. 77-3). Former Section R12-1-607 repealed, new Section R12-1-607 adopted effective August 8, 1986 (Supp. 86-4). Amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2). Amended by final rulemaking at 19 A.A.R. 3882, effective January 4, 2014 (Supp. 13-4).

**R12-1-608. Mobile Diagnostic Radiographic and Mobile Fluoroscopic Systems, Except Dental Panoramic, Cephalometric, Dental CT, or Dental Intraoral Radiographic Systems**

**A.** Equipment

1. All requirements of R12-1-607(A) and (B) apply.
2. For mobile radiographic units the registrant shall provide a "dead-man" switch, together with an electrical cord of sufficient length so that the operator can stand out of the useful beam and at least 1.82 meters (6 feet) from the patient during all x-ray exposures.
3. A registrant shall ensure that a cone, spacer frame, or inherent provision is made so that the equipment is not operated at source-skin distances of less than 20.3 centimeters (8 inches).

**B.** Structural shielding. If a mobile unit is used routinely in one location, it is considered a fixed installation subject to the shielding requirements in R12-1-603(C), and R12-1-607(C).

**C.** Operating procedures

1. All provisions of R12-1-607(D) apply.
2. An individual who operates a mobile x-ray system shall comply with R12-1-419(B).

**Historical Note**

Adopted effective June 30, 1977 (Supp. 77-3). Amended subsections (A) and (C) effective August 8, 1986 (Supp. 86-4). Amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2). Amended by final rulemaking at 19 A.A.R. 3882, effective January 4, 2014 (Supp. 13-4).

**R12-1-609. Chest Photofluorographic Systems**

Use of chest photofluorographic systems for diagnosis of human disease is prohibited.

**Historical Note**

Adopted effective June 30, 1977 (Supp. 77-3). Amended subsections (A) and (C) effective August 8, 1986 (Supp. 86-4). Amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). Amended by final rulemaking at 10 A.A.R. 4458, effective December 4, 2004 (Supp. 04-4).

**R12-1-610. Dental Intraoral Radiographic Systems**

**A.** Equipment. A registrant shall:

1. Use a protective tube housing of diagnostic type;
2. Use diaphragms or cones for restricting the useful beam and to provide the same degree of protection as the housing. The diameter of the useful beam at the end of the cone or spacer frame shall not be more than 7.6 centimeters (3 inches) for intraoral radiography;
3. Ensure that a cone or spacer frame provides a source-to-skin distance of not less than 17.8 centimeters (7 inches) with apparatus operating above 50 kVp or 10 centimeters (4 inches) with apparatus operating at 50 kVp or below for intraoral radiography;
4. Provide a timer to terminate the exposure at a preset time interval, a preset product of current and time, a preset number of pulses, or a preset radiation exposure to the image receptor;
5. Ensure that it is not possible to make an exposure if the timer is set to the "zero" or "off" position;
6. Ensure that the tube head remains stationary if placed in the exposure position;
7. Ensure that the exposure initiating device is a "dead-man" switch; and
8. Use a control panel that includes:
   a. A means to provide visual or audible indication, detectable at or from the operator's position, during x-ray production or exposure termination; and
   b. Indication of technique factors for kVp, mA, exposure time, and any special mode that may be selected for the exposure.

9. Use technique factors, where deviation of measured values from indicated values for kVp and exposure time do not exceed the limits specified by the manufacturer. In the absence of the manufacturer's specifications, the deviation shall not exceed plus or minus 10 percent of the indicated value for kVp and plus or minus 20 percent for exposure time duration.
10. For a digital system that uses an electronic sensor, use digital radiography techniques that permit reducing x-ray beam on-time to 25 percent of the exposure time required for "D" speed film or lower, reducing radiation to the patient by the same rate.
11. For a computed radiography (imaging plate (IP) made of photostimulable phosphor) system that uses an imaging plate, use radiography techniques that permit reducing x-ray beam on-time to 50 percent of the exposure time required for "D" speed film or lower, reducing radiation to the patient by the same rate.

**B.** Structural shielding. The registrant shall:
1. Provide dental installations with primary and secondary barriers to ensure compliance with the personnel exposure requirements in Article 4 of this Chapter; (Note: In many cases, structural materials of ordinary walls suffice as a protective barrier without addition of special shielding material.)
2. Install primary protective barriers between rooms or areas if dental x-ray units are used in adjacent rooms or areas;
3. Provide each installation with a protective barrier for the operator or arrange the installation so that the operator can stand at least 1.82 meters (6 feet) from the patient and well away from the useful beam;
4. Arrange the operator's position to allow visual contact with the patient during exposure; and
5. Comply with fixed installation requirements, if a mobile unit is used routinely in one location.

**C.** Operating procedures
1. A dentist or other persons shall not hold patients or films during exposure. Only persons required for the radiographic procedure are allowed in the radiographic room during exposures.
2. An operator shall stand at least 1.82 meters (6 feet) from the patient or behind a protective barrier during each exposure.
3. An operator shall ensure that only the patient is in the useful beam.
4. The licensed practitioner or other person shall not hold the tube housing or the cone during the exposure.
5. A registrant shall not perform dental fluoroscopy without an image intensifier.

**Historical Note**

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective August 8, 1986 (Supp. 86-4). Amended January 2, 1996 (Supp. 96-1). Amended effective June 13, 1997 (Supp. 97-2). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2). Amended by final rulemaking at 19 A.A.R. 3882, effective January 4, 2014 (Supp. 13-4).

**R12-1-610.01. Hand-held Intraoral Dental Radiographic Unit Requirements For Use**

**A.** Registrants are subject to the following requirements for Intraoral dental radiographic units designed to be operated as a hand-held unit:
1. For all uses:
   a. Operators of hand-held intraoral dental radiographic units shall be specifically trained to operate such equipment.
   b. A hand-held intraoral dental radiographic unit shall be held without any motion during a patient examination. A tube stand may be utilized to immobilize a hand-held intraoral dental radiographic unit during patient examination.
   c. The operator shall ensure there are no bystanders within a radius of at least six feet from the patient being examined with a hand-held intraoral radiographic unit.
2. Additional requirements for operatories in permanent facilities:
   a. Hand-held intraoral dental radiographic units shall be used for patient examinations in dental operatories that meet the structural shielding requirements specified by the Agency or by a qualified health or medical physicist.
   b. Hand-held intraoral dental radiographic units shall not be used for patient examinations in hallways and waiting rooms.

**B.** Hand-held units may only be used in a manner as specified on the registration issued by the Agency.

**Historical Note**

New Section R12-1-610.01 made by final rulemaking at 19 A.A.R. 3882, effective January 4, 2014 (Supp. 13-4).

**R12-1-611. Therapeutic X-ray Systems of Less Than 1 MeV**

**A.** Equipment requirements.
1. Leakage radiation. When the x-ray tube is operated at its maximum rated tube current for the maximum kVp, the leakage air kerma rate shall not exceed the value specified at the distance specified for that classification of therapeutic radiation machine. For each therapeutic radiation machine, the registrant shall determine, or obtain from the manufacturer, the leakage radiation existing at the positions specified:
   a. 5-50 kVp Systems. The leakage air kerma rate measured at any position 5 centimeters from the tube housing assembly shall not exceed 1 mGy (100 mrad) in any one hour.
   b. Greater than 50 kVp and less than 1MeV Systems. The leakage air kerma rate measured at a distance of 1 meter from the target in any direction shall not exceed 1 centigray (1 rad) in any 1 hour. This air kerma rate measurement may be averaged over areas no larger than 100 square centimeters (100 cm2). In addition, the air kerma rate at a distance of 5 centimeters from the surface of the tube housing assembly shall not exceed 30 centigray (30 rad) per hour.
2. Permanent beam limiting devices. A registrant shall ensure that fixed diaphragms or cones used for limiting the useful beam provide the same or higher degree of attenuation as required for the tube housing assembly.
3. Removable and adjustable beam-limiting devices. A registrant shall ensure that:
   a. Removable and adjustable beam-limiting devices, for the portion of the useful beam to be blocked by these devices, transmit not more than 1 percent of the original x-ray beam at the maximum kilovoltage and maximum treatment filter; and
   b. When adjustable beam limiting devices are used, the position and shape of the radiation field shall be indicated by a light beam.

4. Filter system. A registrant shall ensure that the filter system is designed so that:
   a. Filters cannot be accidentally displaced from the useful beam at any possible tube orientation;
   b. For equipment installed after January 1, 2011, an interlock system prevents irradiation if the proper filter is not in place;
   c. The air kerma rate escaping from the filter slot shall not exceed 1 centiGray (1 rad) per hour at one (1) meter under any operating conditions; and
   d. Each filter is marked regarding its material of construction and its thickness or wedge angle for wedge filters.
5. X-ray tube immobilization. A registrant shall ensure that the tube housing assembly is capable of being immobilized during stationary treatments and the x-ray tube shall be so mounted that it cannot accidentally turn or slide with respect to the housing aperture.
6. Focal spot marking. A registrant shall ensure that the tube housing assembly is marked so that it is possible to determine the location of the focal spot to within 5 millimeters, and the marking is readily accessible for use during calibration procedures.
7. Therapy treatment timers. A registrant shall:
   a. Provide a timer that has a display at the treatment control panel. The timer shall have a preset time selector and an elapsed time indicator;
   b. Ensure that the timer is a cumulative timer that activates with the radiation, retains its reading after irradiation is interrupted or terminated, and requires the operator to reset the preset time selector after irradiation is terminated and before irradiation can be reinitiated;
   c. Ensure that the timer terminates irradiation when a preselected time has elapsed;
   d. Ensure that the timer permits accurate presetting and determination of exposure times as short as one second;
   e. Ensure that the timer does not permit an exposure if set at zero; and
   f. Ensure that the timer does not activate until the shutter is opened if irradiation is controlled by a shutter mechanism.
8. Control panel functions. In addition to the displays required in other provisions of this Section, a registrant shall ensure that a control panel has:
   a. An indication of whether electrical power is available at the control panel and if activation of the x-ray tube is possible;
   b. An indication of whether x-rays are being produced;
   c. A means for indicating kVp and x-ray tube current;
   d. A means for terminating an exposure at any time;
   e. A locking device that will prevent unauthorized use of the x-ray system; and
   f. For x-ray equipment installed after January 2, 1996, a positive display of specific filters in the beam.
9. Multiple tubes. If one control panel is used to energize more than one x-ray tube a registrant shall ensure that:
   a. It is possible to activate only one x-ray tube during any time interval,
   b. There is an indication at the control panel that identifies which x-ray tube is energized, and
   c. There is an indication at the tube housing assembly when that tube is energized.
10. Source-to-patient distance. A registrant shall ensure that there is a means of determining the source-to-patient distance to within 1 centimeter.
11. Shutters. Unless it is possible to bring the x-ray output to the prescribed exposure parameters within five seconds, a registrant shall ensure that the entire useful beam is automatically attenuated by a shutter with a lead equivalency not less than that of the tube housing assembly. In addition the registrant shall ensure that:
    a. After the unit is at operating parameters, the operator controls the shutter electrically from the control panel; and
    b. An indication of shutter position appears at the control panel.
12. Low filtration x-ray tubes. A registrant shall ensure that each x-ray system equipped with a beryllium or other low-filtration window is clearly labeled as low-filtration equipment on the tube housing assembly and at the control panel.

**B.** Facility design requirements. In addition to shielding necessary to meet the requirements of Article 4 of this Chapter, a registrant shall ensure that:
1. Warning lights. A treatment room to which access is possible through more than one entrance has a warning light, in a readily observable position near the outside of any access doors, which will indicate when the useful beam is "on."
2. Voice communication. Two-way oral communication is possible between the patient and the operator at the control panel; or where excessive noise levels make oral communication impractical, another effective method of communication.
3. Viewing systems. Windows, mirrors, closed-circuit television, or an equivalent system, permits continuous observation of the patient during irradiation and is located so that the operator can observe the patient from the control panel. If the primary viewing system is by electronic means (for example, television), the registrant shall have an alternate viewing system for use in the event of electronic failure.
4. Systems above 150 kVp. For treatment rooms that contain an x-ray system capable of operating above 150 kVp a registrant shall ensure that:
   a. All necessary shielding, except for any beam interceptor, is provided by fixed barriers;
   b. The control panel is within a protective booth equipped with an interlocked door, or located outside the treatment rooms;
   c. All doors of the treatment room are electrically connected to the control panel so that x-ray production cannot occur unless all doors are closed; and
   d. Opening of any door to the treatment room during exposure results in automatic termination of x-ray production or reduction of radiation levels to an average of no more than 516 nC/kg (2 milliroentgens) per hour and a maximum of 2.6 μC/kg (10 milliroentgens) per hour at a distance of 1 meter (3.3 feet) from the target in any direction, and restoration of the machine to full operation is possible only from the control panel after the termination or reduction.

**C.** Surveys. A registrant shall ensure that:
1. All facilities, both new and existing, or not previously surveyed, are surveyed before being put into service for the treatment of patients by, or under the direction of, a person trained and experienced in the principles of radia-

tion protection, and perform additional surveys of a facility after any change in the facility or a facility's equipment that might cause a significant increase in radiation hazard, before being put into service for the treatment of patients.

2. The person conducting the survey reports the survey findings in writing to the individual in charge of the facility and maintains a copy of the survey report for inspection by the Agency.
3. The installation is operated in compliance with any limitations indicated by the protection survey required by subsection (C)(1).

**D.** Calibrations. A registrant shall ensure that:

1. The calibration of a therapeutic x-ray system includes, but is not limited to, the following determinations:
   a. Verification that the x-ray system is operating in compliance with the design specifications;
   b. The dose rate equivalent for each combination of field size, technique factors, filter, and treatment distance used;
   c. The degree of congruence between the radiation field and the field indicated by the localizing device if a localizing device is used; and
   d. An evaluation of the uniformity of the radiation field symmetry for the field sizes used and any dependence upon source housing assembly orientation;
2. The calibration of an x-ray system is performed at intervals not to exceed annually and after any change or replacement of components that could cause a change in the radiation output;
3. The calibration of the radiation output of the x-ray system is performed by, or under the direction of, a person trained and experienced in performing calibrations, who is physically present at the facility during calibration;
4. Calibration of the radiation output of an x-ray system is performed with a calibrated instrument. The registrant shall ensure that calibration of the instrument is directly traceable to the National Institute of Standards and Technology (NIST) and that the instrument has been calibrated within the preceding 24 months;
5. Records of calibration performed under subsection (D)(3) are maintained for at least three years after completion of the calibration and are made available for inspection by the Agency; and
6. A copy of the most recent calibration is available for use by the operator at the control panel.

**E.** Spot checks. A registrant shall ensure that spot checks are performed on therapeutic x-ray systems capable of operation at greater than 150 kVp. The registrant shall ensure that spot checks meet the following requirements:

1. The spot-check procedures are in writing and have been developed by a qualified expert;
2. The measurements taken during the spot checks demonstrate the degree of consistency of the operating characteristics that can affect the radiation output of the x-ray system;
3. The written spot-check procedure specifies the frequency of the tests or measurements, made at intervals not to exceed monthly;
4. The spot-check procedure identifies conditions that require recalibration of the system in accordance with subsection (D)(l); and
5. Records of spot-check measurements performed as required by subsection (E)(3) are maintained, available for inspection by the Agency, for three years following the measurements.

**F.** Operating procedures. A registrant shall ensure that:

1. Therapeutic x-ray systems are not left unattended unless the system is secured according to subsection (A)(8)(e);
2. If a patient must be held in position for radiation therapy, mechanical supporting or restraining devices are used;
3. The tube housing assembly is not held by an individual during exposures; and
4. At 150 kVp or more the patient is the only person in the treatment room during production of radiation. At less than 150 kVp an individual may be in the room with patient, provided the individual is protected by a barrier sufficient to meet the requirements of Article 4 of this Chapter.

**G.** Electronic Brachytherapy units are exempt from the requirements of this Section.

**Historical Note**

Adopted effective June 30, 1977 (Supp. 77-3). Former Section R12-1-611 repealed, new Section R12-1-611 adopted effective August 8, 1986 (Supp. 86-4). Amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2). Amended by final rulemaking at 19 A.A.R. 3882, effective January 4, 2014 (Supp. 13-4).

**R12-1-611.01. Electronic Brachytherapy to Deliver Interstitial and Intracavity Therapeutic Radiation Dosage**

**A.** Electronic brachytherapy devices used to deliver interstitial and intracavity therapeutic radiation dosage shall be subject to the requirements of this Section, and unless otherwise specified in this Section shall be exempt from the requirements of R12-1-611.

1. An electronic brachytherapy device that does not meet the requirements of this Section shall not be used for irradiation of patients; and
2. An electronic brachytherapy device shall only be utilized for human use applications specifically approved by the U.S. Food and Drug Administration (FDA), unless participating in a research study approved by the registrant's Institutional Review Board (IRB).

**B.** Each facility location authorized to use an electronic brachytherapy device in accordance with this Section shall possess appropriately calibrated portable monitoring equipment. At a minimum, such equipment shall include a portable survey instrument capable of measuring dose rates over the range 10 μSv (1 mrem) per hour to 10 mSv (1000 mrem) per hour. The survey instrument shall be capable of measuring as low as 10 μSv (1 mrem) per hour in the energy range of the electronic brachytherapy unit for which the survey instrument is to be used. Published correction factors utilized in conjunction with the instrument's readings may be used to achieve sensitivity. The survey instrument or instruments shall be operable and calibrated before first use, at intervals not to exceed 12 months, and after survey instrument repairs.

**C.** Facility Design Requirements for Electronic Brachytherapy Devices. In addition to shielding adequate to meet requirements of R12-1-603(C), the treatment room shall meet the following design requirements:

1. If applicable, provision shall be made to prevent simultaneous operation of more than one therapeutic radiation machine in a treatment room.
2. Access to the treatment room shall be controlled by a door at each entrance.
3. Each treatment room shall have provisions to permit continuous oral communication and visual observation of the

patient from the treatment control panel during irradiation. The electronic brachytherapy device shall not be used for patient irradiation unless the patient can be observed.

4. For electronic brachytherapy devices capable of operating below 150 kVp, radiation shielding for the staff in the treatment room may be available, either as a portable shield or as localized shielded material around the treatment site or both, in lieu of the requirements for room shielding. The shielding shall meet the requirements of R12-1-603(C).
5. For electronic brachytherapy devices capable of operating at or greater than 150 kVp, the facility must meet the requirements of R12-1-611(B)(4).

**D.** Control Panel Functions. The control panel, in addition to the displays required by other provisions in this Section, shall:

1. Provide an indication of whether electrical power is available at the control panel and if activation of the electronic brachytherapy source is possible;
2. Provide an indication of whether x-rays are being produced;
3. Provide a means for indicating electronic brachytherapy source potential and current;
4. Provide the means for terminating an exposure at any time; and
5. Include an access control (locking) device that will prevent unauthorized use of the electronic brachytherapy device.

**E.** Timer. A suitable irradiation control device (timer) shall be provided to terminate the irradiation after a pre-set time interval or integrated charge on a dosimeter-based monitor.

1. A timer shall be provided at the treatment control panel. The timer shall indicate the planned setting and the time elapsed or remaining;
2. The timer shall not permit an exposure if set at zero;
3. The timer shall be a cumulative device that activates with an indication of "BEAM-ON" that retains its reading after irradiation is interrupted or terminated. After irradiation is terminated and before irradiation can be reinitiated, it shall be necessary to reset the elapsed time indicator;
4. The timer shall terminate irradiation when a pre-selected time has elapsed, if any dose monitoring system has not previously terminated irradiation.
5. The timer shall permit setting of exposure times as short as 0.1 second; and
6. The timer shall be accurate to within one percent of the selected value or 0.1 second, whichever is greater.

**F.** Qualified Medical Physicist Support.

1. The services of a Qualified Medical Physicist shall be required in facilities having electronic brachytherapy devices. The Qualified Medical Physicist shall be responsible for:
   a. Evaluation of the output from the electronic brachytherapy source;
   b. Generation of the necessary dosimetric information;
   c. Supervision and review of treatment calculations prior to initial treatment of any treatment site;
   d. Establishing the periodic and day-of-use quality assurance checks and reviewing the data from those checks as required in subsection (J);
   e. Consultation with the authorized user in treatment planning, as needed; and
   f. Performing calculations/assessments regarding patient treatments that may constitute a medical event.
2. If the Qualified Medical Physicist is not a full-time employee of the registrant, then the operating procedures required by subsection (G) shall also specifically address how the Qualified Medical Physicist is to be contacted for problems or emergencies, as well as the specific actions, if any, to be taken until the Qualified Medical Physicist can be contacted.

**G.** Operating Procedures.

1. Only individuals approved by the authorized user, Radiation Safety Officer, or Qualified Medical Physicist shall be present in the treatment room during treatment;
2. Electronic brachytherapy devices shall not be made available for medical use unless the requirements of subsections (A), (H), and (I) have been met;
3. The electronic brachytherapy device shall be inoperable, either by hardware or password, when unattended by qualified staff or service personnel;
4. During operation, the electronic brachytherapy device operator shall monitor the position of all persons in the treatment room, and all persons entering the treatment room, to prevent entering persons from unshielded exposure from the treatment beam;
5. If a patient must be held in position during treatment, mechanical supporting or restraining devices shall be used;
6. Written procedures shall be developed, implemented, and maintained for responding to an abnormal situation. These procedures shall include:
   a. Instructions for responding to equipment failures and the names of the individuals responsible for implementing corrective actions; and
   b. The names and telephone numbers of the authorized users, the Qualified Medical Physicist, and the Radiation Safety Officer to be contacted if the device or console operates abnormally.
7. A copy of the current operating and emergency procedures shall be physically located at the electronic brachytherapy device control console;
8. Instructions shall be maintained with the electronic brachytherapy device control console to inform the operator of the names and telephone numbers of the authorized users, the Qualified Medical Physicist, and the Radiation Safety Officer to be contacted if the device or console operates abnormally; and
9. The Radiation Safety Officer, or the Radiation Safety Officer's designee, and an authorized user shall be notified immediately if the patient has a medical emergency, suffers injury or dies. The Radiation Safety Officer or the Qualified Medical Physicist shall inform the manufacturer of the event.

**H.** Safety Precautions for Electronic Brachytherapy Devices.

1. Any person in the treatment room, other than the person being treated, shall wear personnel monitoring devices;
2. An authorized user and a Qualified Medical Physicist shall be physically present during the initiation of all new patient treatments involving the electronic brachytherapy device;
3. After the first treatment one of the following individuals shall be physically present during continuation of all patient treatments involving the electronic brachytherapy device:
   a. A Qualified Medical Physicist, or
   b. An authorized user, or
   c. A certified therapy technologist (CTT) certified by the Arizona Medical Radiologic Technology Board of Examiners, under the direct supervision of an

authorized user, who has been trained in the operation and emergency response for the electronic brachytherapy device;

4. When shielding is required by subsection (C)(4), surveys shall be conducted to ensure that the requirements of R12-1-408, R12-1-414, and R12-1-416 are met. Alternatively, a Qualified Medical Physicist shall designate shield locations sufficient to meet the requirements of R12-1-603(C) and R12-1-607(C) for any individual, other than the patient, in the treatment room; and
5. All personnel in the treatment room are required to remain behind shielding during treatment. A Qualified Medical Physicist shall approve any deviation from this requirement and shall designate alternative radiation safety protocols, compatible with patient safety, to provide an equivalent degree of protection.

**I.** Electronic Brachytherapy Source Calibration Measurements.

1. Calibration of the electronic brachytherapy source output shall be performed by, or under the direct supervision of, a Qualified Medical Physicist. If the control console is integral to the electronic brachytherapy device, the required procedures shall be kept where the operator is located during electronic brachytherapy device operation;
2. Calibration of the electronic brachytherapy source output shall be made for each electronic brachytherapy source, or after any repair affecting the x-ray beam generation, or when indicated by the electronic brachytherapy source quality assurance checks;
3. Calibration of the electronic brachytherapy source output shall utilize a dosimetry system appropriate for the energy output of the unit and calibrated by the National Institute for Standards and Technology (NIST) or by an American Association of Physicists in Medicine (AAPM) Accredited Dosimetry Calibration Laboratory (ADCL). The calibration shall have been performed within the previous 24 months and after any servicing that may have affected system calibration;
4. Calibration of the electronic brachytherapy source output shall include, as applicable, determination of:
   a. The output within two percent of the expected value, if applicable, or determination of the output if there is no expected value;
   b. Timer accuracy and linearity over the typical range of use;
   c. Proper operation of back-up exposure control devices;
   d. Evaluation that the relative dose distribution about the source is within five percent of that expected; and
   e. Source positioning accuracy to within one millimeter within the applicator;
5. Calibration of the x-ray source output required shall be in accordance with current published recommendations from a recognized national professional association with expertise in electronic brachytherapy (when available). In the absence of a calibration protocol published by a national professional association, the manufacturer's calibration protocol shall be followed.
6. The registrant shall maintain a record of each calibration in an auditable form for the duration of the registration. The record shall include: the date of the calibration; the manufacturer's name, model number and serial number for the electronic brachytherapy device and a unique identifier for its electronic instrument or instruments brachytherapy source; the model numbers and serial numbers of the instrument or instruments used to calibrate the electronic brachytherapy device; and the name and signature of the Qualified Medical Physicist responsible for performing the calibration.

**J.** Periodic and Day-of-Use Quality Assurance Checks for Electronic Brachytherapy Devices.

1. Quality assurance checks shall be performed on each electronic brachytherapy device:
   a. At the beginning of each day of use;
   b. Each time the device is moved to a new room or site; and
   c. After each x-ray tube installation.
2. The registrant shall perform periodic quality assurance checks required in accordance with procedures established by the Qualified Medical Physicist;
3. To satisfy the requirements of this subsection, radiation output quality assurance checks shall include at a minimum:
   a. Verification that output of the electronic brachytherapy source falls within three percent of expected values, as appropriate for the device, as determined by:
      i. Output as a function of time, or
      ii. Output as a function of setting on a monitor chamber.
   b. Verification of the consistency of the dose distribution to within three percent (or the manufacturer's or Qualified Medical Physicist's documented recommendation not to exceed five percent), observed at the source calibration required by subsection (I); and
   c. Validation of the operation of positioning methods to ensure that the treatment dose exposes the intended location within one millimeter; and
4. The registrant shall use a dosimetry system that has been intercompared within the previous 12 months with the dosimetry system described in this Section to make the quality assurance checks required in subsection (J)(3);
5. The registrant shall review the results of each radiation output quality assurance check to ensure that:
   a. An authorized user and Qualified Medical Physicist is immediately notified if any parameter is not within its acceptable tolerance, and the electronic brachytherapy device is not used until the Qualified Medical Physicist has determined that all parameters are within their acceptable tolerances;
   b. If all radiation output quality assurance check parameters appear to be within their acceptable range, the acceptable quality assurance checklist shall be reviewed and signed by either the authorized user or Qualified Medical Physicist prior to the next patient use of the unit. In addition, the Qualified Medical Physicist shall review and sign the results of each radiation output quality assurance check at intervals not to exceed 30 days.
6. To satisfy the requirements of subsection (J)(1), safety device quality assurance checks shall, at a minimum, assure:
   a. Proper operation of radiation exposure indicator lights on the electronic brachytherapy device and on the control console;
   b. Proper operation of viewing and intercom systems in each electronic brachytherapy facility, if applicable;
   c. Proper operation of radiation monitors, if applicable;
   d. The integrity of all cables, catheters or parts of the device that carry high voltages; and
   e. Connecting guide tubes, transfer tubes, transfer-tube-applicator interfaces, and treatment spacers are

free from any defects that interfere with proper operation.

7. If the results of the safety device quality assurance checks required in subsection (J)(6) indicate the malfunction of any system, a registrant shall secure the control console in the OFF position and not use the electronic brachytherapy device except as may be necessary to repair, replace, or check the malfunctioning system.
8. The registrant shall maintain a record of each quality assurance check required by this Section in a legible form for three years.
   a. The record shall include the date of the quality assurance check; the manufacturer's name, model number and serial number for the electronic brachytherapy device; the name and signature of the individual who performed the periodic quality assurance check and the name and signature of the Qualified Medical Physicist who reviewed the quality assurance check;
   b. For radiation output quality assurance checks required by subsection (J)(3), the record shall also include the unique identifier for the electronic brachytherapy source and the manufacturer's name; model number and serial number for the instrument or instruments used to measure the radiation output of the electronic brachytherapy device.

**K.** Therapy-related Computer Systems. The registrant shall perform acceptance testing on the treatment planning system of electronic brachytherapy-related computer systems in accordance with current published recommendations from a recognized national professional association with expertise in electronic brachytherapy (when available). In the absence of an acceptance testing protocol published by a national professional association, the manufacturer's acceptance testing protocol shall be followed.

1. Acceptance testing shall be performed by, or under the direct supervision of a Qualified Medical Physicist. At a minimum, the acceptance testing shall include, as applicable, verification of:
   a. The source-specific input parameters required by the dose calculation algorithm;
   b. The accuracy of dose, dwell time, and treatment time calculations at representative points;
   c. The accuracy of isodose plots and graphic displays;
   d. The accuracy of the software used to determine radiation source positions from radiographic images; and
   e. If the treatment planning system is different from the treatment delivery system, the accuracy of electronic transfer of the treatment delivery parameters to the treatment delivery unit from the treatment planning system.
2. The position indicators in the applicator shall be compared to the actual position of the source or planned dwell positions, as appropriate, at the time of commissioning.
3. Prior to each patient treatment regimen, the parameters for the treatment shall be evaluated for correctness and approved by the authorized user and the Qualified Medical Physicist through means independent of that used for the determination of the parameters.

**L.** Training for e-brachytherapy Authorized Users.

1. The registrant for any therapeutic radiation machine subject to this Section shall require the authorized user to be a physician who is certified in:
   a. Radiation oncology or therapeutic radiology by the American Board of Radiology or radiology (combined diagnostic and therapeutic radiology program) by the American Board of Radiology prior to 1976; or
   b. Radiation oncology by the American Osteopathic Board of Radiology; or
   c. Radiology, with specialization in radiotherapy, as a British "Fellow of the Faculty of Radiology" or "Fellow of the Royal College of Radiology"; or
   d. Therapeutic radiology by the Canadian Royal College of Physicians and Surgeons; or
2. Is in the active practice of therapeutic radiology, and has completed 200 hours of instruction in basic radiation techniques applicable to the use of an external beam radiation therapy unit, 500 hours of supervised work experience, and a minimum of three years of supervised clinical experience.
   a. To satisfy the requirement for instruction, the classroom and laboratory training shall include:
      i. Radiation physics and instrumentation;
      ii. Radiation protection;
      iii. Mathematics pertaining to the use and measurement of ionization radiation; and
      iv. Radiation biology.
   b. To satisfy the requirement for supervised work experience, training shall be under the supervision of an authorized user and shall include:
      i. Review of the full calibration measurements and periodic quality assurance checks;
      ii. Evaluation of prepared treatment plans and calculation of treatment times or patient treatment settings or both;
      iii. Using administrative controls to prevent medical events as described in R12-1-444;
      iv. Implementing emergency procedures to be followed in the event of the abnormal operation of an external beam radiation therapy unit or console; and
      v. Checking and using radiation survey meters.
   c. To satisfy the requirement for a period of supervised clinical experience, training shall include one year in a formal training program approved by the Residency Review Committee for Radiology of the Accreditation Council for Graduate Medical Education or the Committee on Postdoctoral Training of the American Osteopathic Association and an additional two years of clinical experience in therapeutic radiology under the supervision of an authorized user. The supervised clinical experience shall include:
      i. Examining individuals and reviewing their case histories to determine their suitability for external beam radiation therapy treatment, and any limitations or contraindications or both;
      ii. Selecting proper dose and how it is to be administered;
      iii. Calculating the therapeutic radiation machine doses and collaborating with the authorized user in the review of patients' progress and consideration of the need to modify originally prescribed doses or treatment plans as warranted by patients' reaction to radiation or both; and
      iv. Post-administration follow-up and review of case histories.
3. Notwithstanding the requirements of this subsection, the registrant for any therapeutic radiation machine subject to this Section may also submit the training of the prospec-

tive authorized user physician for Agency review on a case-by-case basis if the training includes substantially equivalent training as that listed in subsection (L)(2) and the training includes dosimetry calculation training and experience.

4. A physician shall not act as an authorized user until such time as the physician's training has been reviewed and approved by the Agency.

**M.** Training for Qualified Medical Physicist. The registrant for any therapeutic radiation machine subject to this Section shall require the Qualified Medical Physicist to:

1. Be certified with the Agency, as a provider of radiation services in the area of calibration and compliance surveys of external beam radiation therapy units; and
2. Be certified by the American Board of Radiology in:
   a. Therapeutic radiological physics; or
   b. Roentgen-ray and gamma-ray physics; or
   c. X-ray and radium physics; or
   d. Radiological physics; or
3. Be certified by the American Board of Medical Physics in Radiation Oncology Physics; or
4. Be certified by the Canadian College of Physicists in Medicine; or
5. 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, and have completed one year of full-time training in medical physics and an additional year of full-time work experience under the supervision of a Qualified Medical Physicist at a medical institution. This training and work experience shall be conducted in clinical radiation facilities that provide high-energy external beam radiation therapy (photons and electrons with energies greater than or equal to one MV/one MeV). To meet this requirement, the individual shall have performed the tasks listed in this subsection under the supervision of a Qualified Medical Physicist during the year of work experience.

**N.** Qualifications of Operators. Individuals who will be operating a therapeutic radiation machine for medical use shall be certified by the Agency as a CTT by the Arizona Medical Radiologic Technology Board of Examiners.

**O.** Additional training requirements.

1. A registrant shall provide instruction, initially and at least annually, to all individuals who operate the electronic brachytherapy device, as appropriate to the individual's assigned duties, in the operating procedures identified in subsection (G). If the interval between patients exceeds one year, retraining of the individuals shall be provided.
2. In addition to the requirements of subsection (L) for therapeutic radiation machine authorized users and subsection (M) for Qualified Medical Physicists, these individuals shall also receive device-specific instruction initially from the manufacturer, and annually from either the manufacturer or other qualified trainer. The training shall be of a duration recommended by a recognized national professional association with expertise in electronic brachytherapy (when available). In the absence of any training protocol recommended by a national professional association, the manufacturer's training protocol shall be followed. The training shall include, but not be limited to:
   a. Device-specific radiation safety requirements;
   b. Device operation;
   c. Clinical use for the types of use approved by the FDA;
   d. Emergency procedures, including an emergency drill; and
   e. The registrant's quality assurance program.
3. A registrant shall retain a record of individuals receiving manufacturers instruction for three years. The record shall include a list of the topics covered, the date of the instruction, the name or names of the attendee or attendees, and the name or names of the individual or individuals who provided the instruction.

**P.** Mobile Electronic Brachytherapy Service. A registrant providing mobile electronic brachytherapy service shall, at a minimum:

1. Check all survey instruments before medical use at each address of use or on each day of use, whichever is more restrictive;
2. Account for the electronic brachytherapy x-ray tube in the electronic brachytherapy device before departure from the client's address; and
3. Perform, at each location on each day of use, all of the required quality assurance checks specified in this Section to assure proper operation of the device.

**Q.** Medical events shall be reported to the Agency. For purposes of this Section "medical event" means a therapeutic radiation dose from a machine:

1. Delivered to the wrong patient;
2. Delivered using the wrong mode of treatment;
3. Delivered to the wrong treatment site; or
4. Delivered in one week to the correct patient, using the correct mode, to the correct therapy site, but greater than 130 percent of the prescribed weekly dose; or

**R.** A therapeutic radiation dose from a machine with errors in the calibration, time of exposure, or treatment geometry that result in a calculated total treatment dose differing from the final, prescribed total treatment dose by more than 20 percent, except for treatments given in 1 to 3 fractions, in which case a difference of more than 10 percent constitutes a medical event.

**S.** Reports of therapy medical events:

1. Within 24 hours after discovery of a medical event, a registrant shall notify the Agency by telephone by speaking to an Agency staff member. The registrant shall also notify the referring physician of the affected patient and the patient or a responsible relative or guardian, unless the referring physician personally informs the registrant either that he or she will inform the patient, or that in his or her medical judgment, telling the patient or the patient's responsible relative or guardian would be harmful to one or the other, respectively. If the Agency staff member, referring physician, or the patient's responsible relative or guardian cannot be reached within 24 hours, the registrant shall notify them as soon as practicable. The registrant shall not delay medical care for the patient because of notification problems.
2. Within 15 days following the verbal notification to the Agency, the registrant shall report, in writing, to the Agency and individuals notified under subsection (S)(1). The written report shall include the registrant's name, the referring physician's name, a brief description of the event, the effect on the patient, the action taken to prevent recurrence, whether the registrant informed the patient or the patient's responsible relative or guardian, and if not, why not. The report shall not include the patient's name or other information that could lead to identification of the patient.
3. Each registrant shall maintain records of all medical events for Agency inspection. The records shall:

a. Contain the names of all individuals involved in the event, including:
   i. The physician,
   ii. The allied health personnel,
   iii. The patient,
   iv. The patient's referring physician,
   v. The patient's identification number if one has been assigned,
   vi. A brief description of the event,
   vii. The effect on the patient, and
   viii. The action taken to prevent recurrence.
b. Be maintained for three years beyond the termination date of the affected registration.

**Historical Note**
New Section R12-1-611.01 made by final rulemaking at 20 A.A.R. 811, effective May 3, 2014 (Supp. 14-1).

**R12-1-611.02. Other Use of Electronically-Produced Radiation to Deliver Superficial Therapeutic Radiation Dosage**
A person shall not utilize any device which is designed to electrically generate a source of ionizing radiation to deliver superficial therapeutic radiation dosage, and which is not appropriately regulated under any existing category of therapeutic radiation machine, until:

1. The applicant or registrant has, at a minimum, provided the Agency with:
   a. A detailed description of the device and its intended application or applications;
   b. Facility design requirements, including shielding and access control;
   c. Documentation of appropriate training for authorized user physician or physicians and qualified medical physicist or physicists;
   d. Methodology for measurement of dosages to be administered to patients or human research subjects;
   e. Documentation regarding calibration, maintenance, and repair of the device, as well as instruments and equipment necessary for radiation safety;
   f. Radiation safety precautions and instructions; and
   g. Other information requested by the Agency in its review of the application; and
2. The applicant or registrant has received written approval from the Agency to utilize the device in accordance with the regulations and specific conditions the Agency considers necessary for the medical use of the device; and
3. The applicant or registrant has submitted the application information and forms required by Article 2.
4. In addition to the requirements of this Section, a registrant using a device for x-ray radiation therapy shall meet the requirements of R12-1-611.01(Q), (R), and (S).

**Historical Note**
New Section R12-1-611.02 made by final rulemaking at 20 A.A.R. 811, effective May 3, 2014 (Supp. 14-1).

**R12-1-612. Computed Tomography Systems**

**A.** Definitions:
1. "CT" means computed tomography.
2. "CT conditions of operation" means all selectable parameters governing the operation of a CT including nominal tomographic section thickness, and technique factors.
3. "CTDI" means computed tomography dose index, the integral of the dose profile along a line perpendicular to the tomographic plane divided by the product of the nominal tomographic thickness and the number of tomogram produced in a single scan.
4. "CTDI vol" means a value of a volume-weighted tomography dose index. The unit of the CTDI vol is Gray or subunits of the Gray. The value of the CTDI vol for patient scan is used to trigger a notification when the value exceeds or will exceed a threshold value.
5. "CTN" means CT number, the number used to represent the x-ray attenuation associated with each elemental area of the CT image.
6. "Dose profile" means the dose as a function of position along a line.
7. "DLP" means the dose-length product. The DLP is the mathematical product of the CTDI vol and the length of the scan. The unit DLP is the Gray-cm of subunits of the Gray-cm. The DLP is used to trigger a notification when the value exceeds or will exceed a threshold value.
8. "Elemental area" means the smallest area within a tomogram for which the x-ray attenuation properties of a body are depicted.
9. "Multiple tomogram system" means a CT system that obtains x-ray transmissions data simultaneously during a single scan to produce more than one tomogram.
10. "Nominal tomographic section thickness" means the full width at half-maximum of the sensitivity profile taken at the center of the cross section volume over which x-ray transmission data are collected.
11. "Reference plane" means a plane that is displaced from and parallel to the tomographic plane.
12. "Scan" means the complete process of collecting x-ray transmission data for the production of a tomogram. Data can be collected simultaneously during a single scan for the production of one or more tomograms.

**B.** Facility: A registrant shall ensure that a CT facility has:
1. An operable two-way communication system between the patient and the operator in each CT room.
2. A viewing system that will allow the operator to continuously view the patient from the control panel during each examination. If the viewing system malfunctions the CT shall not be used until the viewing system is repaired.

**C.** Equipment. A registrant shall ensure that:
1. There is a means to terminate x-ray exposure automatically in the event of equipment failure by:
   a. De-energizing the x-ray source, or
   b. Shuttering the x-ray beam.
2. The equipment shall provide the operator the ability to terminate the x-ray exposure at any time during the examination, provided the scan or series of scans is greater than one-half second duration.
   a. If an operator terminates an x-ray exposure, the operator shall reset the CT conditions of operation before the initiation of another scan.
   b. A visible signal shall indicate when an x-ray exposure has been terminated because of equipment failure.
3. A means is provided to permit visual determination of the tomographic plane for a single tomogram system, or the location of a reference plane offset from a single tomograph or multiple tomogram system.
   a. If a light source is used to satisfy this requirement, it shall provide illumination of the tomographic plane or reference plane under ambient light conditions.
   b. The difference between the actual plane location and the indicated location of a tomographic plane or reference plane shall not exceed 5 millimeters.
   c. The deviation of indicated scan increment versus actual increment shall not exceed plus or minus 1 millimeter with any mass from 0 to 100 kilograms resting on the patient support device.

4. The control panel and gantry provides a visual indication, if x-rays are produced.
5. Emergency buttons and switches are marked by function.
6. Parameters of CT operation used during a patient examination are visible to the operator upon initiation of the scan. If an operational parameter is not adjustable by the operator, this subsection may be met by indicating on the control panel the parameter is not adjustable by the operator.
7. Radiation exposure does not exceed 100 mR in one hour at one meter in any direction from the tube port of an operating CT.
8. The angular position or positions where the maximum surface CTDI occurs is identified to allow for reproducible positioning of a CT dosimetry phantom, except in those cases where the x-ray tubes are designed to move, in which case, the maximum dose and associated tube position shall be evaluated according to manufacturer recommendations.

**D.** Operating Procedures. A registrant shall ensure that:
1. Operating procedures are available at the control panel, or by electronic means, regarding the operation of a CT and evaluation of a CT's operation.
2. The operating procedures contain the following information:
   a. A copy of the latest evaluation of the CT's operation, to include output for each CT procedure, performed by a qualified expert;
   b. Instructions on the use of the CT performance phantom by the qualified expert, a schedule of quality control tests with the results of the most recent quality control test, and the allowable variations for the indicated parameters;
   c. The distance in millimeters between the tomographic plane and the reference plane if a reference plane is used; and
   d. A current technique chart that contains the information required in R12-1-607(D)(4)(a) for both adult and pediatric patients, as applicable, is available at the CT operating console, and a procedure for determining whether a CT has been performed according to instructions of a physician.
   e. A written or electronic log that contains the information required in R12-1-607(D)(5) as well as an entry in the record of any displayed values for the exam from either a CTDI vol or DLP measurement for each patient exam completed on equipment manufactured on or after January 1, 2011.
3. If the evaluation of the CT's operation or quality control test identifies a parameter exceeding the tolerance established by a qualified expert, the use of a CT for patient examination is limited to those uses established in written instructions from the qualified expert.

**E.** Quality control tests. A registrant shall have a written quality control test procedure, developed by a qualified expert, and ensure that the quality control test procedure:
1. Incorporates the use of a CT performance phantom that is compatible with an approved accreditation program approved by the Medicare Improvements for Patients and Providers Act (MIPPA) or supplied by or approved for use by the manufacturer of the unit.
2. Is followed in the evaluation of the CT's operation, that the interval between tests does not exceed those set forth in the application for accreditation or quarterly if not accredited by an organization approved by (MIPPA), and that system conditions are specified by the registrant's qualified expert.
3. Includes obtaining quality control test images with the CT performance phantom using the same processing mode and CT conditions of operation that are used to perform the evaluation of the CT's operation.
4. Requires that images obtained under subsection (E)(3) be retained until a new evaluation of the CT's operation is performed.
5. Requires that any Alerts and Notification settings using CTDI vol or DLP are reviewed against preloaded techniques in the system and any missing fields are reviewed with the staff radiologist and noted in the annual report.
6. Requires the quality control test procedure and records of quality control tests performed be maintained for three years for Agency inspection.

**F.** Evaluation of a CT's operation. A registrant shall ensure that:
1. The evaluation of a CT's operation is performed by, or under the direct supervision of, a qualified expert who is physically present at the facility during the evaluation of the CT's operation.
2. The evaluation of a CT's operation:
   a. Is performed before initial patient use and annually (within two months of the annual due date) and after any change or replacement of components that could, in the opinion of the qualified expert, cause a change in radiation output; and
   b. Shall measure the CTDI in a dosimetry phantom along the two axes specified in subsection (F)(4)(b).
   c. A complete evaluation of a CT unit, performed before the annual due date shall clearly list if the new survey changes the annual due date for the unit. It shall be clearly noted on all documentation for the next three years that the survey has established a new annual due date based upon the date of the new survey.
3. The evaluation of a CT's x-ray system is performed with a calibrated dosimetry system that:
   a. Has been calibrated using a method that is traceable to the National Institute of Standards and Technology (NIST), and
   b. Has been calibrated within the preceding two years.
4. CT dosimetry phantoms used in determining radiation output are compatible with an approved accreditation program approved by (MIPPA) or supplied by or approved for use by the manufacturer of the unit; and
   a. Are constructed in a way that the parameters used to image the most commonly imaged parts of the human body are evaluated; and
   b. At a minimum, provide means for placement of a dosimeter along the axis of rotation and along a line parallel to the axis of rotation 1.0 centimeter from the outer surface and within the phantom.
5. Any effects on the measured dose due to the removal of phantom material to accommodate the dosimeter are accounted for in the reported data or included in the statement of maximum deviation for the measured values.

**G.** CT units designated for simulator use, veterinary use, dental use, podiatry use, and non-diagnostic use on humans are exempt from the annual requirements in subsections (E) and (F) provided an initial evaluation is conducted by a qualified expert and the output does not exceed the manufacturers specified limits. The initial evaluation shall be maintained for Agency review.

**Historical Note**

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

Section R12-1-612 repealed, new Section R12-1-612 adopted effective August 8, 1986 (Supp. 86-4). Amended effective January 2, 1996 (Supp. 96-1). 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 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). Amended by final rulemaking at 19 A.A.R. 3882, effective January 4, 2014 (Supp. 13-4).

**R12-1-613. Veterinary Medicine Radiographic Systems**

**A.** Equipment. A registrant shall ensure that:
1. Before January 2, 1996, the total filtration permanently in the useful beam is not less than 1.5 millimeters aluminum-equivalent for equipment operating at up to 70 kVp and 2.0 millimeters aluminum-equivalent for equipment operating in excess of 70 kVp;
2. A device is provided to terminate the exposure after a preset time or exposure;
3. Each radiographic system has a "dead-man" exposure switch with an electrical cord of sufficient length to allow the operator to stand at least 1.82 meters (six feet) away from the useful beam during x-ray exposures.

**B.** Procedures: A registrant shall ensure that:
1. Unless required to restrain an animal, the operator stands at least 1.82 meters (6 feet) away from the useful beam and the animal during a radiographic exposure;
2. An individual other than the operator is not in the x-ray room or area while an exposure is being made, unless the individual's assistance is required;
3. If possible, an animal is held in position during an x-ray exposure using mechanical supporting or restraining devices;
4. An individual holding an animal during an x-ray exposure is:
   a. Wearing protective gloves and an apron of not less than 0.5 millimeter lead equivalent or positioned behind a whole-body protective barrier;
   b. Wearing required personnel monitoring devices; and
   c. Positioned so that no part of the person's body, except hands and arms, will be struck by the useful beam;
5. If an individual holds or supports an animal or a film during an x-ray exposure, the name of the individual is recorded in an x-ray log that contains the animal's name, the type of x-ray procedure, the number of exposures, and the date of the procedure; and
6. As a condition of employment an individual is not required to routinely hold or support animals, or hold film during radiation exposures.

**Historical Note**

Adopted effective June 30, 1977 (Supp. 77-3). Amended subsection (B) effective August 8, 1986 (Supp. 86-4). Amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3).

**R12-1-614. Mammography Systems**

**A.** Equipment. A registrant shall ensure that:
1. Only radiation machines specifically designed for mammographic examinations are used;
2. The film processor used in the registrant's facility is maintained in accordance with the film processor's and film manufacturer's recommendations;
3. Each facility has an image development system onsite unless the Agency has approved an alternate system;
4. If used with screen-film image receptors, and the contribution to filtration made by the compression device is included, the useful beam has a half-value layer between the values of: "measured kVp/100 and measured kVp/100 + L millimeters" of aluminum equivalent, where L = 0.12 for Mo/Mo, L= 0.19 for Mo/Rh, L=0.22 for Rh/Rh, L=0.30 for W/Rh target filtration combinations and L= 0.33 for other target filtration combinations not otherwise specified.
5. The combination of focal spot size, source-to-image distance and magnification produces a radiograph with a resolution of at least 12 line pairs per millimeter at an object-to-image receptor distance of 4.5 centimeters; or the standards in Table 3-3 of the American Association of Physicists in Medicine (AAPM), Report No. 29, Equipment Requirements and Quality Control for Mammography, August 1990, published by the American Institute of Physics, Suite 1NO1, 2 Huntington Quadrangle, Melville, NY 11747 (This report is incorporated by reference and available under R12-1-101. The incorporated material contains no future editions or amendments. The report is available online at: http://www.aapm.org/pubs/reports; print copies may be purchased from Medical Physics Publishing, 4513 Vernon Blvd., Madison, WI 53705; toll free at (800) 442-5778.);
6. The compression device used with the mammographic unit, unless specifically manufactured otherwise, is parallel to the imaging plane, not varying at any spot by more than 1 centimeter;
7. The mammographic x-ray system with initial power drive:
   a. Has compression paddles compatible with each size of image receptor;
   b. Is capable of compressing the breast with a force of at least 25 pounds, but not more than 45 pounds, and maintaining the compression for at least three seconds; and
   c. Is used in a manner so that the chest wall edge of the compression device is aligned just beyond the chest wall edge of the image receptor so that the chest wall edge of the compression device does not appear on the image receptor;
8. A mammographic x-ray system using screen-film image receptors has:
   a. At least two different sizes of moving anti-scatter grids, including one for each size of image receptor utilized; and
   b. Automatic exposure control;
9. All mammographic x-ray systems indicate or provide a means of determining, the mAs resulting from each exposure made with automatic exposure control;
10. The collimation provided limits the useful beam to the image receptor so that the beam does not extend beyond any edge of the image receptor at any designated source to image receptor distance by more than 2 percent of the source to image receptor distance;
11. The accuracy of the indicated kVp is within plus or minus 2kVp;
12. Mammographic x-ray systems operating with automatic exposure control are capable of maintaining a film density within plus or minus 0.15 optical density units over the clinical range of kVp used, for a breast having an equivalent phantom thickness from 2 to 6 centimeters. If a technique chart is used, the operator shall maintain the

film density within plus or minus 0.15 optical density units of the mean optical density.

13. At a kVp of 28, the mammographic x-ray system is capable of generating at least 2.0 µC/kg/mAs (8mR/mAs) and at least 200 µC/kg/second (800 mR/second), measured at a point 4.5 centimeters above the surface of the patient support device when the Source-image receptor distance is at its maximum;
14. Screens are not used for mammography if one or more areas of greater than 1 centimeter squared of poor screen-film contact are seen when tested, using a 40 mesh screen test;
15. Mammographic image quality meets the minimum mammography film standards for phantom performance in Mammography Quality Control Manual, 1999 edition, published by the American College of Radiology (ACR). (This manual is incorporated by reference and available under R12-1-101. The incorporated material contains no future editions or amendments. The manual is available from ACR Publication Sales, P.O. Box 533, Annapolis Junction, MD 20701: toll free at (800) 227-7762; e-mail at: acr@brightkey.net).
16. The mean glandular dose for one cranio-caudal view of a 4.2 centimeter (1.8 inch) compressed breast, composed of 50 percent adipose and 50 percent glandular tissue, does not exceed 300 millirads (3 milligray); and
17. A radiologic physicist who meets the requirements in R12-1-615(A)(1)(c) evaluates the operation of a mammographic x-ray system:
    a. When first installed and annually thereafter,
    b. Following any major change in equipment or replacement of parts, and
    c. When quality assurance tests indicate calibration is necessary.

**B.** Operating Procedures. A registrant shall ensure that:

1. Each mammographic facility has a quality assurance program, and that the quality assurance program includes performance and documentation of the quality control tests in subsection (B)(2), conducted at the required time intervals. Test results shall fall within the specified limits in subsection (B)(2) or the registrant shall take corrective action and maintain documentation that the results are within specified limits before performing or processing any further examinations using the system that failed. A radiologic physicist, as defined in R12-1-615(A)(1)(c), shall review the program and make any recommendations necessary for the facility to comply with this Section;
2. The quality assurance program meets federal requirements (Contained in 21 CFR 900.12(d)(1), and (e)(1) through (e)(10), revised April 1, 2013, incorporated by reference and available under R12-1-101. This incorporated material contains no future editions or amendments.); or the following requirements:
    a. Daily sensitometric and densitometric evaluation of the image processing system demonstrates that Base + Fog < +0.03 optical density of operating level, Mid Density ± 0.15 optical density of operating level, and Density Difference ± 0.15 optical density of operating level;
    b. Weekly phantom image quality evaluations demonstrate the visualization of at least four fibers, three speck groups, and three masses with a background of greater than 1.40 optical density, not varying by 0.20 optical density of operating level;
    c. Monthly technique chart evaluations demonstrate updates for all equipment changes and that all examinations are being performed according to a physicist's density control recommendation;
    d. Quarterly fixer retention evaluations demonstrate an acceptable limit of less than or equal to 5.0 micrograms per square centimeter;
    e. Quarterly repeat analysis demonstrates an acceptable limit of less than 2 percent increase in repeats;
    f. Semiannual darkroom fog evaluations meet the limit of less than or equal to 0.05 optical density of fog, using the two minute exposed film method;
    g. Semiannual screen film contact evaluations meet the limit of less than one area of poor contact of 1 centimeter squared, using a 40 mesh screen on all clinically-used screens;
    h. Semiannual automatic compression force evaluations meet the limit of greater than or equal to 25 pounds (111 Newtons) and less than 45 pounds (200 Newtons);
    i. A survey shall be conducted annually and whenever indicated for installation, major repairs, parts replacement, or as deemed necessary by a qualified expert when quality control test results indicate a survey is necessary; the survey shall include all of the following tests:
        i. Automatic exposure control performance and thickness response;
        ii. Accuracy and reproducibility of kVp;
        iii. System resolution;
        iv. Breast entrance air kerma and automatic exposure control reproducibility;
        v. Average glandular dose;
        vi. X-ray field, light field, and image receptor alignment;
        vii. Compression paddle alignment;
        viii. Uniformity of screen speed;
        ix. System artifacts;
        x. Radiation output;
        xi. Decompression;
        xii. Beam quality and half value layer;
    j. For systems with image receptor modalities other than screen film:
        i. The quality assurance and quality control program for the acquisition system meets or exceeds the recommendations by the manufacturer; and
        ii. The quality assurance and quality control program for the printer meets or exceeds the recommendations by the image receptor manufacturer. In the absence of recommendations by the image receptor manufacturer for the specified printer, the quality control and assurance program meets or exceeds the recommendations of the printer manufacturer; and
        iii. The quality assurance and quality control program for the interpretation monitors meets or exceeds the recommendations by the image receptor manufacturer. In the absence of recommendations by the image receptor manufacturer for the specified monitor or monitors, the quality control and assurance program meets or exceeds the recommendations of the interpretation monitor or monitors manufacturer; and
    k. The registrant maintains records documenting compliance with the provisions in this subsection for three years from the date each requirement is met.

The records shall be made available for Agency inspection.

**C.** Mammographic films and reports.

1. A registrant shall maintain films and reports for a minimum of five years. In those cases where no subsequent mammographic procedures are performed, the registrant shall maintain films and associated reports for 10 years. If the mammographic facility is closed, the registrant shall make arrangements for storage of the films and associated reports for five years after the closure; and
2. A registrant shall make films and reports available for comparison upon request for temporary or permanent transfer to other mammographic facilities.

**Historical Note**

Adopted effective January 2, 1996 (Supp. 96-1). Amended effective June 13, 1997 (Supp. 97-2). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). 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). Amended by final rulemaking at 19 A.A.R. 3882, effective January 4, 2014 (Supp. 13-4).

**R12-1-615. Mammography Personnel**

**A.** Personnel.

1. Each registrant shall require personnel who perform mammography, which includes the production, processing, and interpretation of mammograms and related quality assurance activities, to meet the following requirements:
   a. An interpreting physician shall meet federal requirements (Contained in 21 CFR 900.12(a)(1), revised April 1, 2013, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.); or
      i. Be licensed under A.R.S. Title 32, Chapters 13 or 17;
      ii. Have initially completed 40 hours of medical education credits in mammography;
      iii. Be certified by the American Board of Radiology or the American Osteopathic Board of Radiology or meet the requirements of the mammography quality standards act regulations for quality standards of interpreting physicians;
      iv. Have interpreted or reviewed an average of 300 mammograms per year during the preceding two years or have completed a radiology residency that included mammogram image interpretation in the preceding two years;
      v. Have completed 15 hours of continuing medical education credits in mammography during the preceding three years; and
      vi. Have received at least eight hours of training specific to each mammographic modality before engaging in independent interpretation.
   b. A mammographic technologist shall meet federal requirements (Contained in 21 CFR 900.12(a)(2), revised April 1, 2013, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.); or
      i. Possess a valid mammographic technologist certificate issued by the Medical Radiologic Technology Board of Examiners, as required in A.R.S. § 32-2841, or be pursuing mammography certification by training under the direct supervision of a technologist who possesses a valid mammographic technologist certificate;
      ii. Have performed at least 200 mammographic examinations in the preceding two years;
      iii. Have completed 15 hours of continuing medical education credits in mammography during the preceding three years; and
      iv. Have received at least eight hours of training specific to each mammographic modality to be used by the technologist in performing mammographic examinations.
   c. A radiologic physicist shall meet federal requirements (Contained in 21 CFR 900.12(a)(3), revised April 1, 2013, incorporated by reference and available under R12-1-101. This incorporated material contains no future editions or amendments.); or
      i. Be certified by the American Board of Radiology, American Board of Medical Physics, or the American Board of Health Physics;
      ii. Possess documentation of state approval;
      iii. Hold a master's degree or higher in a physical science;
      iv. Have, upon initial employment as a radiologic physicist, experience conducting, at least one mammographic facility survey and evaluating at least 10 mammographic units;
      v. Have, after completing the experience requirements in subsection (A)(1)(c)(iv), continuing experience surveying two mammographic facilities and evaluating six mammographic units during the preceding two years;
      vi. Have completed 15 hours of continuing medical education credits in mammography during the three preceding years;
      vii. Have received at least eight hours of training specific to any modality surveyed; and
2. Each registrant shall maintain records documenting the requirements in subsection (A)(1) for three years from the date the requirement is met and make the records available for Agency inspection.

**B.** Radiologic physicists shall apply for and renew their certification on agency approved forms. In addition to Agency supplied forms, applicants must also submit documentation showing education, mammography specific training, education, and board certification. Upon renewal, an applicant must submit documentation showing current continuing education requirements are met.

**Historical Note**

Adopted effective January 2, 1996 (Supp. 96-1). Section repealed by final rulemaking at 9 A.A.C. 4302, effective November 14, 2003 (Supp. 03-3). New Section R12-1-615 made by final rulemaking at 19 A.A.R. 3882, effective January 4, 2014 (Supp. 13-4).

**Appendix A. Information Submitted to the Agency According to R12-1-604(A)(3)(c)**

**A.** Name and address of the applicant and, if applicable, the name and address of any person within this state that is authorized to act on behalf of the applicant;

**B.** Disease or conditions to be diagnosed using the proposed x-ray examination;

**C.** A detailed description of each x-ray examination that will be used in the diagnosis;

**D.** A description of the population to be examined in the screening program, using characteristics such as age, sex, physical condition, and other descriptive information;
**E.** An evaluation of any known alternative diagnostic modalities not involving ionizing radiation that could achieve the same diagnosis as a screening program and why these modalities have not been chosen;
**F.** An evaluation by a qualified expert of the x-ray equipment used in the screening program, which demonstrates that the x-ray equipment satisfies the requirements of this Article.
**G.** A description of the quality control program;
**H.** A copy of the technique chart for the planned x-ray examination;
**I.** The qualifications of each individual who will be operating the x-ray equipment;
**J.** The qualifications of the individual who will be supervising each operator of the x-ray equipment;
**K.** The name and address of the individual who will interpret each radiographic image;
**L.** A description of the planned procedures for advising a screened individual and the screened individual's physician of the screening procedure results, and the need for further medical care, and
**M.** A description of the procedures for retention or disposition of the radiographic images and other records pertaining to the x-ray examination.

**Historical Note**
Adopted effective January 2, 1996 (Supp. 96-1).
Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3).

**Appendix B. Repealed**

**Historical Note**
Adopted effective January 2, 1996 (Supp. 96-1). Section repealed by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3).

## 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).
**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(E) for the specified in vitro uses without filing Form ARRA-9 as required by R12-1-306(E)(2); provided, that the licensee is subject to the other provisions of R12-1-306(E).

**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). Amended by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

**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 appli-

cable, 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.

**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 recog-

nized, 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 Post-doctoral 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 stereotac-

tic 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.

**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 breastfeeding 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 8. RADIATION SAFETY REQUIREMENTS FOR ANALYTICAL X-RAY OPERATIONS

**R12-1-801. Scope**

The rules in this Article establish requirements for the use of analytical x-ray equipment by persons registered under R12-1-204. The provisions of this Article supplement other applicable provisions of this Chapter.

**Historical Note**

Former Rule Section H.1; Former Section R12-1-801

repealed, new Section R12-1-801 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). Amended by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-802. Definitions**

"Analytical x-ray equipment" means devices or machines 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.

"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 is precluded during operation except through bypassing of interlocks or other safety devices to perform maintenance or servicing.

"Fail-safe characteristic" 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.

"Local component" means part of an analytical x-ray system and includes each area that is struck by x-rays, such as radiation source housings, port and shutter assemblies, collimators, sample holders, cameras, goniometers, detectors and shielding, but does not include power supplies, transformers, amplifiers, readout devices, and control panels.

"Normal operating procedures" means instructions or procedures including, but not limited to, sample insertion and manipulation, equipment alignment, routine maintenance by the registrant, and data recording procedures which are related to radiation safety.

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

"Primary beam" means radiation which passes through an aperture of the source housing on a direct path from the x-ray tube.

**Historical Note**

Former Rule Section H.2; Former Section R12-1-802 repealed, new Section R12-1-802 adopted effective June 30, 1977 (Supp. 77-3). Amended effective Aug. 8, 1986 (Supp. 86-4). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2).

**R12-1-803. Enclosed-beam X-ray Systems**

**A.** Enclosed beam x-ray systems are exempt from other equipment requirements contained in this Article provided the enclosed beam x-ray systems are designed and constructed so that radiation levels measured at 5 cm from any accessible surface of the enclosure housing the x-ray source do not exceed 5 μSv (0.5 mrem) in one hour.

**B.** A registrant using enclosed beam x-ray systems shall comply with applicable provisions of R12-1-804(A), R12-1-805(B), and 12 A.A.C. 1, Article 4.

**C.** A person who maintains or services analytical x-ray systems, shall:

1. Obtain permission in advance from the radiation safety officer before bypassing interlocks or other safety devices,
2. Label equipment as "out of service" until maintenance or service is completed,
3. Wear extremity personnel monitoring devices, and
4. Ensure that interlocks or other safety devices are operating upon completion of maintenance or service.

**Historical Note**

Former Rule Section H.3; Former Section R12-1-803 repealed, new Section R12-1-803 adopted effective June 30, 1977 (Supp. 77-3). Former Section R12-1-803 repealed, new Section R12-1-803 adopted effective Aug. 8, 1986 (Supp. 86-4). 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).

**R12-1-804. Open-beam X-ray Systems**

**A.** A registrant shall label open beam x-ray systems with a readily discernible sign or signs bearing the radiation symbol and the words:

1. "CAUTION -- HIGH INTENSITY X-RAY BEAM," or a similar warning, on the x-ray source housing; and
2. "CAUTION RADIATION -- THIS EQUIPMENT PRODUCES RADIATION WHEN ENERGIZED" or a similar warning, near any switch that energizes an x-ray tube if the radiation source is an x-ray tube.

**B.** A registrant shall ensure that an open beam x-ray system has all of the following warning devices:

1. X-ray tube status (On-Off) indicator in systems where the primary beam is controlled in this fashion;
2. Shutter status (Open-Closed) indicators near each port on the radiation housing for systems which control the primary beam; and
3. A clearly visible warning light labeled with the words "X-RAY ON," or a similar warning located near any switch that energizes an x-ray tube, illuminated only when the tube is energized; and
4. The warning devices in subsections (B)(1) through (3) shall be labeled so that their purpose is easily identified.

**C.** A registrant shall ensure that any apparatus utilized in beam alignment procedures is designed in such a way that excessive radiation will not strike the operator. Particular attention shall be given to viewing devices, in order to ascertain that lenses and other transparent components attenuate the beam to an acceptable level.

**D.** A registrant shall provide an interlock device which prevents entry of any portion of an individual's body into the primary beam or causes the primary beam to be shut off upon entry into its path on all open-beam x-ray systems. A registrant may apply to the Agency for an exemption from the requirements of a safety device. An application for exemption shall include:

1. A description of the various safety devices that have been evaluated;
2. The reason each device cannot be used; and
3. A description of the alternative methods that will be used to minimize accidental exposure, including procedures to assure that operators and others in the area will be informed of the absence of safety devices.

**E.** A registrant shall use only systems constructed so that:

1. Each x-ray tube housing is equipped with an interlock that automatically shuts off the tube if the tube is removed from the radiation source housing or the housing is disassembled; and
2. With all shutters closed, radiation measured at a distance of 5 centimeters from the surface of the system is not capable of producing a dose that exceeds 25 Sv (2.5 mRem) in one hour for the specified tube rating of the x-ray tube.

**F.** A registrant shall supply each x-ray generating system with a protective cabinet that limits leakage radiation measured at a distance of 5 cm (2 in) from the cabinet surface, so that the system is not capable of producing a dose equivalent that exceeds 25 μSv (2.5 mrem) in one hour.

**G.** A registrant shall ensure that the local components of an analytical x-ray system are located and arranged and have sufficient shielding or access control for the specified tube rating to prevent the radiation level in any area adjacent to the local component group from exceeding the dose limits in R12-1-416.

**H.** A registrant shall perform a radiation survey of the local component group of each analytical x-ray system to demonstrate compliance with subsection (G) upon:
1. Installation,
2. Change in configuration, or
3. Maintenance that affects the radiation level in any area adjacent to the local component group.

**I.** A registrant shall maintain a record of each survey for three years or until the analytical x-ray system is no longer used, whichever period is shorter.

**Historical Note**
Former Rule Section H.4; Former Section R12-1-804 repealed, new Section R12-1-804 adopted effective June 30, 1977 (Supp. 77-3). Former Section R12-1-804 renumbered as Section R12-1-805 without change, new Section R12-1-804 adopted effective Aug. 8, 1986 (Supp. 86-4). 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).

**R12-1-805. Administrative Responsibilities**

**A.** A registrant shall designate a radiation safety officer who shall:
1. Establish and maintain operational procedures so that the radiation exposure of each worker is kept ALARA;
2. Instruct all personnel who work with or near radiation producing machines in safety practices;
3. Maintain a system of personnel monitoring;
4. Establish radiation control areas, including placement of appropriate radiation warning signs or devices;
5. Provide a radiation safety inspection of radiation producing machines on a routine basis;
6. Review modifications to x-ray systems, including x-ray tube housing, cameras, diffractometers, shielding, and safety interlocks;
7. Investigate and report proper authorities any case of excessive exposure to personnel and take remedial action; and,
8. Be familiar with all applicable rules for control of ionizing radiation.

**B.** An individual shall not be permitted to operate or maintain an open beam analytical x-ray system unless the individual has received instruction in and demonstrated competence in all of the following:
1. Identification of radiation hazards associated with the use of the equipment;
2. Significance of all radiation warning and safety devices, interlocks incorporated into the equipment, or the reasons that devices or interlocks have not been installed on certain pieces of equipment and the extra precautions required in lieu of these precautions;
3. Proper operating procedures for the equipment;
4. Recognition of symptoms of acute localized radiation exposure; and
5. Proper procedure for reporting an actual or suspected exposure.

**C.** A registrant shall maintain records of instruction and competence for Agency inspection for three years from the date of course completion or demonstration.

**Historical Note**
Adopted effective June 30, 1977 (Supp. 77-3). Former Section R12-1-805 renumbered as Section R12-1-806 without change. Former Section R12-1-804 renumbered as Section R12-1-805 without change effective Aug. 8, 1986 (Supp. 86-4). 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).

**R12-1-806. Operating Requirements**

**A.** A radiation safety officer shall establish written emergency procedures and post the procedures in a conspicuous location. The procedures shall include the telephone number of the radiation safety officer.

**B.** A registrant shall ensure that written operating procedures are available for all analytical x-ray equipment workers. An individual shall not operate analytical x-ray equipment in any manner other than that specified in the procedures unless the individual obtains the radiation safety officer's written approval.

**C.** An individual shall not bypass a safety device or interlock unless the individual has obtained Radiation Safety Officer approval. The approval shall be for a specific period of time. When a safety device or interlock has been bypassed, the Radiation Safety Officer shall place a readily discernible sign on the radiation source housing, warning the reader of the unsafe condition. A registrant shall maintain the written record of the bypass approval for three years after the approval expires.

**D.** Except as authorized in subsection (C), an individual shall not perform an operation involving removal of covers, shielding materials, or tube housings or modification of shutters, collimators, or beam stops without ascertaining that the tube is off and that it will remain off until all protective devices have been restored to the normal operating condition. An individual repairing analytical x-ray equipment shall use the main switch, rather than interlocks, for routine shutdown in preparation for repairs.

**E.** A registrant shall ensure that unused ports on radiation source housings are closed and secured against unauthorized access to the radiation source.

**F.** Finger or wrist personnel monitoring devices shall be used by:
1. Operators of open beam analytical x-ray equipment not equipped with a safety device; and
2. Personnel performing maintenance procedures that require the presence of a primary x-ray beam when any local component is disassembled or removed.

**G.** A registrant shall ensure that each safety and warning device is tested for proper operation at intervals that do not exceed one month and maintain a record of each test for three years from the date the test is completed.

**Historical Note**
Former Section R12-1-805 renumbered as Section R12-1-806 without change effective Aug. 8, 1986 (Supp. 86-4). 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).

**R12-1-807. Surveys**

**A.** To ensure that personnel exposure does not result in a dose to an individual that exceeds the dose limits specified in Article 4, a registrant shall perform a radiation survey upon:
1. Installation of the equipment and at least once each year after installation;

2. Change in the initial arrangement, number, or type of local components in the system;
3. Maintenance that involves disassembly or removal of a local component in the system;
4. Maintenance that involves alignment, if alignment requires the generation of the primary x-ray beam while any local component of the system is disassembled or removed;
5. A visual inspection of the local components in the system that reveals an abnormal condition; or
6. Determination that personnel are being exposed to radiation in excess of established levels recorded in monitoring records for personnel during previous monitoring periods or the occupational dose limits specified in Article 4.

**B.** The radiation surveys in subsection (A) are not required if the registrant demonstrates that the local components of an analytical x-ray system are located and arranged, and have sufficient shielding or access control, to limit personnel exposure to a level that is ALARA and below the occupational dose limits in Article 4. The Agency shall determine ALARA radiation levels based on the specified x-ray tube rating.

**Historical Note**
New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-808. Posting**
A registrant shall conspicuously post each area or room that contains analytical x-ray equipment with a sign or signs that bear the radiation symbol and the words "CAUTION – X-RAY EQUIPMENT" or words with a similar meaning.

**Historical Note**
New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-809. Training**
A registrant shall not be allow an individual to operate or maintain analytical x-ray equipment unless the individual has received training and demonstrated competence in:

1. Identifying radiation hazards associated with use of the equipment;
2. Recognizing and using radiation warning and safety devices, including interlocks that are incorporated into the equipment, and understanding why these devices are sometimes not installed;
3. Taking precautions associated with use of the equipment;
4. Recognizing symptoms of an acute localized exposure; and
5. Following proper procedure for reporting a suspected personnel exposure.

**Historical Note**
New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

## ARTICLE 9. PARTICLE ACCELERATORS

**R12-1-901. Purpose and Scope**

**A.** This Article establishes procedures and requirements for the registration and the use of particle accelerators.

**B.** In addition to the requirements of this Article, all registrants are subject to the requirements of Articles 1, 2, 4 and 10. Registrants engaged in industrial radiographic operations are subject to the requirements of Article 11, and registrants engaged in the healing arts are subject to the requirements of Article 6 of this Chapter. Registrants using a particle accelerator for the production of radioactive material are subject to the requirements of Article 3, and if the radioactive material is used for medical purposes, Article 7.

**Historical Note**
Former Rule Section I.1; Former Section R12-1-901 repealed, new Section R12-1-901 adopted effective June 30, 1977 (Supp. 77-3). Amended effective June 13, 1997 (Supp. 97-2). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). Amended by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

**R12-1-902. Definitions**
The following definitions apply in this Article, unless the context otherwise requires:

"Added filter" (See Article 6)

"Arc therapy" means radiation therapy that uses electrons to treat large, superficial volumes that follow curved surfaces, as in postmastectomy patients.

"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.

"Beam-limiting device" (See Article 6)

"Beam-monitoring system" means a system of devices that will monitor the useful beam during irradiation and terminate irradiation when a preselected number of monitor units has been accumulated.

"Control panel" (See Article 6)

"Full beam detector" means a radiation detector of such size that the total cross section of the maximum size useful beam is intercepted.

"Gantry" means that part of a linear accelerator that supports the radiation source so that it can rotate about a horizontal axis.

"Interlock" (See Article 1)

"Isocenter" means the point of intersection of the collimator axis and the axis of rotation of the gantry.

"Monitor unit" means a unit response from the beam monitoring system from which the absorbed dose can be calculated.

"Moving beam therapy" means radiation therapy in which there is displacement of the useful beam relative to the patient. Moving beam therapy includes arc therapy, skip therapy, and rotational beam therapy.

"Rotational beam therapy" means radiation therapy that is administered to a patient from a radiation source that rotates around the patient's body or the patient is rotated while the beam is held fixed.

"Skip therapy" means rotational beam therapy that is administered in a way that maximizes the dose to an area of interest and minimizes the dose to surrounding healthy tissue.

"Spot check" (See Article 6)

"Stationary beam therapy" means radiation therapy that involves a beam from a radiation source that is aimed at the patient from different directions. The distance of the source from the isocenter remains constant irrespective of the beam direction.

"Virtual source" means a point from which radiation appears to originate.

**Historical Note**

Former Rule Section I.2; Former Section R12-1-902 repealed, new Section R12-1-902 adopted effective June 30, 1977 (Supp. 77-3). Amended effective June 13, 1997 (Supp. 97-2). Section repealed by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). New Section made by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

**R12-1-903. General Registration Requirements**

**A.** The requirements in this Section supplement the registration requirements in 12 A.A.C. 1, Article 2.

**B.** The Agency shall approve a registration application for use of a particle accelerator only if the Agency determines that:
1. The applicant is qualified by training and experience to use the accelerator for the purpose in the application submitted to the Agency under Article 2;
2. The applicant's proposed equipment, facilities, and operating and emergency procedures are adequate to protect public health;
3. The applicant satisfies any other applicable l requirements in this Section; and 4.The applicant has appointed a radiation safety officer.

**Historical Note**

Former Rule Section I.3; Former Section R12-1-903 repealed, new Section R12-1-903 adopted effective June 30, 1977 (Supp. 77-3). Amended effective Aug. 8, 1986 (Supp. 86-4). 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 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3).

**R12-1-904. Registration of Particle Accelerators Used in the Practice of Medicine**

**A.** The requirements in this Section supplement the registration requirements in R12-1-903.

**B.** An applicant that is a "medical institution," as defined in 12 A.A.C. 1, Article 7, and performing human research shall appoint a radiation safety committee that meets the following requirements:
1. The committee shall consist of at least four individuals and shall include:
   a. An authorized user of each type of use permitted by the registration,
   b. The Radiation Safety Officer,
   c. A representative of the nursing service, and
   d. A representative of management who is neither an authorized user nor a Radiation Safety Officer, and
   e. Any other members the registrant selects;
2. The committee shall meet at least once in each 12-month period, unless otherwise specified by registration condition;
3. To conduct business at least 50 percent of the membership of the committee shall be present including the Radiation Safety Officer and the management representative;
4. The minutes of each radiation safety committee meeting shall include a reference of any discussion or documents related to the review required in R12-1-407(C);
5. Review the radiation safety program for all sources of radiation as required in R12-1-407(C);
6. Establish a table that contains investigational levels for occupational and public dose that, when exceeded, will initiate an investigation and consideration of actions by the Radiation Safety Officer; and
7. Establish the safety objectives of the quality management program required by subsection (E).

**C.** The applicant shall ensure that an individual designated as an authorized user is an Arizona licensed physician; approved by the radiation safety committee, if applicable; and is:
1. Certified in:
   a. Radiology, therapeutic radiology, or radiation oncology by the American Board of Radiology; or
   b. Radiation oncology by the American Osteopathic Board of Radiology; or
   c. Radiology, with specialization in radiotherapy, as a British "Fellow of the Faculty of Radiology" or "Fellow of the Royal College of Radiology"; or
   d. Therapeutic radiology by the Canadian Royal College of Physicians and Surgeons; or
2. Engaged in the active practice of therapeutic radiology, and has completed 200 hours of instruction in basic techniques applicable to the use of a particle accelerator, 500 hours of supervised work experience, and a minimum of three years of supervised clinical experience.
   a. To satisfy the requirement for instruction, the classroom and laboratory training shall include all of the following subjects.
      i. Radiation physics and instrumentation,
      ii. Radiation protection,
      iii. Mathematics pertaining to the use and measurement of radiotherapy, and
      iv. Radiation biology.
   b. To satisfy the requirement for supervised work experience, training shall occur under the supervision of an authorized user at a medical institution and shall include:
      i. Reviewing full calibration measurements and periodic spot checks,
      ii. Preparing treatment plans and calculating treatment times,
      iii. Using administrative controls to prevent misadministration,
      iv. Implementing emergency procedures to be followed in the event of the abnormal operation of a particle accelerator, and
      v. Checking and using survey meters.
   c. To satisfy the requirement for a period of supervised clinical experience, training shall include one year in a formal training program approved by the Residency Review Committee for Radiology of the Accreditation Council for Graduate Medical Education or the Committee on Postdoctoral Training of the American Osteopathic Association and an additional two years of clinical experience in therapeutic radiology under the supervision of an authorized user at a medical institution. The supervised clinical experience shall include:
      i. Examining individuals and reviewing their case histories to determine their suitability for treatment, noting any limitations or contraindications;
      ii. Selecting the proper dose and how it is to be administered;
      iii. Calculating the therapy doses and collaborating with the authorized user in the review of patients' or human research subjects' progress

and consideration of the need to modify originally prescribed doses, as warranted by patients' or human research subjects' reaction to radiation; and

iv. Post-administration follow up and review of case histories.

**D.** With the application the applicant shall provide the name of each authorized user to the Agency so the names can be listed on the registration form, and so that the Agency can determine whether the authorized user's training and experience satisfies the requirements in subsection (C).

**E.** Each registrant shall establish and maintain a written quality management program to provide high confidence that the radiation produced by the particle accelerator will be administered as directed by an authorized user. The quality management program shall include, at minimum, the tests and checks listed in Appendix A.

**F.** Each registrant shall ensure that a particle accelerator is calibrated by an authorized medical physicist who meets the training and experience qualifications in R12-1-711.

**G.** At the time of application for registration or when a therapy program is expanded to multiple sites, each applicant or registrant shall provide the Agency with a description of the quality management program, a listing of the professional staff assigned to the facility, and the expected ratio of patient workload to staff member for programs involving multiple therapy sites. If the staffing ratio exceeds the recommended levels in Radiation Oncology in Integrated Cancer Management, Report of the Inter-Society Council for Radiation Oncology, December 1991, the applicant shall provide to the Agency for approval the justification for the larger ratio and the safety considerations that have been addressed in establishing the program. This report is incorporated by reference and available under R12-1-101. The incorporated material contains no future editions or amendments. The report is available from the American Association of Physicists in Medicine: online at http://www.aapm.org/pubs/reports; print copies may be purchased from Medical Physics Publishing, 4513 Vernon Blvd., Madison, WI 53705; toll free at (800) 442-5778.

**Historical Note**

Former Rule Section I.4; Former Section R12-1-904 repealed, new Section R12-1-904 adopted effective June 30, 1977 (Supp. 77-3). Amended effective Aug. 8, 1986 (Supp. 86-4). 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. 4302, effective November 14, 2003 (Supp. 03-3). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

**R12-1-905. Medical Particle Accelerator Equipment, Facility and Shielding, and Spot Checks**

**A.** Equipment

1. Leakage radiation
   a. X-ray leakage radiation from the source housing assembly shall not exceed 0.1 percent of the maximum dose equivalent rate of the unattenuated useful beam.
   b. Neutron leakage radiation from the source housing assembly shall not exceed 0.5 percent of the maximum dose equivalent rate of the unattenuated useful beam.
   c. Leakage radiation measurements made at any point 1 meter from the path of the charged particle between its point of origin and the target, window or scattering foil shall meet the requirements of subsection (A)(1)(a) and (b) when computed as a percentage of the dose rate equivalent of the unattenuated useful beam measured at 1 meter from the virtual source. Leakage radiation measurements at each point shall be averaged over an area up to but not exceeding 100 square centimeters (15.5 square inches).
   d. The registrant shall maintain, for inspection by the Agency, records that show leakage radiation measurements for the life of the operation.
2. Beam limiting devices (not to include blocks or wedges). Adjustable or interchangeable beam limiting devices shall be provided and shall transmit no more than 2 percent of the useful beam for the portion of the useful beam that is to be attenuated by the beam limiting device. The neutron component of the useful beam shall not be included in this requirement. Measurements shall be averaged over an area up to but not exceeding 100 square centimeters (15.5 square inches) at the normal treatment distance.
3. Filters. The following requirements apply to systems that use a system of wedge filters, interchangeable field flattening filters, or interchangeable beam scattering filters:
   a. Irradiation shall not be possible until a selection of a filter has been made at the treatment control panel;
   b. An interlock system shall be provided to prevent irradiation if the filter selected is not in the correct position;
   c. An indication of the wedge filter orientation with respect to the treatment field shall be provided at the control panel, by direct observation, or by electronic means, when wedge filters are used;
   d. A display shall be provided at the treatment control panel showing the filter or filters in use;
   e. Each filter that is removable from the system shall be clearly identified as to that filter's material of construction, thickness, and the nominal wedge angle for wedge filters, or a record tracing these factors for each filter shall be maintained at the system console; and
   f. An interlock shall be provided to prevent irradiation if any filter selection operation carried out in the treatment room does not agree with the filter selection operation carried out at the treatment control panel.
4. Beam monitor. Equipment installed after the effective date of this Section shall be provided with at least one radiation detector in the radiation head. This detector shall be incorporated into a primary system so that all of the following criteria are met:
   a. Each primary system shall have a detector that is a transmission detector and a full beam detector and that is placed on the patient side of any fixed added filters other than a wedge filter;
   b. The detectors shall be removable only with tools and shall be interlocked to prevent incorrect positioning;
   c. Each detector shall be capable of independently monitoring and controlling the useful beam;
   d. Each detector shall form part of a dose-monitoring system from which the absorbed dose can be calculated at a reference point in the treatment volume;
   e. Each dose monitoring system shall have a legible display at the treatment control panel that:
      i. Maintains a reading until intentionally reset to zero;

ii. Has only one scale and no scale multiplying factors in replacement equipment; and
iii. Utilizes a design such that increasing dose is displayed by increasing numbers and is designed so that, in the event of an overdosage of radiation, the absorbed dose may be accurately determined under all nominal conditions of use or foreseeable failures;

f. In the event of power failure, the dose monitoring information required in subsection (A)(4) displayed at the control panel at the time of failure shall be retrievable in at least one system; and

g. Selection and display of dose monitor units;
i. Irradiation shall not be possible until a selection of dose monitor units has been made at the treatment control panel.
ii. Each primary system shall terminate irradiation when the preselected number of dose monitor units has been detected by the system.
iii. Each secondary system shall terminate irradiation when 110 percent of the preselected number of dose monitor units has been detected by the system.
iv. It shall be possible to interrupt irradiation and equipment movements at any time from the operator's position at the treatment control panel. Following an interruption, it shall be possible to restart irradiation by operator action without any reselection of operating conditions. If any change is made of a preselected value during an interruption the equipment shall go to termination condition.
v. It shall be possible to terminate irradiation and equipment movements, or go from an interruption condition to termination conditions at any time from the operator's position at the treatment control panel.

5. Beam monitoring system. All accelerator systems shall be provided with a beam monitoring system in the radiation head capable of monitoring and terminating irradiation.
a. Each beam monitoring system shall have a display at the treatment control panel that registers the accumulated monitor units.
b. The beam monitoring system shall terminate irradiation if the preselected number of monitor units has been detected by the system.
c. For units with a secondary beam monitoring system, the primary beam monitoring system shall terminate irradiation if the preselected number of monitor units has been detected. The secondary beam monitoring system shall terminate irradiation if the primary system fails.
d. In the event of a power failure, the display information required in subsection (A)(5)(a) shall be retained in at least one system following the power failure.
e. An interlock device shall prevent irradiation if any beam monitoring system is inoperable.
f. For purposes of this rule:
i. "Beam monitoring system" means a system of devices that will monitor the useful beam during irradiation and will terminate irradiation if a preselected number of monitor units is accumulated.
ii. "Monitor unit" means a unit response from the beam monitoring system from which the absorbed dose can be calculated.

6. Treatment beam mode selection. In equipment capable of both x-ray and electron therapy:
a. Irradiation shall not be possible until a selection of radiation type is made at the treatment control panel;
b. An interlock system shall be provided to prevent irradiation if any selected operations carried out in the treatment room do not agree with the selected operations indicated at the treatment control panel;
c. An interlock system shall be available and in operating condition on a therapy machine, and shall be used to prevent unwanted x-ray or electron irradiation when preparing for, or performing radiation therapy procedures. The interlock system need not be available for use, if the therapy machine is only used to make an image of an inanimate object; and
d. The radiation type selected shall be displayed at the treatment control panel before and during irradiation.

7. Treatment beam energy selection. Equipment capable of generating radiation beams of different energies shall meet all of the following requirements:
a. Irradiation shall not be possible until a selection of energy is made at the treatment control panel;
b. An interlock system shall be provided to ensure that the equipment can emit only the energy of radiation that is selected;
c. An interlock system shall be provided to prevent irradiation if any selected operations carried out in the treatment room do not agree with the selected operations indicated at the treatment control panel; and
d. The energy selected shall be displayed at the treatment control panel before and during irradiation.

8. Selection of stationary or moving beam therapy. Equipment capable of both stationary and moving beam therapy modes shall meet all of the following requirements:
a. Irradiation shall not be possible until a selection of stationary beam therapy or moving beam therapy is made at the treatment control panel;
b. An interlock system shall be provided to ensure that the equipment can operate only in the mode that is selected;
c. An interlock system shall be provided to prevent irradiation if any selected operations carried out in the treatment room do not agree with the selected operations indicated at the treatment control panel;
d. An interlock system shall be provided to terminate irradiation if the movement stops during moving beam therapy;
e. Moving beam therapy shall be so controlled that the required relationship between the number of dose monitor units and movement is obtained; and
f. The mode of operation shall be displayed at the treatment control panel.

9. Focal spot location and beam orientation. The registrant shall determine, or obtain from the manufacturer, the location in reference to an accessible point on the radiation head of all of the following:
a. The x-ray target or the virtual source of x-rays,
b. The electron window or the scattering foil, and
c. All possible orientations of the useful beam.

10. System checking facilities. Capabilities shall be provided for checking of all safety interlock systems.

**B.** Facility and shielding requirements.
1. In addition to protective barriers sufficient to ensure compliance with R12-1-907, all of the following design requirements apply:
   a. Except for entrance doors or beam interceptors, all the required barriers shall be fixed barriers;
   b. The treatment control panel shall be located outside the treatment room;
   c. Windows, mirrors, operable closed-circuit television, or other equivalent viewing systems shall be provided to permit continuous observation of the patient during irradiation and shall be so located that the operator may observe the patient from the treatment control panel;
   d. Provision shall be made for two-way oral communication between the patient and the operator at the treatment control panel;
   e. Each point of entry into the treatment room shall be provided with warning lights that will indicate when the useful beam is "on" in a readily observable position outside of the room; and
   f. Interlocks shall be provided and shall result in all entrance doors being closed before treatment can be initiated or continued. If the radiation beam is interrupted by any door opening, it shall be possible to restore the machine to operation only by closing the door and reinitiating exposure by manual action at the control panel.
2. An authorized medical physicist, trained and experienced in the principles of radiation protection, shall perform a radiation protection survey on all installations before human use and after any change in an installation that might produce a radiation hazard. The authorized medical physicist shall provide the survey results in writing to the individual in charge of the installation and transmit a copy of the survey results to the Agency.
3. Calibrations.
   a. Calibration of the therapy system, including radiation output calibration, shall be performed before placing new installations into operation for the purpose of irradiation of patients. Subsequent calibrations shall be made at intervals not to exceed 12 months, and after any change that may cause the calibration of the therapy system to change.
   b. Calibration of the radiation output of the therapy beam shall be performed with an instrument that has been calibrated using a method that is traceable to the National Institute of Standards and Technology (NIST), within the preceding two years.
   c. Calibration of a particle accelerator shall be performed by, or under the supervision of an authorized medical physicist who meets the qualification requirements specified in R12-1-711, and a copy of the calibration report shall be maintained by the registrant for inspection by the Agency.
   d. Calibration of the therapy beam shall include, but not necessarily be limited to, all of the following determinations:
      i. Verification that the equipment is operating within the design specifications concerning the light localizer, the side light and back pointer alignment with the isocenter, when applicable, variation in the axis of rotation for the table, gantry and jaw system, and beam flatness and symmetry at specific depths;
      ii. The exposure rate or dose rate in air or at various depths of water for the range of field sizes used for each effective energy, and for each treatment distance used for radiation therapy;
      iii. The congruence between the radiation field and the field defined by the localizing device;
      iv. The uniformity of the radiation field and its dependency upon the direction of the useful beam; and
      v. The calibration determinations above shall be provided in sufficient detail, to allow the absorbed dose to tissue in the useful beam to be calculated to within plus or minus 5 percent.
   e. Records of calibrations shall be maintained for three years following the date the calibration was performed.
   f. A copy of the current calibration report shall be available in the therapy facility for use by the operator, and the report shall contain the following information:
      i. The action taken by the authorized medical physicist performing the calibration if it indicates a change has occurred since the last calibration,
      ii. A listing of the persons informed of the change in calibration results, and
      iii. A statement as to the effect the change in calibration has had on the therapy doses prior to the current calibration finding.

**C.** Spot checks.
1. The spot check procedures shall be in writing and shall have been developed by an authorized medical physicist trained and experienced in performing calibrations.
2. The measurements taken during spot checks shall demonstrate the degree of consistency of the operating characteristics which can affect the radiation output of the system or the radiation dose delivered to a patient during a therapy procedure.
3. The written spot check procedure shall indicate the frequency at which tests or measurements are to be performed, not to exceed monthly.
4. The spot check procedure shall note conditions that require recalibration of the therapy system before further human irradiation.
5. Records of spot checks shall be maintained and available for inspection by the Agency for three years following the spot check measurements. Records of spot checks not performed by an authorized medical physicist shall be signed by an authorized medical physicist within 15 days of the spot check.

**D.** Operating procedures.
1. Only the patient shall be in the treatment room during irradiation.
2. If a patient must be held in position during treatment only, mechanical supporting or restraining devices shall be used for this purpose.

**Historical Note**

Adopted effective June 30, 1977 (Supp. 77-3). Repealed effective August 8, 1986 (Supp. 86-4). New Section made 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. 4302, effective November 14, 2003 (Supp. 03-3). 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).

**R12-1-906. Limitations**

**A.** A registrant shall not permit an individual to act as:
1. A particle accelerator operator of any type unless the individual:
   a. Has received copies of and instruction in this Article and the registrant's operating and emergency procedures,
   b. Demonstrates an understanding of the material, and
   c. Has demonstrated competence in the use the particle accelerator, related equipment, and survey instruments that will be employed during the operation of the particle accelerator;
2. A medical particle accelerator operator unless the individual is certified as required in A.R.S. § 32-2811 or the operator meets the requirements in R12-1-603(B); or
3. An industrial particle accelerator operator unless the individual has been instructed in radiation safety.

**B.** A registrant shall provide either the Radiation Safety Committee or the Radiation Safety Officer with the authority to terminate operations at a particle accelerator facility if this is necessary to protect health and safety or property.

**C.** If equipment is capable of both stationary and moving beam therapy, the registrant shall ensure that:
1. Irradiation is not possible unless either stationary or moving beam therapy has been selected at the control panel,
2. An interlock is provided to ensure that the machine will operate only in the mode that has been selected,
3. An interlock is provided that terminates irradiation if the gantry fails to move properly during moving beam therapy,
4. A means is provided to prevent movement during stationary therapy, and
5. The mode of operation is displayed at the control panel.

**Historical Note**

Adopted effective June 30, 1977 (Supp. 77-3). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3).

**R12-1-907. Shielding and Safety Design**

**A.** An authorized medical physicist experienced in the principles of radiation protection and installation design shall be consulted in the design of a particle accelerator installation and called upon to perform a radiation survey when the accelerator is first capable of producing radiation. The registrant shall provide a copy of the installation radiation survey to the Agency before an Agency inspection conducted according to R12-1-914.

**B.** The registrant shall shield each particle accelerator installation with the primary and secondary protective barriers necessary to comply with R12-1-408 and R12-1-416.

**C.** At the time of application for registration and before treatment of the first patient, the applicant shall provide to the Agency a copy of an installation report, signed by the contractor who installed required shielding material recommended by the authorized medical physicist who performed the shielding calculations for the particle accelerator facility.

**D.** As part of the annual radiation protection program review required in R12-1-407(C), the registrant shall document installed facility shielding and other radiation exposure controls, review patient workload, and note associated changes, if any, in public exposure that are the result of installed facility shielding, increased workload, and other radiation exposure controls in use at the time of the review.

**Historical Note**

Adopted effective June 30, 1977 (Supp. 77-3). Amended subsection (A) effective Aug. 8, 1986 (Supp. 86-4). Amended effective June 13, 1997 (Supp. 97-2). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

**R12-1-908. Particle Accelerator Controls and Interlock Systems**

A registrant shall ensure that:
1. Instrumentation, readouts and controls on the particle accelerator control panel are clearly identified and easily discernible;
2. All entrances into the area that contains the particle accelerator room, target room, or other high radiation area, are provided with interlocks that shut down the machine if an entrance door is opened;
3. If an interlock system connected to an entrance door that provides access to the therapy suite has been tripped, it is not possible to resume operation of the particle accelerator by resetting the interlock switch at the entrance where it had been tripped;
4. Each safety interlock is on a circuit that allows it to operate independently of all other safety interlocks;
5. If possible, the interlock system is fail-safe in design, so that any defect or component failure in the interlock system prevents operation of the particle accelerator; and
6. A scram button or other emergency power cutoff switch is located and easily identifiable in the area that contains the particle accelerator. The registrant shall ensure that the scram button prevents persons from restarting the particle accelerator at the accelerator control panel without resetting the button or switch.

**Historical Note**

Adopted effective June 30, 1977 (Supp. 77-3). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3).

**R12-1-909. Warning Systems**

A registrant shall ensure that:
1. High radiation areas and entrances to the high radiation areas in medical facilities are equipped with a continuously-operating warning light system that operates when, and only when, radiation is produced;
2. High radiation areas and entrances to the high radiation areas in nonmedical facilities are equipped with an easily-observable flashing or rotating warning light system that operates when, and only when, radiation is produced;
3. High radiation areas associated with nonmedical particle accelerators have an audible warning device that is activated for 15 seconds before creation of the high radiation area; and the warning device is clearly discernible in all high radiation areas and all radiation areas; and
4. High radiation areas associated with any particle accelerator are posted according to R12-1-428 and R12-1-429.

**Historical Note**

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective June 13, 1997 (Supp. 97-2). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3).

**R12-1-910. Operating Procedures**

**A.** A registrant shall secure from use a particle accelerator when it is not being used to prevent unauthorized use.

**B.** A particle accelerator operator shall use the switch on the control panel to turn the accelerator beam on and off during normal operations. The safety interlock system may be used to turn off the accelerator beam in emergencies.

**C.** A registrant shall ensure that all safety and warning systems, including interlocks, are tested for proper operation at intervals not to exceed three months, and maintain a record of each test for Agency inspection for at least three years from the date of the test.

**D.** A registrant shall keep current electrical circuit diagrams of a particle accelerator and the associated interlock systems, and maintain the diagrams for inspection by the Agency.

**E.** A registrant shall not bypass an interlock unless the by-pass is:
1. Authorized in writing by the Radiation Safety Committee or Radiation Safety Office,
2. Recorded in a permanent log with a notice of the by-pass posted at any affected interlock and at the control panel, and
3. Terminated as soon as possible.

**F.** A registrant shall maintain a copy of the current operating and emergency procedures at the particle accelerator control panel.

**Historical Note**

Adopted effective June 30, 1977 (Supp. 77-3). Amended subsection (D) effective Aug. 8, 1986 (Supp. 86-4). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

**R12-1-911. Radiation Surveys**

**A.** The registrant shall ensure that a portable survey instrument is available at all times in a particle accelerator facility.

**B.** An authorized medical physicist shall:
1. Check the operation of the portable survey instrument required in subsection (A), using a known radiation source, before each use;
2. Perform and document a radiation protection survey when changes have been made in shielding, operation, equipment, or occupancy of adjacent areas;
3. For particle accelerator facilities greater than 30 Mev, establish a program of radiation protection surveys that will evaluate the airborne radiation hazards, and ensure that the particulate radioactivity present in the accelerator facility will not result in personnel exposure that exceeds the limits in Article 4; and
4. Perform radiation protection surveys, including smear surveys of the particle accelerator facility, as prescribed in the written procedures established by the Radiation Safety Officer of the particle accelerator facility and approved by the Agency at the time of application for registration.

**C.** The registrant shall maintain the following records:
1. Radiation protection surveys required in subsection (B)(2), and the associated facility description, required in R12-1-202, until the registration is terminated; and
2. Records of the surveys required in subsections (B)(3) and (4) for three years following the measurement.

**Historical Note**

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective Aug. 8, 1986 (Supp. 86-4). 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. 4302, effective November 14, 2003 (Supp. 03-3). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

**R12-1-912. Repealed**

**Historical Note**

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective Aug. 8, 1986 (Supp. 86-4). Amended effective June 13, 1997 (Supp. 97-2). Section repealed by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

**R12-1-913. Misadministration**

**A.** For purposes of this rule "misadministration" means:
1. A therapeutic radiation dose from a machine:
   a. Delivered to the wrong patient;
   b. Delivered using the wrong mode of treatment;
   c. Delivered to the wrong treatment site; or
   d. Delivered in one week to the correct patient, using the correct mode, to the correct therapy site, but greater than 130 percent of the prescribed weekly dose; or
2. A therapeutic radiation dose from a machine with errors in the calibration, time of exposure, or treatment geometry that result in a calculated total treatment dose differing from the final, prescribed total treatment dose by more than 20 percent, except for treatments given in 1 to 3 fractions, in which case a difference of more than 10 percent constitutes a misadministration.

**B.** Reports of therapy misadministration
1. Within 24 hours after discovery of a misadministration, a registrant shall notify the Agency by telephone. The registrant shall also notify the referring physician of the affected patient and the patient or a responsible relative or guardian, unless the referring physician personally informs the registrant either that he or she will inform the patient, or that in his or her medical judgment, telling the patient or the patient's responsible relative or guardian would be harmful to one or the other, respectively. If the referring physician or the patient's responsible relative or guardian cannot be reached within 24 hours, the registrant shall notify them as soon as practicable. The registrant shall not delay medical care for the patient because of notification problems.
2. Within 15 days following the verbal notification to the Agency, the registrant shall report, in writing, to the Agency and individuals notified under subsection (B)(1). The written report shall include the registrant's name, the referring physician's name, a brief description of the event, the effect on the patient, the action taken to prevent recurrence, whether the registrant informed the patient or the patient's responsible relative or guardian, and if not, why not. The report shall not include the patient's name or other information that could lead to identification of the patient.
3. Each registrant shall maintain records of all misadministrations for Agency inspection. The records shall:
   a. Contain the names of all individuals involved in the event, including:
      i. The physician,
      ii. The allied health personnel,
      iii. The patient,
      iv. The patient's referring physician,
      v. The patient's identification number if one has been assigned,
      vi. A brief description of the event,
      vii. The effect on the patient, and
      viii. The action taken to prevent recurrence.
   b. Be maintained for three years beyond the termination date of the affected registration.

**Historical Note**

New Section made 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 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

**R12-1-914. Initial Inspections of Particle Accelerators Used in the Practice of Medicine**

The Agency shall inspect a particle accelerator, used in the practice of medicine, before its initial use to treat human disease.

**Historical Note**

New Section made by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

**Appendix A. Quality Control Program**

**A.** Mechanical Tests
1. Patient support assembly motions
2. Gantry angle indicators
3. Optical distance indicators
4. Alignment lights
5. Congruence of radiation beam and light field
6. Accuracy of field size indicators
7. Mechanical isocenter- gantry and collimator
8. Mechanical interlocks

**B.** Radiation Beam Tests
1. Machine operating parameters,
2. Dose per monitor unit for x-ray and electron beams,
3. Dose per degree for moving beam therapy,
4. Radiation isocenter,
5. Flatness and symmetry,
6. Wedge transmission factors,
7. Shadow tray transmission factors,
8. Energy check on central axis,
9. Radiation output versus field size.

**C.** Control Panel Checks
1. Radiation "ON" condition,
2. Indicator lamp check,
3. Computer control of accelerator,
4. Interlock display,
5. Digital display,
6. Analog display,
7. Status display,
8. Reset display.

**D.** Facility Checks
1. Patient audio-visual communication,
2. Entrance door interlock,
3. Warning lights,
4. Emergency off button.

**E.** Dose Output Check
1. Each registrant shall use the services of a third party authorized medical physicist or third party TLD system to verify the accelerator's radiation output every two years.
2. If the output check is not within plus or minus 5 percent of the calibrated output, the accelerator shall be recalibrated and the discrepancy investigated.
3. Records of output checks shall be maintained for three years.

**F.** Patient Dosimetry Calculation Checks
1. Calculation of patient treatment times
2. Computer calculation of patient treatment times

**Historical Note**

New Appendix made by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

## ARTICLE 10. NOTICES, INSTRUCTIONS, AND REPORTS TO RADIATION WORKERS; INSPECTIONS

**R12-1-1001. Purpose and Scope**

This Article establishes requirements for notices, instructions, and reports by licensees or registrants to individuals working for a licensee or registrant. This Article explains the options available to these individuals in connection with ARRA inspections of licensees or registrants regarding radiological working conditions. The rules in this Article apply to all persons who receive, possess, use, own, or transfer sources of radiation licensed or registered by the ARRA.

**Historical Note**

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).

**R12-1-1002. Posting of Notices for Workers**

**A.** Each licensee or registrant shall post current copies of the following documents:
1. The rules in this Chapter;
2. The license, certificate of registration, conditions, or documents incorporated into the license or registration by reference, and any amendments to the license or registration;
3. The operating procedures applicable to work under the license or registration;
4. Any notice of violation involving radiological working conditions, proposed imposition of a civil penalty, or order issued under 12 A.A.C. 1, Article 12, and any response from the licensee or registrant.

**B.** If posting of a document specified in subsections (A)(1), (2) and (3) is not practicable, the licensee or registrant may post a notice which describes the document and states where it may be examined.

**C.** Form ARRA-6 (shown following R12-1-1008), "Notice to Employees" shall be posted by each licensee or registrant wherever individuals work in or frequent any portion of a restricted area.

**D.** Each licensee or registrant shall post documents, notices, or forms, as required by this Section, so that they are conspicuous and appear in a sufficient number of places to permit individuals engaged in work under the license or registration to observe them on the way to or from any particular work location to which the document applies and shall replace any document if it is defaced or altered.

**E.** Agency documents posted as required in subsection (A)(4) shall be posted within two working days after receipt of the documents from the Agency; the licensee's or registrant's response, if any, shall be posted within two working days after dispatch from the licensee or registrant. The documents shall remain posted for a minimum of five working days or until action correcting the violation has been completed, whichever is later.

**Historical Note**

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective February 25, 1985 (Supp. 85-1). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2).

**R12-1-1003. Instructions for Workers**

**A.** A licensee or registrant shall ensure that each individual who, in the course of employment, is likely to receive in a year an occupational dose in excess of 1 mSv (100 mrem), receives instruction in all of the following subjects:
1. Storage, transfer, or use of radiation and radioactive material;

2. Health protection problems associated with exposure to radiation or radioactive material, precautions or procedures to minimize exposure, and purposes and functions of protective devices;
3. Applicable provisions in Agency rules, licenses, and registrations that protect of personnel from exposure to radiation or radioactive material, with an emphasis on the duties of workers;
4. The duty to promptly report to the licensee or registrant any condition that may lead to or cause a violation of a provision in an Agency rule, license, or registration or unnecessary exposure to radiation or radioactive material;
5. Correct response to warnings in the event of any unusual occurrence or malfunction that may involve exposure to radiation or radioactive material; and
6. Radiation exposure reports that a worker may request according to R12-1-1004.

**B.** In determining whether subsection (A) applies to an individual, a licensee or registrant shall take into consideration assigned activities during normal and abnormal situations that involve exposure to radiation or radioactive material and could reasonably be expected to occur during the life of a facility. The licensee or registrant shall provide instruction that is commensurate with potential radiological health protection problems present in the work place.

**Historical Note**

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

**R12-1-1004. Notifications and Reports to Individuals**

**A.** A licensee or registrant shall report radiation exposure data for an individual and the results of any measurements, analyses, and calculations of radioactive material deposited or retained in the body to the individual as specified in this Section. The information reported shall include data and results obtained under Agency rules, orders, or license conditions, as shown in records maintained by the licensee or registrant. Each notification and report shall be in writing; include appropriate identifying data, such as the name of the licensee or registrant, the name of the individual, and the individual's Social Security number; include the individual's exposure information; and contain the following statement:

"This report is furnished to you under the provisions of 12 A.A.C. 1. You should preserve this report for future reference."

**B.** Each licensee or registrant shall make dose information available to workers as shown in records maintained by the licensee or registrant under the provisions of Article 4. Each licensee or registrant shall provide annual notification of exposure to radiation or radioactive material for each worker, as shown in records maintained by the licensee or registrant under R12-1-419(E) if:

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

**C.** At the request of a worker formerly engaged in work controlled by the licensee or the registrant, each licensee or registrant shall furnish to the worker a report of the worker's exposure to radiation or radioactive material. The report shall be furnished within 30 days from the time the request is made, or within 30 days after the exposure of the individual has been determined by the licensee or registrant, whichever is later; the report shall cover, within the period of time specified in the request, each calendar quarter in which the worker's activities involved exposure to radiation from radioactive material licensed by, or radiation machines registered with, the Agency; and the report shall include the dates and locations of work under the license or registration in which the worker participated during this period.

**D.** Reports to individuals of their exposure to radiation shall be made according to R12-1-446.

**Historical Note**

Adopted effective June 30, 1977 (Supp. 77-3) Amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

**R12-1-1005. Licensee, Registrant, and Worker Representation During Agency Inspection**

**A.** As a condition of licensure or registration, each licensee or registrant shall afford to the Agency, at all reasonable times and without undue delay, an opportunity to inspect materials, machines, activities, facilities, premises, and records.

**B.** During an inspection, the licensee or registrant shall permit Agency inspectors to consult privately with workers as specified in Section R12-1-1006. The licensee or registrant may accompany Agency inspectors during other phases of an inspection.

**C.** A worker authorized to consult with an Agency inspector under R12-1-1006 may authorize another individual to represent the worker's interests during the Agency inspection. The licensee or registrant shall notify the inspectors of the worker's authorization and give the worker's representative an opportunity to accompany the inspectors during the inspection of physical working conditions.

**D.** Each worker's representative shall be routinely engaged in work under control of the licensee or registrant or shall have received instructions under R12-1-1003.

**E.** Different representatives of licensees or registrants and workers may accompany the inspectors during different phases of an inspection if there is no resulting interference with the inspection. However, only one worker's representative at a time may accompany the inspectors.

**F.** With the approval of the licensee or registrant and the worker's representative an individual who is not routinely engaged in work under control of the licensee or registrant, for example, a consultant to the licensee or registrant or to the worker's representative, shall be afforded the opportunity to accompany Agency inspectors during the inspection of physical working conditions.

**G.** Notwithstanding the other provisions of this Section, Agency inspectors are authorized to refuse to permit accompaniment by any individual who deliberately interferes with a fair and orderly inspection. With regard to any area containing proprietary information the worker's representative for that area shall be an individual previously authorized by the licensee or registrant to enter that area. With regard to areas containing information classified by an agency of the U.S. Government in the interest of national security, any individual who accompanies an inspector may have access to such information only if authorized by the classifying agency.

**Historical Note**

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective February 25, 1985 (Supp. 85-1). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2).

**R12-1-1006. Consultation with Workers During Inspections**

**A.** A licensee or registrant shall afford Agency inspectors talking to a licensee or registrant representative the opportunity to consult privately with workers concerning matters of occupational radiation protection and other matters related to applicable provisions of Agency rules, licenses, and registrations to the extent the inspectors deem consultation necessary for conducting an effective and thorough inspection.

**B.** During the course of an inspection, any worker may privately bring to the attention of the inspectors, either orally or in writing, any past or present condition which the worker has reason to believe may have contributed to or caused any violation of the Act, these rules, or a license or registration condition, or any unnecessary exposure of an individual to radiation from licensed radioactive material or a registered radiation machine under the licensee's or registrant's control. If this notification is in writing, the worker shall comply with the requirements of R12-1-1007(A).

**C.** The provisions of R12-1-1006(B) shall not be interpreted as authorization to disregard instructions required by R12-1-1003.

**Historical Note**

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective February 25, 1985 (Supp. 85-1). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2).

**R12-1-1007. Inspection Requests by Workers**

**A.** Any worker or representative of workers who believes that a violation of the Act, these rules, license, or registration conditions exists, or has occurred with regard to radiological working conditions in which the worker is engaged, may request an inspection of the facility by the Agency. Any request shall be in writing, addressed to the Director, set forth the specific grounds for the request, and be signed by the worker or representative of the workers. The Agency shall provide a copy to the licensee or registrant no later than at the time of inspection except that, upon the request of the worker, the Agency shall protect the worker's name and the name of individuals referred to in the request to the extent authorized by law, except for good cause shown.

**B.** If, upon receipt of a request for inspection, the Agency's Director deter mines that there are reasonable grounds to believe that the alleged violation exists or has occurred, the Director shall initiate an inspection as soon as practicable, to determine if the alleged violation exists or has occurred. Inspections performed under this subsection need not be limited to matters referred to in the complaint.

**C.** A licensee or registrant shall not discharge or in any manner discriminate against any worker because the worker has filed any complaint or caused to be instituted any proceeding under these rules or has testified or is about to testify in the instituted proceeding or because the worker exercises on behalf of the worker or others, any option afforded by this Article.

**Historical Note**

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective February 25, 1985 (Supp. 85-1). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2).

**R12-1-1008. Inspection not Warranted; Review**

If the Agency determines, with respect to a complaint under R12-1-1007, that an inspection is not warranted or there are no reasonable grounds to believe that a violation exists or has occurred, the Agency shall notify the complainant in writing of the determination. The complainant may obtain review of the determination by submitting a written request for hearing to the Agency. The Agency shall provide for a hearing before the Radiation Regulatory Hearing Board under 12 A.A.C. 1, Article 12 and A.R.S. Title 41, Chapter 6, Article 10.

**Historical Note**

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective February 25, 1985 (Supp. 85-1). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). R12-1-1008 updated to reflect a corrected Arizona Revised Statute article number (Supp. 07-1).

**Exhibit A. Form ARRA-6 (2012) Notice to Employees**
**ARRA-6 (2012) ARIZONA RADIATION REGULATORY AGENCY**

# NOTICE TO EMPLOYEES

## STANDARDS FOR PROTECTION AGAINST RADIATION; NOTICES, INSTRUCTIONS, AND REPORTS TO WORKERS; INSPECTIONS

In Article 4 of the Arizona Radiation Regulatory Agency (ARRA) rules for the Control of Radiation, the Arizona Radiation Regulatory Agency has established standards for your protection against radiation hazards. In Article 10 of the rules for the Control of Radiation, the Arizona Radiation Regulatory Agency has established certain provisions for the options of workers engaged in work under an ARRA license or registration.

**YOUR EMPLOYER'S RESPONSIBILITY**

Your employer is required to -

1. Apply these rules to work involving sources of radiation.
2. Post or otherwise make available to you a copy of the Arizona Radiation Regulatory Agency rules, licenses, and operating procedures which apply to work you are engaged in, and explain their provisions to you.
3. Post notice of violation involving radiological working conditions, proposed imposition of civil penalties, and orders.

**YOUR RESPONSIBILITY AS A WORKER**

You should familiarize yourself with those provisions of the Arizona Radiation Regulatory Agency rules and the operating procedures which apply to the work you are engaged in. You should observe their provisions for your own protection and protection of your co-workers.

**WHAT IS COVERED BY THESE RULES**

1. Limits on exposure to radiation and radioactive material in restricted and unrestricted areas;
2. Measures to be taken after accidental exposure;
3. Personnel monitoring, surveys, and equipment;
4. Caution signs, labels, and safety interlock equipment;
5. Exposure records and reports;
6. Options for workers regarding ARRA inspections; and
7. Related matters.

**REPORTS ON YOUR RADIATION EXPOSURE HISTORY**

1. The Arizona Radiation Regulatory Agency rules require that your employer give you a written report if you receive an exposure in excess of any applicable limit set forth in the rules or in the license. The basic limits for exposure to employees are set forth in Article 4 of the rules. These Sections specify limits on exposure to radiation and exposure to concentrations of radioactive material in air and water.
2. If you work where personnel monitoring is required, and if you request information on your radiation exposures,
   a. Your employer must give you a written report, upon termination of your employment, of your radiation exposures; and
   b. Your employer must advise you annually of your exposure to radiation.

**INSPECTIONS**

All licensed or registered activities are subject to inspection by representatives of the Arizona Radiation Regulatory Agency. In addition, any worker or representative of workers who believes that there is a violation of the regulations issued thereunder, or the terms of the employer's license or rules with regard to radiological working conditions in which the worker is engaged, may request an inspection by sending a notice of the alleged violation to the Arizona Radiation Regulatory Agency. The request must set forth the specific grounds for the notice and must be signed by the worker on his own behalf or as a representative of the workers. During inspections, ARRA inspectors may confer privately with workers, and any worker may bring to the attention of the inspectors any past or present condition which he believes contributed to or caused any violation as described above.

**INQUIRIES**

Inquiries dealing with the matters outlined above can be sent to the:

**ARIZONA RADIATION REGULATORY AGENCY**

**POSTING REQUIREMENT**

IN ACCORDANCE WITH A.A.C. R12-1-1002, COPIES OF THIS NOTICE SHALL BE POSTED IN SUCH A MANNER TO PERMIT EMPLOYEES WORKING IN OR FREQUENTING ANY PORTION OF A RESTRICTED AREA, USED FOR ACTIVITIES LICENSED OR REGISTERED PURSUANT TO ARTICLE 2 OR ARTICLE 3 OF THE AGENCY'S RULES, TO OBSERVE A COPY OR COPIES ON THE WAY TO OR FROM THEIR WORK AREA.

**Historical Note**

Exhibit A amended by final rulemaking at 18 A.A.R. 1895, effective September 10, 2012 (Supp. 12-3).

## ARTICLE 11. INDUSTRIAL USES OF X-RAYS, NOT INCLUDING ANALYTICAL X-RAY SYSTEMS

**R12-1-1101. Repealed**

**Historical Note**

Adopted effective June 30, 1977 (Supp. 77-3). Repealed effective June 13, 1997 (Supp. 97-2).

**R12-1-1102. Definitions**

"Access point" means any door or cover that is designed to be removed or opened for maintenance or service purposes, opened using tools, and used to provide access to the interior of a cabinet x-ray unit.

"Annual refresher safety training" means a review provided by the registrant for its employees on radiation safety aspects of industrial radiography. The review shall include, as applicable, the results of internal inspections, new procedures or equipment, new or revised statutes or rules, accidents, or errors that have occurred, and provide opportunities for employees to ask safety questions.

"Aperture" means any opening in the outside surface of a cabinet x-ray unit, other than a port, which remains open during generation of x-radiation.

"Door" means any barrier that is designed to be movable or opened for routine operation purposes, rather than opened

using tools, and used to provide access to the interior of the cabinet x-ray unit.
"Ground fault" means an accidental electrical grounding of an electrical conductor.
"Hands-on experience" means the accumulation of knowledge or skill in any area relevant to radiography.
"Port" means any opening in the outside surface of a cabinet x-ray unit that is designed to remain open, during generation of x-rays, for conveying material that is being irradiated into and out of the cabinet, or for partial insertion of an object for irradiation if the dimensions of the object do not permit complete insertion into the cabinet x-ray unit.
"Practical examination" means a demonstration, through practical application of safety rules and principles of industrial radiography, which includes use of all radiography equipment and tests knowledge of radiography procedures.
"Radiographic operations" means all activities associated with use of a radiographic x-ray system. This includes performing surveys to confirm the adequacy of boundaries, setting up equipment, and conducting any activity inside restricted area boundaries.

**Historical Note**
Adopted effective June 30, 1977 (Supp. 77-3). Repealed effective June 13, 1997 (Supp. 9702). New Section made by final rulemaking at 11 A.A.R. 978, effective April 3, 2005 (Supp. 05-1).

**R12-1-1103. Repealed**

**Historical Note**
Adopted effective June 30, 1977 (Supp. 77-3). Repealed effective June 13, 1997 (Supp. 97-2).

**R12-1-1104. Registration Requirements**

**A.** The Agency shall review an application for registration of a radiation machine for use in industrial radiography and approve the registration if an applicant meets all of the following requirements:
1. The applicant satisfies the general requirements in Article 2 and any special requirements contained in this Article,
2. The applicant submits a program for training radiographer's assistants that complies with R12-1-1146, and
3. The applicant submits procedures for verifying and documenting the certification status of each radiographer and for ensuring that the certification remains valid.

**B.** An applicant shall submit written operating and emergency procedures, as prescribed in R12-1-1128.

**C.** An applicant shall submit a description of a program for review of job performance of each radiographer and radiographer's assistant at intervals that do not exceed six months, as prescribed in R12-1-1146(E).

**D.** An applicant shall submit a description of the applicant's overall organizational structure as it applies to radiation safety responsibilities in industrial radiography, including specified delegation of authority and responsibility.

**E**. An applicant shall submit and list the qualifications of each individual designated as an RSO under R12-1-1120 and indicate which designee is responsible for ensuring that the registrant's radiation safety program is implemented.

**F.** If an applicant intends to perform "in-house" calibrations of survey instruments, the applicant shall describe each calibration method to be used, the relevant experience of each person who will perform a calibration, and procedures to ensure that all calibrations are performed according to the procedures prescribed in R12-1-1108.

**G.** An applicant shall identify and describe the location of all field stations and permanent radiographic installations.

**H.** An applicant shall identify each location where records required by this Chapter will be maintained.

**Historical Note**
Adopted effective June 30, 1977 (Supp. 77-3). Repealed effective June 13, 1997 (Supp. 97-2). New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-1105. Reserved**

**R12-1-1106. Equipment Performance**

A registrant shall ensure that each x-ray machine has a lock or other security system designed to prevent unauthorized use or accidental production of radiation and is secured against unauthorized use at all times, except when under the direct surveillance of a radiographer or radiographer's assistant.

**Historical Note**
New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-1107. Reserved**

**R12-1-1108. Radiation Survey Instruments**

**A.** A registrant shall maintain at least two calibrated and operable radiation survey instruments at each location where sources of radiation are present to make radiation surveys required by this Article and Article 4 of this Chapter. Instrumentation required by this Section shall be capable of measuring a range from 0.02 millisieverts (2 millirems) per hour through 0.01 sievert (1 rem) per hour.

**B.** A registrant shall ensure that each radiation survey instrument required under subsection (A) is calibrated:
1. At intervals that do not exceed six months, and after instrument servicing, except for battery changes;
2. For linear scale instruments, at two points located approximately one-third and two-thirds of full-scale on each scale; for logarithmic scale instruments, at mid-range of each decade, and at two points of at least one decade; and for digital instruments, at 3 points between 0.02 and 10 millisieverts (2 and 1000 millirems) per hour; and
3. So that an accuracy within plus or minus 20% of the calibration source can be demonstrated at each point checked.

**C.** A registrant shall make a record each time a radiation survey instrument is calibrated, and maintain each record for three years after it is made.

**Historical Note**
New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-1109. Reserved**

**R12-1-1110. Quarterly Inventory**

**A.** A registrant shall conduct a quarterly physical inventory to account for all x-ray machines received and possessed under the registration.

**B.** A registrant shall maintain a record of the quarterly inventory required under subsection (A) for three years after it is made.

**C.** The record required by subsection (B) shall include the date of the inventory, name of the individual who conducted the inventory, location of each x-ray machine, and manufacturer, model, and serial number of each x-ray machine.

**Historical Note**
New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-1111. Reserved**

**R12-1-1112. Utilization Logs**

**A.** A registrant shall maintain for each x-ray machine a utilization log that provides all of the following information:
1. A description, including the make, model, and serial number of each x-ray machine;
2. The identity and signature of the radiographer using the machine; and
3. The plant or site where the machine is used and dates of use, including each date when the machine is removed from or returned to storage.

**B.** A registrant shall retain a log required by subsection (A) for three years after the log is made.

**Historical Note**
New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-1113. Reserved**

**R12-1-1114. Inspection and Maintenance of Radiation Machines, Survey Instruments, and Associated Equipment**

**A.** A registrant shall perform visual and operability checks on survey instruments and radiation machines before use on each day the equipment is to be used to ensure that the equipment is in good working condition and required labeling is present. Survey instrument operability checks shall be performed using check sources or other authorized means. If equipment problems are found, the registrant shall remove the equipment from service until it is repaired.

**B.** A registrant shall have written inspection and maintenance procedures for radiation machines and survey instruments that require inspection and maintenance, at intervals that do not exceed three months or before first use of the equipment and to ensure the proper functioning of components important to safety. Replacement components shall meet design specifications. If equipment problems are discovered, the registrant shall remove the equipment from service until the equipment is repaired.

**C.** A registrant shall maintain records of equipment problems found in daily checks and quarterly inspections and retain each record for three years after it is made. The record shall include the date of the check or inspection, name of the inspector, equipment involved, any problems found, and any repair or needed maintenance performed.

**Historical Note**
New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-1115. Reserved**

**R12-1-1116. Surveillance**

During each radiographic operation a radiographer, or the radiographer's assistant as permitted by R12-1-1118, shall maintain continuous direct visual surveillance of the operation to protect against unauthorized entry into a high radiation area, except at permanent radiographic installations where all entrances are locked and the registrant is in compliance with R12-1-1136.

**Historical Note**
New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-1117. Reserved**

**R12-1-1118. Industrial Radiographic Operations**

**A.** If industrial radiography is performed at a location other than a permanent radiographic installation, a registrant shall ensure that the radiographer is accompanied by at least one other radiographer or radiographer's assistant, qualified under R12-1-1146. The additional radiographer or radiographer's assistant shall observe the operations and be capable of providing immediate assistance to prevent unauthorized entry. The registrant shall not allow industrial radiography if only one qualified individual is present.

**B.** A registrant shall ensure that each industrial radiographic operation is conducted at a location of use authorized on the registration of a permanent radiographic installation, unless another permanent location is specifically authorized by the Agency.

**Historical Note**
New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-1119. Reserved**

**R12-1-1120. Radiation Safety Officer (RSO)**

**A.** A registrant shall have a radiation safety officer (RSO) who is responsible for implementing procedures and regulatory requirements in the daily operation of the radiation safety program.

**B.** A registrant shall ensure that the RSO has satisfied the following minimum requirements:
1. The training and testing requirements in R12-1-1146;
2. Two thousand hours of hands-on experience as a qualified radiographer for an industrial radiographic operation; and
3. Formal training in the establishment and maintenance of a radiation safety program.

**C.** A registrant may use an individual in the position of RSO who does not have the training and experience required in subsection (B), if the registrant provides the Agency with a description of the individual's training and experience in the field of ionizing radiation and training with respect to the establishment and maintenance of a radiation safety protection program.

**D.** The specific duties and authorities of the RSO include, but are not limited to:
1. Establishing and overseeing operating, emergency, and ALARA procedures as required in Article 4 of this Chapter, and reviewing the procedures every year to ensure that they conform to current Agency rules and registration conditions;
2. Overseeing and approving all phases of the training program for radiographic personnel, ensuring that appropriate and effective radiation protection practices are taught;
3. Overseeing radiation surveys and associated documentation to ensure that the surveys are performed in accordance with the rules and taking corrective measures if levels of radiation exceed established action limits;
4. Overseeing the personnel monitoring program to ensure that monitoring devices are calibrated and used properly by occupationally exposed personnel and ensuring that records are kept of the monitoring results and timely notifications are made as required in R12-1-444; and
5. Overseeing operations to ensure that they are conducted safely and instituting corrective actions, which may include ceasing operations if necessary.

**Historical Note**
New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-1121. Reserved**

**R12-1-1122. Form of Records**

A registrant shall maintain records in accordance with R12-1-405.

**Historical Note**
New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-1123. Reserved**

**R12-1-1124. Reserved**

**R12-1-1125. Reserved**

**R12-1-1126. Posting**
A registrant shall post any area in which industrial radiography is being performed as required by R12-1-429. Exceptions listed in R12-1-430 do not apply to industrial radiographic operations.

**Historical Note**
New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-1127. Reserved**

**R12-1-1128. Operating and Emergency Procedures**

**A.** A registrant shall have operating and emergency procedures that include, at minimum, instructions in the following, as applicable:
1. Use of radiation machines, so that persons are not exposed to radiation that exceeds the limits in Article 4 of this Chapter;
2. Methods and occasions for conducting radiation surveys;
3. Methods for controlling access to radiographic areas;
4. Methods and occasions for locking and securing a radiation machine;
5. Personnel monitoring and associated equipment;
6. Inspection, maintenance, and operability checks of a radiation machine and survey instruments;
7. Actions to be taken immediately by radiography personnel if a pocket dosimeter is found to be off-scale or an alarm rate meter sounds an alarm;
8. Procedures for identifying and reporting defects and noncompliance, as required by R12-1-448;
9. The procedure for notifying the RSO and the Agency in the event of an accident;
10. Minimizing exposure of persons in the event of an accident, and
11. Maintenance of records.

**B.** The registrant shall maintain copies of current operating and emergency procedures until the Agency terminates the registration. Superseded procedures shall be maintained for three years after a change is made. Additionally, records shall be maintained in accordance with R12-1-1138.

**Historical Note**
New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-1129. Reserved**

**R12-1-1130. Personnel Monitoring**

**A.** An individual shall not act as a radiographer or a radiographer's assistant unless, at all times during radiographic operations, the individual wears, on the trunk of the body, a direct reading dosimeter, an operating alarm rate meter, and either a film badge, a TLD, or an optically stimulated luminescence (OSL) dosimeter. At permanent radiography installations where other required alarm or warning devices are in routine use, an alarm rate meter is not required.
1. A registrant shall provide pocket dosimeters that have a range from zero to 2 millisieverts (200 millirems) and ensure that the dosimeters are recharged at the start of each shift. Electronic personnel dosimeters are permitted in place of ion-chamber pocket dosimeters.
2. The registrant shall assign a film badge, TLD, or OSL dosimeter to one individual, who shall wear the assigned equipment.
3. The registrant shall replace film badges at least monthly and replace TLDs or OSL dosimeters at least quarterly.
4. After replacement, the registrant shall ensure that each film badge or TLD is processed as soon as possible.

**B.** A radiographer or radiographer's assistant shall record exposures noted from direct reading dosimeters, such as pocket dosimeters or electronic personnel dosimeters, at the beginning and end of each shift.

**C.** A registrant shall check each pocket dosimeter or electronic personnel dosimeter at least yearly for correct response to radiation, and discontinue use of a dosimeter if it is not accurate within plus or minus 20% of the true radiation exposure.

**D.** If an individual's pocket dosimeter has an off-scale reading, or the electronic personnel dosimeter reads greater than 2 millisieverts (200 millirems), and radiation exposure cannot be ruled out as the cause, a registrant shall send the individual's film badge, TLD, or OSL dosimeter for processing within 24 hours. The registrant shall not allow the individual to work with a radiation machine until the individual's radiation exposure is determined. Using the information from the badge or dosimeter, the RSO or the RSO's designee shall calculate the affected individual's cumulative radiation exposure, as prescribed in Article 4 of this Chapter and include the results in records maintained in accordance with subsection (G).

**E.** If an individual's monitoring device is lost or damaged, the individual shall cease work immediately until the registrant provides a replacement film badge, TLD, or OSL dosimeter and the RSO or the RSO's designee calculates the exposure for the time period from issuance to discovery of a lost or damaged film badge, TLD, or OSL dosimeter. The registrant shall include the calculated exposure and the time period for which the film badge, TLD, or OSL dosimeter was lost or damaged in the records maintained in accordance with subsection (G).

**F.** For each alarm rate meter a registrant shall ensure that:
1. At the start of a shift each individual with an alarm rate meter checks that the alarm functions (sounds) before using the device;
2. Each device is set to give an alarm signal at a preset dose rate of 5 mSv/hr (500 mrem/hr) with an accuracy of plus or minus 20% of the true radiation dose rate;
3. A special means is necessary to change the preset alarm function on the device; and
4. Each device is calibrated at periods that do not to exceed 12 months for correct response to radiation

**G.** Each registrant shall maintain the following personnel monitoring records:
1. Each dosimeter reading and the yearly operability check required by subsections (B) and (C) for three years after each record is made;
2. A record of each alarm rate meter calibration for three years after the record is made;
3. Any report received from the film badge, TLD, or OSL processor. The registrant shall maintain these records until the Agency terminates the registration; and
4. Any estimation of an exposure evidenced by an off-scale personnel direct-reading dosimeter or a lost or damaged film badge, TLD, or OSL dosimeter. The records shall be maintained until the Agency terminates the registration.

**Historical Note**
New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-1131. Reserved**

**R12-1-1132. Supervision of a Radiographer's Assistant**

If a radiographer's assistant uses a radiation machine or conducts a radiation survey required by R12-1-1134(B), the registrant shall ensure that the assistant is under the personal supervision of a radiographer. For purposes of this Section "personal supervision" means:

1. The radiographer is physically present at the site where the radiation machine is being used;
2. The radiographer is available to give immediate assistance if required; and
3. The radiographer is able to observe directly the assistant's performance.

**Historical Note**

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

**R12-1-1133. Reserved**

**R12-1-1134. Radiation Surveys**

**A.** A registrant shall conduct surveys with a calibrated and operable radiation survey instrument that meets the requirements of R12-1-1108.

**B.** A registrant shall conduct a survey of a radiographic machine any time the machine is placed in storage to ensure that the machine will not expose personnel to radiation.

**C.** A registrant shall maintain a record of each exposure survey conducted before a machine is placed in storage under subsection (B), if that survey is the last one performed during the workday. Each record shall be maintained for three years after it is made.

**Historical Note**

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

**R12-1-1135. Reserved**

**R12-1-1136. Permanent Radiographic Installations**

**A.** If a registrant maintains a permanent radiographic installation that does not fall within the definition of "enclosed radiography" in R12-1-102, the registrant shall ensure that each entrance used for personnel access to the high radiation area has either:

1. An entrance control device of the type described in R12-1-420(A)(1), which reduces the radiation level upon entry into the area, or
2. Both conspicuous visible and audible alarm signals to warn of the presence of radiation. The registrant shall ensure that the visible signal is actuated by radiation if the x-ray tube is energized and the audible signal is actuated if a person attempts to enter the installation while the x-ray tube is energized.

**B.** A registrant shall test the alarm system for proper operation with a radiation source each day before the installation is used for radiographic operations. The test shall include a check of both the visible and audible signals. The registrant shall test each device referenced in subsection (A)(1) monthly. If an entrance control device or alarm signal is operating improperly, the registrant shall immediately label the device or signal as "defective" and repair the device or signal within seven calendar days. The registrant may continue to use the facility during this seven-day period, if the registrant implements continuous surveillance requirements of R12-1-1116 and uses an alarm rate meter.

**C.** A registrant shall maintain each record of alarm system and entrance control device tests for three years after the record is made.

**Historical Note**

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

**R12-1-1137. Reserved**

**R12-1-1138. Location of Documents and Records**

**A.** A registrant shall maintain a copy of each record required by this Article and other applicable Articles of this Chapter at the location specified on the registration application.

**B.** A registrant shall maintain a copy of the following at each field station and temporary job site:

1. The registration that authorizes use of a radiation machines;
2. A copy of Articles 4, 10, and 11 of this Chapter;
3. Utilization logs for each radiation machine dispatched from that location, as required by R12-1-1112;
4. Records of equipment problems identified in daily checks of equipment, as required by R12-1-1114;
5. Records of alarm system and entrance control device checks, as required by R12-1-1136;
6. Records of direct-reading dosimeters such as pocket dosimeters and electronic personnel dosimeters, as required by R12-1-1130;
7. Operating and emergency procedures, as required by R12-1-1128;
8. A report on the most recent calibration of the radiation survey instruments in use at the site, as required by R12-1-1108;
9. A report on the most recent calibration of each alarm rate meter and operability check of each pocket dosimeter, or electronic personnel dosimeter, as required by R12-1-1130;
10. Most recent survey record, as required by R12-1-1134; and
11. If a registrant is operating in the state under R12-1-207, a copy of the out-of-state machine registration and a written authorization from the Agency to operate in the state.

**Historical Note**

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

**R12-1-1139. Reserved**

**R12-1-1140. Enclosed Radiography**

**A.** The Agency has determined that any certified or certifiable cabinet x-ray system, as defined in Article 1, is exempt from the requirements of Article 11, provided that both of the following conditions are met:

1. The registrant makes, or causes to be made, an evaluation of each certified and certifiable cabinet x-ray system, at intervals that do not exceed 12 months, to determine whether the system conforms to the standards for certified and certifiable cabinet x-ray systems defined in Article 1. Records of each evaluation shall be maintained for three years from the date the record is created; and
2. The registrant performs a physical radiation survey with a survey instrument calibrated within the preceding 12 months and designed for the energy range and levels of radiation that will be assessed.

**B.** A registrant with a cabinet x-ray system that is not exempt under subsection (A) shall comply with the recordkeeping requirements of this Article and the following special requirements. The registrant shall:

1. Ensure that radiation levels measured at 5 centimeters (2 inches) from any accessible exterior surface of the enclosure do not exceed 50 microsievert (0.5 milliroentgen) in

one hour for any combination of technical factors (i.e., mA, kVp);

2. Ensure that access to the interior of the enclosure is possible only through interlocked doors or panels that prevent production of radiation unless all interlocked doors or panels are securely closed. The registrant shall ensure that opening a door or panel results in immediate termination of radiation production and subsequent reactivation of the x-ray tube is only possible at the control panel;
3. Provide visible warning signals, activated only during production of radiation, at the control panel and at each access point to the interior of the enclosure;
4. Before using an x-ray system make, or cause to be made, an initial evaluation of the x-ray system to determine compliance with this Article, and subsequently evaluate the x-ray system at intervals that do not exceed three months. The registrant shall maintain a record of each evaluation for two years, and
5. Using instrumentation that complies with R12-1-1108, perform a physical radiation survey to satisfy the requirements of subsection (B)(4).

**C.** A registrant with a shielded room x-ray systems shall comply with the recordkeeping requirements of this Article and the following special requirements. The registrant shall:

1. Shield each x-ray room so that every location on the exterior meets the requirements for an "unrestricted area" as specified in R12-1-416;
2. Provide access to the interior of a shielded x-ray room only through doors or panels that are interlocked. The registrant shall ensure that radiation production is possible only when all interlocked doors and panels are securely closed, opening of any interlocked door or panel results in immediate termination of radiation production; and subsequent reactivation of the x-ray tube is only possible at the control panel;
3. Provide each access point with two interlocks, each on a separate circuit, so that failure of one interlock will not affect the performance of the other interlock;
4. Provide visible warning signals, activated only during production of radiation at the control panel and each access point to the shielded room;
5. Make, or cause to be made, an initial evaluation of each shielded room x-ray system to determine compliance with this Article, and subsequently evaluate the x-ray system at intervals that do not exceed three months. The registrant shall maintain a record of each evaluation for two years;
6. Perform radiation surveys to determine exposure with an instrument that meets the requirements of R12-1-1108;
7. Inspect electrical interlocks and warning devices for correct operation before each use, and maintain a record of each inspection for two years;
8. Not permit an individual to operate an x-ray machine for shielded room radiography unless the individual has received a copy of, and instruction in, the operating procedures and demonstrated competence in the safe use of the equipment;
9. Ensure that an individual does not occupy the interior of any shielded room x-ray system during production of radiation;
10. Provide personnel monitoring devices that meet the requirements of R12-1-1130 to each shielded room x-ray machine operator, and require that each operator use the devices;
11. Maintain records of:
    a. Quarterly inventories for mobile systems, as prescribed in R12-1-1110; and
    b. Utilization logs for all systems, as prescribed in R12-1-1112; and
12. Maintain records for three years from the date of the quarterly inventory or utilization log.

**D.** A registrant shall connect an enclosed radiography machine to the electrical system in a manner that will prevent a ground fault from generating x-radiation.

**Historical Note**

New Section made by final rulemaking at 11 A.A.R. 978, effective April 3, 2005 (Supp. 05-1).

**R12-1-1141. Reserved**

**R12-1-1142. Baggage and Package Inspection Systems**

**A.** For x-ray systems designed to screen carry-on baggage or packages at airlines, railroads, bus terminals, package inspection facilities, or similar facilities, a registrant shall ensure the x-ray system has an operator present at the control area in a position that permits surveillance of the ports and doors during generation of x-radiation to prevent exposure to passengers and other members of the public.

**B.** For an exposure or preset succession of exposures of one-half second or greater duration, a registrant shall use a system that enables the operator to terminate the exposure or preset succession of exposures at any time.

**C.** For an exposure or preset succession of exposures of less than one-half second duration, a registrant shall use a system that allows the operator to complete the exposure in progress, but prevent additional exposures.

**D.** A registrant shall operate a baggage or package inspection system according to the manufacturer's instructions.

**E.** A registrant shall not disconnect or otherwise tamper with the safety systems of a baggage or package inspection system, except for maintenance purposes.

**F.** In addition to the requirements in this Section, a registrant using a baggage or package inspection system shall meet the requirements in R12-1-1140(A), (B), and (D).

**Historical Note**

New Section made by final rulemaking at 11 A.A.R. 978, effective April 3, 2005 (Supp. 05-1). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

**R12-1-1143. Reserved**

**R12-1-1144. Reserved**

**R12-1-1145. Reserved**

**R12-1-1146. Training**

**A.** A registrant shall not allow an individual to act as a radiographer until the individual has received training in the subjects in subsection (G), has participated in a minimum of two months of on-the-job training, and is certified through a radiographer certification program by a independent certifying organization in accordance with the criteria specified in Appendix A.

1. A registrant shall provide the Agency with proof of an individuals's certification upon request.
2. A registrant shall maintain proof of an individual's certification at the job site where the individual is performing field radiography.
3. A registrant that employs a certified radiographer in Arizona shall ensure that:
    a. The radiographer has obtained initial certification or recertification within the last five years; and
    b. An uncertified radiographer works only as a radiographer's assistant until certified.
4. A radiographer shall recertify every five years by:

a. Taking an approved radiography certification examination in accordance with this subsection; or
b. Providing written evidence that the radiographer is active in the practice of industrial radiography and has participated in continuing education during the previous five-year period.

5. If an individual cannot provide the written evidence required in subsection (4)(b), the individual shall retake the certification examination.
6. A radiographer shall provide the registrant with proof of certification in the form of a card issued by the certifying organization that contains:
a. A picture of the certified radiographer,
b. The radiographer's certification number,
c. The date the certification expires, and
d. The radiographer's signature.

**B.** A registrant shall not allow an individual to act as a radiographer until the individual:
1. Receives copies of and instruction in the requirements of this Article, applicable Sections of Articles 4 and 10 and R12-1-107, the Agency registration or registrations under which the individual will perform industrial radiography, and the registrant's operating and emergency procedures;
2. Demonstrates an understanding of the registrant's registration and operating and emergency procedures by successful completion of a written or oral examination that covers the relevant material;
3. Receives training in:
a. Use of the registrant's radiation machine,
b. Daily inspection of the radiation machine, and
c. Use of radiation survey instruments; and
4. Demonstrates an understanding of the use of the radiation machines and survey instruments described in subsection (B)(3) by successful completion of a practical examination covering this material.

**C.** A registrant shall not allow an individual to act as a radiographer's assistant until the individual:
1. Receives copies of and instruction in the requirements of this Article, applicable Sections of Articles 4 and 10 and R12-1-107, the Agency registration or registrations under which the radiographer will perform industrial radiography, and the registrant's operating and emergency procedures;
2. Develops competence to use, under the personal supervision of the radiographer, the registrant's radiation machine and radiation survey instruments; and
3. Demonstrates understanding of the instructions provided under subsection (C)(1) by successfully completing a written test on the subjects covered and demonstrates competence using the hardware described in subsection (C)(2) by successfully completing a practical examination.

**D.** A registrant shall provide refresher safety training for each radiographer and radiographer's assistant at intervals that do not exceed 12 months.

**E.** Except where an individual serves both as a radiographer and an RSO, the RSO or the RSO's designee shall design and implement an inspection program to examine the job performance of each radiographer and radiographer's assistant and ensure that the Agency's rules and registration requirements, and the registrant's operating and emergency procedures, are followed. The inspection program shall:
1. Include observation of the performance of each radiographer and radiographer's assistant during an actual industrial radiographic operation, at intervals that do not exceed six months; and
2. Provide that, if a radiographer or a radiographer's assistant has not participated in an industrial radiographic operation for more than six months since the last inspection, each radiographer shall demonstrate knowledge of the training requirements in subsection (B)(3) and each radiographer's assistant shall demonstrate knowledge of the training requirements of subsection (C)(2) by a practical examination before these workers can participate in a radiographic operation.

**F.** A registrant shall maintain records of the training required in this Section, including certification documents, written and practical examinations, refresher safety training documents, and inspection documents, in accordance with subsection (I).

**G.** A registrant shall include the following subjects in the training required under subsection (A):
1. Fundamentals of radiation safety, including:
a. Characteristics of x-ray radiation;
b. Units of radiation dose and quantity of radioactivity;
c. Hazards of exposure to radiation;
d. Levels of radiation from x-ray machines; and
e. Methods of controlling radiation dose (time, distance, and shielding);
2. Radiation detection instruments, including:
a. Use, operation, calibration, and limitations of radiation survey instruments;
b. Survey techniques; and
c. Use of personnel monitoring equipment;
3. Equipment topics, including:
a. Operation and control of radiation machines; and
b. Inspection and maintenance of each radiation machine and survey instrument;
4. The requirements of pertinent Agency rules; and
5. Case histories of accidents in radiography.

**H.** A registrant shall maintain records of radiographer certification in accordance with subsection (I)(1) and provide proof of certification as required in subsection (A)(1).

**I.** A registrant shall maintain the following records for three years after each record is made:
1. Records of training for each radiographer and each radiographer's assistant. For radiographers, the records shall include radiographer certification documents and verification of certification status. All records shall include copies of written tests, dates of oral and practical examinations, and names of individuals who conducted and took the oral and practical examinations; and
2. Records of annual refresher safety training and semi-annual inspections of job performance for each radiographer and each radiographer's assistant. The records for the annual refresher safety training shall list topics discussed during training, the date of training, and names of each instructor and attendee. For inspections of job performance, the records shall include a list of items checked during the inspection and any non-compliance observed by the RSO.

**Historical Note**
New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**Appendix A. Standards for Organizations that Provide Radiography Certification**

Note: For purposes of this Article an "independent certifying organization" means an organization that meets all of the criteria in this Appendix.

I. Requirements for an Organization that Provides Radiographer Certification

To qualify to provide radiography certification, an organization shall:

**A.** Be a society or association, with members who participate in, or have an interest in, the field of industrial radiography;
**B.** Not restrict membership because of race, color, religion, sex, age, national origin, or disability;
**C.** Have a certification program that is open to nonmembers, as well as members;
**D.** Be an incorporated, nationally recognized organization that is involved in setting national standards of practice within its fields of expertise;
**E.** Have a staff comparable to other nationally recognized organizations, a viable system for financing its operations, and a policy-and decision-making review board;
**F.** Have a set of written, organizational by-laws and policies that address conflicts of interest and provide a system for monitoring and enforcing the by-laws and policies;
**G.** Have a committee, with members who can carry out their responsibilities impartially, review and approve the certification guidelines and procedures, and advise the organization's staff in implementing the certification program;
**H.** Have a committee, with members who can carry out their responsibilities impartially, review complaints against certified individuals, and determine sanctions;
**I.** Have written procedures that describe all aspects of the organization's certification program;
**J.** Maintain records of the current status of each individual's certification and administration of the certification program;
**K.** Have procedures to ensure that certified individuals are provided due process with respect to administration of the certification program, including a process for becoming certified and a process for imposing sanctions against certified individuals;
**L.** Have procedures for proctoring examinations and qualifying proctors. The organization, through these procedures, shall ensure that an individual who proctors an examination is not employed by the same company or corporation (or a wholly-owned subsidiary of the company or corporation) that employs an examinee;
**M.** Exchange information about certified individuals with the Agency, other independent certifying organizations, the NRC, or Agreement States and allow periodic review of its certification program and related records; and
**N.** Provide a description to the Agency of its procedures for choosing examination sites and providing a favorable examination environment.

II. Requirements for a Certification Program

An independent certifying organization shall ensure that its certification program:

**A.** Requires an applicant for certification to:
1. Obtain training in the subjects listed in R12-1-1146(G), and
2. Satisfactorily complete a written examination that covers these subjects;

**B.** Require an applicant for certification to provide documentation demonstrating that the applicant has:
1. Received training in the subjects listed in R12-1-1146(G);
2. Satisfactorily completed the on-the-job training required in R12-1-1146(A); and
3. Received verification from a registrant that the applicant has demonstrated the capability of independently working as a radiographer;

**C.** Provides procedures that protect examination questions from disclosure;
**D.** Provides procedures for denying certification to an applicant and revoking, suspending, and reinstating a certificate;
**E.** Provides a certification period that is not less than three years or more than five years, procedures for renewing certifications and, if the procedures allow renewals without examination, a system for assessing evidence of recent full-time employment and annual refresher training; and
**F.** Provides a timely response to inquiries, by telephone or letter, from members of the public, about an individual's certification status.

III. Requirements for a Written Examination

An independent certifying organization shall ensure that its examination:

**A.** Is designed to test an individual's knowledge and understanding of the subjects listed in R12-1-1146(G) or equivalent NRC or Agreement State requirements;
**B.** Is written in a multiple-choice format; and
**C.** Has psychometrically valid questions drawn from a question bank and based on the material in R12-1-1146(G).

**Historical Note**
New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

## ARTICLE 12. ADMINISTRATIVE PROVISIONS

### R12-1-1201. Timeliness

**A.** Any application, request, response, or report required by any rule, order, application, or letter shall be considered timely if it is postmarked on or before the due date, or hand-delivered to the Agency office before 5:00 p.m. on the due date. If the due date falls on a Saturday, a Sunday, or a legal holiday, the due date is extended to the end of the next day that is not a Saturday, a Sunday, or legal holiday.
**B.** As used in this Article, "working days" are all days other than Saturdays, Sundays, or legal holidays prescribed in A.R.S. § 1-301.

**Historical Note**
Adopted effective June 23, 1983 (Supp. 83-3). Section repealed, new Section adopted effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3).

### R12-1-1202. Administrative Hearings

**A.** All hearings shall be governed by Title 41, Chapter 6, Article 10.
**B.** If the Radiation Regulatory Hearing Board is conducting a hearing, all motions and rulings shall be in writing, except those made during the hearing may be oral. The Board shall ensure that any agreements reached during a conference are incorporated in the record, and that all hearings are recorded.
**C.** If it is necessary for an administrative law judge or the Board to visit the site of an alleged violation or activity that is regulated by the Agency in order to supplement testimonial or documentary evidence presented at the hearing, the party that proposed the visit shall enter the purpose of the visit and all pertinent observations into the record.

**Historical Note**
Adopted effective June 23, 1983 (Supp. 83-3). Section repealed, new Section adopted effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3).

### R12-1-1203. Procedures for Rulemaking Public Hearings

**A.** Hearings on proposed rulemaking by the Agency shall be held before the Director or another person designated by the Director to act as the hearing officer.

**B.** All hearings shall be governed by the Administrative Procedure Act, A.R.S. §§ 41-1021, 41-1021.01 through 41-1025, 41-1028, 41-1029, and 41-1031.
**C.** The hearing shall be recorded and shall be retained as part of the record of the rulemaking.
**D.** A written summary of the comments presented shall be prepared along with a written response to the comments by the Agency staff and retained with the record of the rulemaking.
**E.** The request for hearing shall identify the rule involved or propose a new rule.

**Historical Note**
Adopted effective June 23, 1983 (Supp. 83-3). Section repealed, new Section adopted effective January 2, 1996 (Supp. 96-1).

**R12-1-1204. Initiation of Administrative Hearings**
**A.** An administrative hearing shall be initiated by the Director or commenced in response to the request of any person directly affected by an order of the Director or a proposed licensing or registration action by the Agency.
**B.** If the Director initiates an administrative hearing pursuant to R12-1-1220, the order may incorporate a notice of hearing; otherwise a notice of any hearing and the notice of violation shall be issued separately.
**C.** For any hearing on a proposed licensing or registration action, only a notice of hearing shall be issued.
**D.** A notice of hearing shall specify the time, place, and nature of the hearing and may include specification of the legal authority and jurisdiction under which the hearing is to be held; the particular sections of the statutes, rules, or license conditions involved; the amount of the penalty and other sanctions proposed, if appropriate; and a statement of matters asserted and issues involved.
**E.** A hearing may be requested by filing a written request for hearing with the Director within the time limit specified in the pertinent order or notice. A request for hearing on a regulatory action not subject to public notice requirements may be filed at any time, provided that a request to reconsider a licensing or registration action shall be filed within 30 days of the issuance of the licensing or registration action.
1. The request for a hearing to appeal an order shall identify the order which the person desires to appeal and include a statement reciting the matters asserted, issues involved, and the applicable statutes or rules. The Agency shall respond within 30 calendar days to the person and forward the request and response to the Chairperson of the Board.
2. The request for a hearing to appeal a licensing or registration action shall identify the action appealed. The Agency shall respond within 30 calendar days to the person and forward the request and response to the Chairperson of the Board.
3. The request for hearing shall include a statement identifying the interest claimed to be affected by the action. If a statement is not provided or is clearly insufficient, the Chairperson may deny the request and notify the person of that action.
4. If the request for hearing is denied for insufficiency, the requestor shall have five days from the notice of denial within which to file an amended request for hearing. The amended request shall refer back to the original request for hearing.

**Historical Note**
Adopted effective January 2, 1996 (Supp. 96-1).

**R12-1-1205. Intervention in Administrative Hearings; Director as a Party**
**A.** Any person may submit a timely motion to intervene in a proceeding if an unconditional right to intervene is granted by law or the applicant claims an interest to any property or transaction affected by the proceeding.
**B.** A motion to intervene shall be in writing and shall state the reason why the applicant should be allowed to intervene. If the applicant claims an interest in property or in a transaction affected by the proceeding, the applicant shall demonstrate that the result of the proceeding may as a practical matter impair or impede protection of that interest.
**C.** The applicant shall serve the motion upon the administrative law judge or the Board, as appropriate, and the Director as a party at least five working days before the hearing. An application for leave to intervene shall not be granted, if by doing so, the issues will be unduly broadened.
**D.** If two or more persons have substantially similar positions, the administrative law judge may declare them a class of interested persons for purposes of the hearing. The members of a class shall designate one person to be spokesperson for the class. More than one class may be established for a hearing.
**E.** The Director is party to all administrative hearings.

**Historical Note**
Adopted effective June 23, 1983 (Supp. 83-3). Section repealed, new Section adopted effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3).

**R12-1-1206. Repealed**

**Historical Note**
Adopted effective January 2, 1996 (Supp. 96-1). Section repealed by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3).

**R12-1-1207. Rehearing or Review**
**A.** The Board may grant a rehearing or review of a decision for any of the following reasons, materially affecting a party's rights:
1. Irregularity in the administrative proceedings or any order or abuse of discretion, that deprived a party of a fair hearing;
2. Misconduct of the Board, an administrative law judge, or the prevailing party;
3. Accident or surprise that could not have been prevented by ordinary prudence;
4. Newly discovered material evidence that could not, with reasonable diligence have been discovered and produced at the original hearing;
5. Excessive or insufficient penalties;
6. Error in the admission or rejection of evidence or other errors of law occurring at the administrative hearing or during the progress of the proceedings;
7. That the decision is not justified by the evidence or is contrary to law.

**B.** The Board may affirm or modify a decision or grant a rehearing to all or any of the parties and on all or part of the issues for any of the reasons listed in subsection (A). An order modifying a decision or granting a rehearing shall specify with particularity the ground or grounds for the order. A rehearing shall cover only the subject matters specified in the order.
**C.** No later than 15 working days after the date on the decision the Board may, on its own initiative, order a rehearing or review of its decision for any reason for which it might have granted a rehearing on motion of a party. After giving the parties notice and an opportunity to be heard on the matter, the

Board may grant a motion for rehearing or review for a reason not stated in the motion.

**D.** If a motion for rehearing or review is based upon affidavits, they shall be served with the motion. An opposing party may, within 30 calendar days after service, serve opposing affidavits. This period of time may be extended by the Board if good cause is shown or a written stipulation is received from both parties. The Board may permit reply affidavits.

**Historical Note**
Adopted effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3).

**R12-1-1208. Repealed**

**Historical Note**
Adopted effective January 2, 1996 (Supp. 96-1). Section repealed by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3).

**R12-1-1209. Notice of Violation**

**A.** Except as provided in R12-1-1220, the Agency shall issue a notice of violation and provide time, as specified in R12-1-1210, for the registrant or licensee to respond before the Director issues any order to modify, suspend, or revoke a license or registration, or to impose a civil penalty.

**B.** The notice shall specify:
1. The severity level and circumstances of the alleged violation;
2. The particular statute, rule, or registration or license condition violated; and
3. The division of the registration or license.

**C.** The notice shall specify a civil penalty if one is proposed by the Agency.

**Historical Note**
Adopted effective January 2, 1996 (Supp. 96-1). 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. 4302, effective November 14, 2003 (Supp. 03-3).

**R12-1-1210. Response to Notice of Violation**

**A.** Except as provided in subsection (D), within 30 calendar days of the date of the notice, or longer time period specified in the notice, the person charged with the violation shall submit a written response that includes a description of:
1. The actions taken to achieve compliance and the results of the actions;
2. The actions that are proposed and the date when full compliance is expected to be achieved; and
3. If the violation is a repeat violation, why corrective actions taken previously did not prevent the violation from recurring and why the new actions will be effective.

**B.** If the person charged with a violation submits a timely response, the Director, in consideration of the answer and the severity level of the violation, shall do one of the following:
1. Issue an initial order conditionally imposing the full amount of the proposed civil penalty and any other sanctions proposed;
2. Issue an initial order conditionally mitigating or waiving the proposed civil penalty under R12-1-1214(B);
3. Waive the penalty as authorized under R12-1-1216(C);
4. Enter into a consent agreement as authorized under R12-1-1222.

**C.** If the Agency does not receive an adequate and timely response to the notice, the Director shall issue an initial order conditionally imposing any or all sanctions and civil penalties proposed in the notice of violation. If no civil penalty was proposed, the initial order may impose the base civil penalty listed in R12-1-1216.

**D.** Response to the notice of violation as otherwise required in this Section may be waived by the Agency, if the Agency determines that a response is not required.

**Historical Note**
Adopted effective January 2, 1996 (Supp. 96-1). Amended 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. 4302, effective November 14, 2003 (Supp. 03-3).

**R12-1-1211. Initial Orders**

**A.** Initial orders are valid for 30 calendar days after the date of the order, or until the other time specified in the order, during which time the person charged may:
1. Pay the civil penalty proposed and accept any proposed sanction, or
2. Request a hearing before the Board.

**B.** If a timely request for a hearing is not received, the order shall become final.

**Historical Note**
Adopted effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2).

**R12-1-1212. Request for Hearing in Response to an Initial Order**

**A.** In a request for a hearing, a person charged with a violation shall include a statement of the issues and the explanations and the arguments supporting denial of the violation or demonstrating extenuating circumstances, errors in notice, or any other reasons for not imposing the civil penalty, sanction, or both.

**B.** The statement shall identify all issues. The failure to include an issue may, at the option of the Board, foreclose consideration of that issue. If a statement is not provided or is insufficient, the Board may summarily determine the issues.

**C.** The person charged may admit the violation and request a reduction of the proposed civil penalty based on extenuating circumstances.

**D.** The person charged may waive oral proceedings and request dismissal of any or all of the charged violations, reduction of the civil penalties, or modification of any other imposed sanction based on consideration by the Board of the written statement.

**Historical Note**
Adopted effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2).

**R12-1-1213. Severity Levels of Violations**

**A.** The following violations are classified as severity level I violations:
1. Any failure, malfunction, or insufficiency of a safety system which may result in
   a. Radiation exposure to a person,
   b. A concentration of radionuclides; or
   c. A radiation level,in excess of 10 times the limits specified in 12 A.A.C.1, or 10 times the prescribed therapeutic patient dose.
2. Any inaccurate or incomplete information that is intentionally provided by a licensee or registrant official, and if the information had been complete and accurate at the

time it was provided, would have likely resulted in action such as an immediate order required to protect the public health and safety.

3. Any information that the Agency requires be kept by a licensee or registrant that is incomplete or inaccurate because of falsification by or with the knowledge of a licensee or registrant official, and if the information had been complete and accurate at the time it was reviewed by the Agency, would have likely resulted in action such as an immediate order required to protect the public health and safety.
4. Any concealment or attempted concealment of a severity level I violation of the Act, 12 A.A.C. 1, or a license condition. This is a separate violation in addition to the original violation.
5. Any concealment or attempted concealment of a severity level II violation of the Act, 12 A.A.C. 1, or a license condition. This violation shall increase the severity level of the original violation by one level.
6. For the purposes of subsections (A)(2) and (3) above the term "licensee or registrant official" means the owner, a partner, a corporate officer, a radiation safety officer, the individual signing an application for a license or registration, or the chairman of any radiation safety committee supervising the radiation safety program of the licensee or registrant.

**B.** The following violations are classified as severity level II violations:

1. Any failure, malfunction, or insufficiency of a safety system which may result in:
   a. Radiation exposure to a person,
   b. A concentration of radionuclides, or
   c. A radiation level,in excess of two times the limits specified in 12 A.A.C. 1, or two times the prescribed therapeutic patient dose.
2. Any attempt to prevent an Agency inspection.
3. Any concealment or attempted concealment of a severity level III violation of the Act, 12 A.A.C. 1, or a license condition by a licensee or registrant official as defined in subsection (A)(6). This violation shall increase the severity level of the original violation by one level.
4. Significant information provided and designated by a licensee or registrant and not previously provided to the Agency because of careless disregard on the part of a licensee official or registrant.

**C.** The following violations are classified as severity level III violations:

1. Any failure, malfunction, or insufficiency of a safety system, or loss of control over a radiation source, which may result in:
   a. Radiation exposure to a person,
   b. A concentration of radionuclides, or
   c. A radiation level in excess of the limits specified in 12 A.A.C. 1, or 20% higher than the prescribed therapeutic patient dose.
2. Any concealment or attempted concealment of a severity level IV or V violation of the Act, 12 A.A.C. 1, or a registration or license condition. This violation shall increase the severity level of the original violation by one level.
3. Any violation of the safety requirements for the use, storage, disposal, or the preparation for transportation of sources of radiation, as prescribed in the Act, 12 A.A.C. 1, or in a license or registration condition, provided the violation does not meet the criteria for a severity level I or II violation and the licensee or registrant does not maintain a radiation protection program meeting the requirements of R12-1-407.
4. Any factually incorrect statement upon which the Agency relied or would have relied in consideration of any action.
5. Any unlawful attempt to interfere with the progress of an inspection by the Agency.
6. The acquisition of any source of radiation without the applicable current registration or license, unless otherwise authorized by these rules; or use of the source outside the scope of the current registration or license.
7. The continued use of sources of radiation after April 1, if the annual fee has not been paid for the current year.

**D.** The following violations are classified as severity level IV violations:

1. Any violation of R12-1-407;
2. Any violation of the safety requirements for the use, storage, disposal, or preparation for transportation of sources of radiation, prescribed in the Act, 12 A.A.C. 1, or in a license or registration condition, provided the violation does not meet the criteria for a severity level I, II or III violation;
3. Failure to maintain records of mammography quality control tests required in R12-1-614.
4. Any failure to comply with the reporting requirements in the Act or 12 A.A.C. 1.

**E.** The following violations are classified as severity level V violations:

1. Failure of a registrant or a licensee to comply with the recordkeeping requirements of:
   a. The Act;
   b. 12 A.A.C. 1; or
   c. A registration or facility certification, or license condition, provided that all safety requirements prescribed in the Act, 12 A.A.C. 1, or in a license or registration condition are met or otherwise demonstrated.
2. If compliance with all safety requirements cannot be demonstrated by the registrant or licensee the failure to comply with the recordkeeping requirements is classified as a level IV violation.

**Historical Note**

Adopted effective January 2, 1996 (Supp. 96-1). Amended 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. 4302, effective November 14, 2003 (Supp. 03-3).

**R12-1-1214. Mitigating Factors**

**A.** The Agency may refrain from issuing a Notice of Violation for Severity Level IV or V violations identified by the registrant or licensee provided the severity level IV or V violations are identified in an inspection report, the report includes a brief description of the corrective action, and the violation meets all of the following criteria:

1. It was identified by the licensee, as a result of an event discovered by the licensee or registrant;
2. It was not a violation that could reasonably be expected to have been prevented by the licensee's or registrant's corrective action for a previous violation or a previous licensee or registrant finding;
3. It was or will be corrected within a reasonable time, by specific corrective action committed to by the registrant or licensee by the end of the inspection. The corrective action shall include comprehensive measures that will prevent reoccurrence;
4. It was not a willful violation or, if it was willful:

a. The violation was reported to the Agency;
b. The violation appears to be the isolated action of an employee without management involvement and the violation was not caused by lack of management oversignt;
c. Significant remedial action was taken by the licensee or registrant, demonstrating the seriousness of the violation to all affected personnel.

**B.** The Director may:
1. Reduce the scheduled civil penalty, including any augmentation, by 50% for the discovery, remedy, and voluntary reporting of a severity level I or II violation by the registrant or licensee; or
2. Waive the scheduled civil penalty, including augmented civil penalties, for the discovery, remedy, and voluntary reporting of a severity level III, IV, or V violation by the registrant or licensee. For the purposes of this rule, "voluntary reporting" means that the registrant or licensee has notified the Agency of a violation, the reporting of which may or may not be required under 12 A.A.C. 1.

**Historical Note**
Adopted effective January 2, 1996 (Supp. 96-1).
Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2).

**R12-1-1215. License and Registration Divisions**

**A.** Each registrant or license type is classified into one of three administrative sanction divisions.
1. Division I licenses and registrations:
a. Broad Academic Class A,
b. Broad Academic Class B,
c. Broad Academic Class C,
d. Broad Industrial Class A,
e. Broad Medical,
f. Class C Laser Facility,
g. Distribution,
h. Fixed Gauge Class A,
i. Industrial Radiography Class A,
j. Low Level Radioactive Waste Disposal Site,
k. Major Accelerator Facility,
l. Medical Materials Class A,
m. Medical Teletherapy,
n. NORM Commercial Disposal Site,
o. Nuclear Laundry,
p. Nuclear Pharmacy,
q. Open Field Irradiator,
r. Secondary Uranium Recovery,
s. Waste Processor Class A,
t. Well Logging,
u. X-Ray Machine Class A.
2. Division II licenses and registrations:
a. Broad Industrial Class B,
b. Broad Industrial Class C,
c. Class B Industrial Radiofrequency Facility,
d. Class B Laser Facility,
e. Class C Industrial Radiofrequency Facility,
f. Fixed Gauge Class B,
g. Health Physics Class A,
h. Industrial Radiation Machine,
i. Industrial Radiography Class B,
j. Laser Light Show,
k. Limited Academic,
l. Medical Imaging Facility,
m. Medical Laser,
n. Medical Materials Class B,
o. Medical Radiofrequency Device Facility,
p. NORM Commercial Disposal Site,
q. Research and Development,
r. Self Shielded Irradiator,
s. Tanning Facility,
t. Waste Processor Class B,
u. X-Ray Machine Class B.
3. Division III licenses and registrations:
a. Class A Industrial Radiofrequency Facility,
b. Class A Laser Facility,
c. Gas Chromatograph,
d. General Depleted Uranium,
e. General Industrial,
f. General Medical,
g. General Veterinary Medicine,
h. Health Physics Class B,
i. Laboratory,
j. Leak Detector,
k. Limited Industrial,
l. Medical Materials Class C,
m. Other Ionizing Radiation Machine,
n. Other Nonionizing Radiation Machine,
o. Portable Gauge,
p. Possession Only,
q. Radioactive waste transfer-for-disposal,
r. Unclassified,
s. Veterinary Medicine,
t. X-ray Machine Class C.
u. Class A Medical (non-cosmetic) Radiofrequency Facility,
v. Class B Medical (non-cosmetic) Radiofrequency Facility,
w. Class C Medical (non-cosmetic) Radiofrequency Facility,
x. Class D Medical (non-cosmetic) Radiofrequency Facility.

**B.** Any person required by the Act to register the use of a general license with the Agency, or to obtain a specific license from the Agency, is considered a licensee of the appropriate type notwithstanding the failure of the person to register or obtain a license.

**C.** The Agency shall classify each person that possesses an out-of-state specific license for the use of radioactive material and operates in Arizona under reciprocal recognition, as prescribed in R12-1-320 and authorized in R12-1-1302(D)(16), by placing the person into the administrative sanction division listed in subsection (A) that best defines the out-of-state, licensed activities.

**D.** For administrative purposes, the following persons are classified with the Division III licensees and registrants in subsection (A)(3):
1. Any person not required to register the use of a general license,
2. Any person not required to obtain a specific license,
3. Any person not required to register a source of radiation who violates the Act or 12 A.A.C. 1, and
4. Any person registered to provide x-ray machine service.

**Historical Note**
Adopted effective January 2, 1996 (Supp. 96-1). Amended 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. 4302, effective November 14, 2003 (Supp. 03-3). 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). Amended by final rulemaking at 21 A.A.R. 289, effective April 6, 2015 (Supp. 15-1).

**R12-1-1216. Civil Penalties**

**A.** Except as augmented by R12-1-1217, the schedule of civil penalties is as follows:
1. Severity level I violations:
   a. Division I registration or license -- $4,000;
   b. Division II registration or license -- $3,000;
   c. Division III registration or license -- $2,000.
2. Severity level II violations:
   a. Division I registration or license -- $3,000;
   b. Division II registration or license -- $2,000;
   c. Division III registration or license -- $1,000.
3. Severity level III violations:
   a. Division I registration or license -- $2,000;
   b. Division II registration or license -- $1,000;
   c. Division III registration or license -- $500.
4. Severity level IV violations:
   a. Division I registration or license -- $1,000;
   b. Division II registration or license -- $500;
   c. Division III registration or license -- $250.
5. Severity level V violations:
   a. Division I registration or license -- $500,
   b. Division II registration or license -- $250,
   c. Division III registration or license -- $125.

**B.** Payment of civil penalties for severity level I and severity level II violations may not be avoided merely by rectifying the condition; however, the Board may mitigate or waive the penalty upon determining a violation meets all of the following:
1. It was not a violation that could reasonably be expected to have been prevented by the licensee's or registrant's corrective action for a previous violation or a previous licensee or registrant finding;
2. It was or will be corrected within the time given for corrections, by specific corrective action committed to by the licensee or registrant by the end of the inspection, which includes immediate and comprehensive measures to prevent recurrence;
3. It was not a willful violation.

**C.** The Director or Board shall waive payment of penalties for severity level III through severity level V violations provided:
1. The violation is not subject to augmentation under R12-1-1217; and
2. The registrant or licensee submits a timely and adequate response to the notice; rectifies the conditions which appear to have caused the violation; and complies with the Act, 12 A.A.C. 1, registration, and license conditions.

**Historical Note**
Adopted effective January 2, 1996 (Supp. 96-1).
Amended 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. 4302, effective November 14, 2003 (Supp. 03-3).

**R12-1-1217. Augmentation of Civil Penalties**

**A.** A continuing violation, for the purposes of calculating the proposed civil penalty, is considered a separate violation for each day it continues. The second (or successive) day of a continuing violation is not considered a repeat violation of the violation occurring on the first day.

**B.** If a second severity level I violation is committed within five years, the Agency shall increase the base civil penalty by 100%, provided the registration or license is not revoked under R12-1-1219.

**C.** If a second severity level II violation is committed within a period of five years, the Agency shall increase the base civil penalty by 50%, provided the registration or license is not revoked under R12-1-1219.

**D.** If a severity level III violation is repeated within five years, the Agency shall increase the base civil penalty by 50%. If the same severity level III violation is repeated a second time within five years, the base civil penalty shall be increased by 100%, provided the registration or license is not revoked under R12-1-1219.

**E.** If a severity level IV violation is repeated within five years, the Agency shall propose the base d civil penalty.
1. If the same violation occurs three times within five years, the Agency shall increase the base civil penalty by 50%.
2. If the same violation occurs four times within five years, the Agency shall increase the base civil penalty by 100%, provided the registration or license is not revoked under R12-1-1219.

**F.** If more than three severity level V violations are observed during two consecutive inspections, the Agency shall impose a civil penalty for each violation. The base civil penalty for each violation is the base civil penalty assessed for a severity level V violation. If the inspection shows repetition of a violation the base civil penalty for each repeat violation is the base civil penalty assessed for a severity level IV violation. Subsection (E) does not apply to penalties under this subsection.

**G.** Other rights and procedures are not affected by the repeat nature of a violation.

**H.** A person may avoid the penalties in subsections (D) and (E) by demonstrating to the Director in the response to the penalty that the violation meets all of the following criteria:
1. It was not a violation that could reasonably be expected to have been prevented by the licensee's or registrant's corrective action for a previous violation or a previous licensee or registrant finding;
2. It was or will be corrected within the time given for correction, by specific corrective action committed to by the licensee or registrant by the end of the inspection, which includes immediate and comprehensive measures to prevent recurrence;
3. It was not a willful violation.

**I.** Notwithstanding any other provision of this Section, the Agency shall not impose a penalty that exceeds a maximum of $5,000 for each violation for each day up to a maximum of $25,000 for any 30-day period.

**Historical Note**
Adopted effective January 2, 1996 (Supp. 96-1).
Amended 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. 4302, effective November 14, 2003 (Supp. 03-3).

**R12-1-1218. Payment of Civil Penalties**

**A.** A person shall pay civil penalties imposed under this Article by certified check or money order payable to the Agency and mailed or delivered to the Agency at the address shown on the notice of violation.

**B.** Payment of a civil penalty is due 30 calendar days after the effective date of the final order imposing the civil penalties, unless an alternate payment schedule is agreed upon before that date. A payment schedule shall not extend beyond one year after the due date.

**Historical Note**
Adopted effective January 2, 1996 (Supp. 96-1).
Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2).

**R12-1-1219. Additional Sanctions-Show Cause**

**A.** If a severity level I violation is repeated or if any second severity level I violation is committed within 10 years, the Agency

shall require the registrant or licensee to show cause why the registration or license should not be suspended or revoked.

**B.** If any second severity level II violation is committed within five years, or if a severity level II violation involving radioactive effluent releases, excessive radiation levels, or radiation overexposure to an individual is committed within five years of a similar severity level I violation, the Agency shall require the registrant or licensee to show cause why the registration or license should not be suspended or revoked.

**C.** If repeated or different severity level III violations are committed on three separate occasions within any five year period, the Agency may require the registrant or licensee to show cause why the registration or license should not be suspended or revoked.

**Historical Note**
Adopted effective January 2, 1996 (Supp. 96-1). Amended 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. 4302, effective November 14, 2003 (Supp. 03-3).

**R12-1-1220. Escalated Enforcement**

**A.** The Director may issue an order to suspend, revoke, or modify a registration or license, or impound a radiation source for:
1. Any severity level I violation; or
2. Any of the following occurring within a five-year period:
   a. A repeat severity level II violation,
   b. A different second severity level II violation, or
   c. A severity level II violation after a severity level I violation.

**B.** The Director may issue an order impounding the radiation source or suspending, revoking, or modifying the registration or license upon determining that conditions exist which cause a potential for a severity level I or severity level II violation.

**C.** The Agency shall hold hearings according to A.R.S. § 30-688.

**D.** An order to impound a radiation source, or an order to suspend, revoke, or modify a registration or a license shall remain in effect until the order is suspended or modified by the Board according to A.R.S. § 30-688.

**Historical Note**
Adopted effective January 2, 1996 (Supp. 96-1). Amended 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. 4302, effective November 14, 2003 (Supp. 03-3).

**R12-1-1221. Reserved**

**R12-1-1222. Enforcement Conferences**

**A.** An enforcement conference consists of a meeting in person between management personnel of the registrant or licensee and the Agency.

**B.** The enforcement conference is informal; however, the Agency shall make a record of items discussed and decisions reached. Statements made at the conference shall not be introduced in evidence at a formal hearing unless all parties have consented.

**C.** Based on the results of the conference, the Agency may:
1. Dismiss the notice of violation;
2. Enter into a consent agreement; or
3. Continue with, or initiate, formal proceedings.

**Historical Note**
Adopted effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2).

**R12-1-1223. Registration and Licensing Time-frames**

The Agency shall perform an administrative completeness review and substantive review of an application for a new or renewal license or registration; or an amendment to a license or registration within the time-frames in Table A. The Agency shall review an application for an amendment to an existing license or registration that changes the license category listed in R12-1-1306, using the time-frames specified for the requested category.

**Historical Note**
Adopted effective December 9, 1998 (Supp. 98-4). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3).

**Table A. Registration and Licensing Time-frames**

## REGISTRATION AND LICENSING TIME-FRAMES

| License or Registration category in R12-1-1306 | Administrative Completeness Review Time-frame, in days | Substantive Review Time-frame, in days | Overall Time-frame, in days |
|---|---|---|---|
| A1 | 90 | 30 | 120 |
| A2 | 90 | 30 | 120 |
| A3 | 90 | 30 | 120 |
| A4 | 60 | 30 | 90 |
| B1 | 90 | 30 | 120 |
| B2 | 90 | 30 | 120 |
| B3 | 90 | 30 | 120 |
| B4 | 90 | 30 | 120 |
| B5 | 90 | 30 | 120 |
| B6 | 40 | 20 | 60 |
| C1 | 60 | 30 | 90 |
| C2 | 60 | 30 | 90 |
| C3 | 60 | 30 | 90 |
| C4 | 60 | 30 | 90 |
| C5 | 60 | 30 | 90 |
| C6 | 60 | 30 | 90 |

| | | | |
|---|---|---|---|
| C7 | 60 | 30 | 90 |
| C8 | 90 | 30 | 120 |
| C9 | 60 | 30 | 90 |
| C10 | 40 | 20 | 60 |
| C11 | 90 | 30 | 120 |
| C12 | 90 | 30 | 120 |
| C13 | 90 | 30 | 120 |
| C14 | 90 | 30 | 120 |
| C15 | 90 | 30 | 120 |
| C16 | 90 | 30 | 120 |
| C17 | 90 | 30 | 120 |
| D1 | 90 | 30 | 120 |
| D2 | 90 | 30 | 120 |
| D3 | 90 | 30 | 120 |
| D4 | 40 | 20 | 60 |
| D5 | 40 | 20 | 60 |
| D6 | 90 | 30 | 120 |
| D7 | 40 | 20 | 60 |
| D8 | 60 | 30 | 90 |
| D9 | 90 | 30 | 120 |
| D10 | 90 | 30 | 120 |
| D11 | 1095 | 365 | 1460 |
| D12 | 730 | 180 | 910 |
| D13 | 365 | 90 | 455 |
| D14 | 90 | 30 | 120 |
| D15 | 40 | 20 | 60 |
| D16 | 20 | 10 | 30 |
| D17 | 40 | 20 | 60 |
| D18 | 90 | 30 | 120 |
| D19 | 365 | 120 | 485 |
| E1 | 40 | 20 | 60 |
| E2 | 40 | 20 | 60 |
| E3 | 40 | 20 | 60 |
| E4 | 40 | 20 | 60 |
| E5 | 90 | 30 | 120 |
| E6 | 90 | 30 | 120 |
| F1 | 40 | 20 | 60 |
| F2 | 40 | 20 | 60 |
| F3 | 40 | 20 | 60 |
| F4 | 40 | 20 | 60 |
| F5 | 20 | 10 | 30 |
| F6 | 40 | 20 | 60 |
| F7 | 40 | 20 | 60 |
| F8 | 40 | 20 | 60 |
| F9 | 40 | 20 | 60 |
| F10 | 40 | 20 | 60 |
| F11 | 40 | 20 | 60 |
| F12 | 40 | 20 | 60 |
| F13 | 40 | 20 | 60 |
| F14 | 40 | 20 | 60 |
| F15 | 40 | 20 | 60 |
| F16 | 90 | 30 | 120 |

Footnote: “administrative completeness review time-frame”; “substantive review time-frame,” and “overall time-frame” are defined in A.R.S. § 41-1072.

**Historical Note**

Adopted effective December 9, 1998 (Supp. 98-4). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). Amended by final rulemaking at 21 A.A.R. 289, effective April 6, 2015 (Supp. 15-1).

## ARTICLE 13. LICENSE AND REGISTRATION FEES

**R12-1-1301. Definition**

"Combined" means the Agency has granted authorized activities contained in two or more license types in a single license document, requiring the payment of a single license fee for the more expensive license of the planned combination.

**Historical Note**

Adopted effective November 19, 1982 (Supp. 82-6). Amended effective November 28, 1983 (Supp. 83-6). Amended subsection (B) and added a new subsection (C) effective November 28, 1986 (Supp. 86-6). Section repealed, new Section adopted effective November 5, 1993 (Supp. 93-4). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2).

**R12-1-1302. License and Registration Categories**

**A.** Category A licenses are those specific licenses which authorize a school, college, university, or other teaching facility to possess and use radioactive materials for instructional or research purposes.

1. A broad academic class A license is any category A license which meets the specifications of R12-1-310(A)(1).
2. A broad academic class B license is any category A license other than a broad academic class A license which meets the specifications of R12-1-310(A)(2).
3. A broad academic class C license is any category A license other than a broad academic class A or B license which meets the specifications of R12-1-310(A)(3).
4. A limited academic license is any category A license which authorizes only those radioisotopes, forms, and quantities individually specified in the license.

**B.** Category B licenses are those specific or general licenses which authorize the application of radioactive material or the radiation from it to a human being for medical diagnostic, therapeutic, or research purposes, or the use of radioactive material in medical laboratory testing. Except for a type B6, general medical license, the Agency shall not combine a category B license with a license of any other category.

1. A broad medical license is any category B license which meets the specifications of R12-1-310(A)(1) and meets the requirements of 12 A.A.C. 1, Article 7. A broad medical license may authorize any medical use other than teletherapy.
2. A medical materials class A license is any specific category B license other than a broad medical license, which authorizes the use of radiopharmaceuticals and sealed sources containing radioactive materials for a therapeutic purpose in quantities which require hospitalization of the patient for radiation safety purposes. The license may authorize other radioactive materials and other medical uses, except teletherapy.
3. A medical materials class B license is any specific category B license which authorizes the diagnostic or therapeutic use, other than teletherapy, of radioactive materials only in limited quantities such that the patient need not be hospitalized for radiation safety purposes.
4. A medical materials class C license is any specific category B license which authorizes possession of specified radioisotopes only in the form of sealed sources for treatment of the eye or skin or for use in diagnostic medical imaging devices.
5. A medical teletherapy license is a specific category B license which solely authorizes radioisotopes in the form of multi-curie sealed sources for use in external beam therapy. The Agency shall not combine a medical teletherapy license with any other type of category B license.
6. A general medical license is a registration of the use of radioactive material pursuant to R12-1-306(D) or R12-1-306(E). A general medical license may be combined into a broad medical, medical materials class A, or medical materials class B license.

**C.** Category C licenses are those specific or general licenses authorizing the use of radioactive materials in any activity other than those authorized by a category A, B, or D license. Except as specifically authorized in this Section, the Agency shall not combine a category C license with any other type of license.

1. A broad industrial class A license is any category C license which meets the specifications of R12-1-310(A)(1). The Agency may combine a broad industrial class A license with any other category C license except industrial radiography, open field irradiator, or well logging licenses.
2. A broad industrial class B license is any category C license other than a broad industrial class A license which meets the specifications of R12-1-310(A)(2). The Agency may combine a broad industrial class B license with any other category C license except industrial radiography, open field irradiator, or well logging licenses.
3. A broad industrial class C license is any category C license other than a broad industrial class A or B license which meets the specifications of R12-1-310(A)(3). The Agency may combine a broad industrial class C license with any other category C license except industrial radiography, open field irradiator, or well logging licenses.
4. A limited industrial license is a specific category C license authorizing the possession of the radioactive materials authorized in R12-1-305(A), or R12-1-306(A), (C) or (F) for uses authorized in those subsections, but in quantities greater than authorized by those subsections.
5. A portable gauge license is a specific category C license which authorizes radioactive materials in the form of sealed sources for use in measuring or gauging devices designed and manufactured to be transported to the location of use. The Agency may combine a portable gauge license with any broad scope industrial license or a fixed gauge class A license.
6. A fixed gauge class A license is a specific category C license which authorizes the possession of 50 or more measuring or gauging devices containing radioactive materials, where each device is permanently mounted for use at a single location.
7. A fixed gauge class B license is a specific category C license which authorizes the possession of 1 through 49 measuring or gauging devices containing radioactive materials, where each device is permanently mounted for use at a single location.
8. A leak detector license is a specific category C license which authorizes the use of radioisotopes in the form of a gas to test hermetic seals on electronic packages.
9. A gas chromatograph license is a specific category C license which authorizes the use of radioactive materials as ionization sources in gas chromatography or electron capture devices.

10. A general industrial license means a registration of the use of a material, source, or device generally licensed pursuant to R12-1-305 or R12-1-306, except R12-1-305(B), R12-1-306(D), or R12-1-306(E).
11. An industrial radiography class A license is a specific category C license which authorizes industrial radiography using sealed radioisotope sources at specific facilities identified in the license conditions or at temporary field job sites.
12. An industrial radiography class B license is a specific category C license which authorizes industrial radiography using sealed radioisotope sources only at specific facilities identified in the license conditions.
13. An open field irradiator license is a specific category C license authorizing the use of radioisotopes in the form of sealed sources not permanently mounted within a shielding container, for irradiation of materials.
14. A self-shielded irradiator license is a specific category C license authorizing the use of radioisotopes in the form of sealed sources for irradiation of materials in a shielding device from which the sources are not removed during irradiation. The Agency may combine a self-shielded irradiator license with any broad license.
15. A well logging license is a specific category C license which authorizes the use of radioactive material in sealed or unsealed sources for wireline services or field tracer studies.
16. A research and development license is a specific category C license which authorizes a licensee to utilize radioactive material in unsealed and sealed form for industrial, scientific, or biomedical research, not including administration of radiation or radioactive material to human beings.
17. A laboratory license is a specific category C license which authorizes a licensee to perform specific in-vitro or in-vivo medical or veterinary testing, while possessing quantities of radioactive material greater than the general license quantities authorized in R12-1-306.

**D.** Category D licenses are the following specific radioactive material licenses. Except for type D4, general industrial; type D5, depleted uranium; type D8 and D9, health physics; and type D14, additional facilities licenses, the Agency shall not combine a category D license with any other license.

1. A distribution license is one which authorizes the commercial distribution of radioactive materials or radioisotopes in products to persons holding an appropriate general or specific license. The Agency shall ensure that a distribution license does not:
   a. Authorize distribution of radiopharmaceuticals or distribution to persons exempt from regulatory control, or
   b. Authorize any other use of the radioactive material. An appropriate category C license is required for possession of radioisotopes and their incorporation into products.
2. A nuclear pharmacy license is one which authorizes the preparation, compounding, packaging, or dispensing of radiopharmaceuticals for use by other licensees.
3. A nuclear laundry license is one authorizing the collection and cleaning of items contaminated with radioactive materials.
4. A general industrial license is a registration of a gauging device in accordance with R12-1-306(A). The Agency may combine a general industrial license with a Class A, B, or C broad industrial, limited industrial, portable gauge, or Class A or B fixed gauge license.
5. A depleted uranium general license is a registration of the use of the general license authorized pursuant to R12-1-305(C) or the use of depleted uranium as a concentrated mass or as shielding for another radiation source within a device or machine. The Agency may combine a depleted uranium general license with a medical teletherapy; Class A, B, or C broad industrial; portable gauge; Class A or B fixed gauge; Class A or B industrial radiography; or self-shielded irradiator license. For registration purposes an applicant shall follow the registration instructions in R12-1-305(C).
6. A veterinary medicine license is one which authorizes the use of radioactive materials for specific applications in veterinary medicine as authorized in the license.
7. A general veterinary medicine license is a registration of the use of the general license authorized in R12-1-306(E) in veterinary medicine.
8. A health physics class A license is one which authorizes the use of radioactive materials for performing instrument calibrations, processing leak test or environmental samples, or providing radiation dosimetry services.
9. A health physics class B license is one which authorizes only the collection, possession, and transfer of radioactive materials in the form of leak test samples for processing by others.
10. A secondary uranium recovery license is one which authorizes the extraction of natural uranium or thorium from an ore stream or tailing which is being or has been processed primarily for the extraction of another mineral. The Agency shall not combine a secondary uranium recovery license with any other license.
11. A low-level, radioactive waste disposal facility license is a license that is issued for a "disposal facility," as that term is used in R12-1-439 and R12-1-442, which has a closure or long-term care plan and is constructed and operated according to the requirements in 10 CFR 61, revised January 1, 2015, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.
12. A waste processor class A license is one authorizing the incineration, compaction, repackaging, or any other treatment or processing of low-level radioactive waste prior to transfer to another person authorized to receive or dispose of the waste. The Agency shall not combine a waste processor class A license with any other license.
13. A waste processor class B license is one which authorizes a waste broker to receive prepackaged, low-level radioactive waste from other licensees; combine the waste into shipments; and transfer the waste without treating or processing the waste in any manner and without repackaging except to place damaged or leaking packages into overpacks. The Agency shall not combine a waste processor class B license with any other license.
14. An additional facility license is an endorsement, by license condition to an existing specific license, authorizing one or more additional separate facilities where radioactive material may be stored or used for a period exceeding six months.
15. A possession-only license is a license of any other category which authorizes only the possession in storage, but no use of, the authorized materials. A license which has been suspended as an enforcement action is not considered a possession-only license.
16. A reciprocal license is the registration of the general license authorized by R12-1-320. This license is subject

to a special fee as provided by R12-1-1307 but is exempt from annual fees.

17. Reserved
18. An "unclassified" radioactive material license is one authorizing radioisotopes, physical or chemical forms, possession limits, or uses not included in any other type of license specified in this Section.
19. A NORM commercial disposal site license is one that authorizes the receipt of waste material contaminated with naturally occurring radioactive material from other licensees for permanent disposal, provided the concentration of the radioactive material does not exceed 74kBq (2,000 picocuries)/gram.

**E.** Category E registrations are those that register the possession of x-ray machine(s) under 12 A.A.C. 1, Article 2. The Agency shall not combine Category E registrations with any other registration.

1. An X-ray machine class A registration is one authorizing the possession of X-ray machines in a hospital or other facility offering inpatient care.
2. An X-ray machine class B registration is one authorizing the possession of X-ray machines in a medical, osteopathic, or chiropractic office or clinic not offering inpatient care; or the possession of X-ray machines in a school, college, university, or other teaching facility.
3. An X-ray machine class C registration is one authorizing the possession of X-ray machines in dental, podiatry, and veterinarian offices or clinics.
4. An industrial radiation machine registration is one authorizing the possession of X-ray machines, or the possession of particle accelerators not capable of producing a high radiation area, in a nonmedical facility.
5. An accelerator facility registration is one authorizing the possession and operation of one or more particle accelerators of any kind capable of accelerating any particle and producing a high radiation area.
6. A radiation machine, "other," is one authorizing possession or use of an ionizing radiation machine not included in any other category specified in subsection (E).

**F.** Category F registrations are those that register nonionizing radiation producing sources regulated under 12 A.A.C. 1, Article 14. The Agency shall not combine Category F registrations with any other registration categories that have a difference in fee per unit.

1. A tanning registration authorizes the commercial operation of any number of tanning booths, beds, cabinets, or other devices in a single establishment.
2. A Class A laser registration authorizes the operation of one to 10 laser devices subject to R12-1-1433.
3. A Class B laser registration authorizes the operation of 11 to 49 laser devices subject to R12-1-1433.
4. A Class C laser registration authorizes operation of 50 or more laser devices subject to R12-1-1433.
5. A laser light show registration authorizes the operation of a laser device subject to R12-1-1441.
6. A medical laser registration authorizes the operation of one or more laser devices subject to R12-1-1440.
7. A Class II surgical device registration authorizes the operation of one or more Class II surgical devices subject to R12-1-1438. A device is designated as a Class II surgical device by the USFDA and is labeled as such by the manufacturer.
8. A medical radiofrequency device registration authorizes the operation of one or more medical radiofrequency devices.
9. A class A industrial radiofrequency device registration authorizes the operation of one to five radiofrequency heat sealers or industrial microwave ovens.
10. A class B industrial radiofrequency device registration authorizes the operation of six to 20 radiofrequency heat sealers or industrial microwave ovens.
11. A class C industrial radiofrequency device registration authorizes the operation more than 20 radiofrequency heat sealers or industrial microwave ovens.
12. A class A medical radiofrequency device registration authorizes the operation of one or two radiofrequency diathermy or electrocoagulation units not used in non-ionizing cosmetic procedures.
13. A class B medical radiofrequency device registration authorizes the operation of three to nine radiofrequency diathermy or electrocoagulation units not used in non-ionizing cosmetic procedures.
14. A class C medical radiofrequency device registration authorizes the operation of 10 to 19 radiofrequency diathermy or electrocoagulation units not used in non-ionizing cosmetic procedures.
15. A class D medical radiofrequency device registration authorizes the operation of 20 or more radiofrequency diathermy or electrocoagulation units not used in non-ionizing cosmetic procedures.
16. An "other" nonionizing radiation device authorizes the operation of a nonionizing radiation device or other device not included in any other category specified in subsection (F).

**Historical Note**

Adopted effective November 19, 1982 (Supp. 82-6). Amended effective November 28, 1983 (Supp. 83-6). Section repealed, new Section adopted effective November 5, 1993 (Supp. 93-4). 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 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 11 A.A.R. 978, effective April 3, 2005 (05-1). Amended by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4). Amended by exempt rulemaking at 14 A.A.R. 4243, effective November 17, 2008 (Supp. 08-4). Amended by final rulemaking at 21 A.A.R. 289, effective April 6, 2015 (Supp. 15-1). Amended by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

**R12-1-1303. Fee for Initial License and Initial Registration**

An applicant shall remit for a new license or new registration the appropriate fee as prescribed in R12-1-1306.

**Historical Note**

Adopted effective November 19, 1982 (Supp. 82-6). Amended effective November 28, 1983 (Supp. 83-6). Amended subsections (A), (C), and (D) effective November 28, 1986 (Supp. 86-6). Section repealed, new Section adopted effective November 5, 1993 (Supp. 93-4). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by exempt rulemaking at 14 A.A.R. 4243, effective November 17, 2008 (Supp. 08-4).

**R12-1-1304. Annual Fees for Licenses and Registrations**

**A.** Each license or registration issued by the Agency shall identify the category by a letter and number corresponding to the

appropriate subsection of R12-1-1302 or category type listed in R12-1-1306.

**B.** Except for types D16 and D17, each licensee or registrant shall submit payment of the annual fee in the amount prescribed in R12-1-1306(A) on or before January 1 of each year. This single annual fee will cover any and all renewals, amendments, and regular inspections of the license during the forthcoming calendar year.

**C.** If a licensee or registrant fails to pay the annual fee by January 1, the license is not current.

**D.** If a licensee or registrant fails to pay the annual fee by April 1, the Agency shall apply administrative sanction provisions of 12 A.A.C. 1, Article 12.

**E.** A licensee who is required to pay an annual fee under this Article may qualify as a small entity. If a licensee qualifies as a small entity and provides the Agency with proper certification along with its annual fee payment, the licensee may pay reduced annual fees as shown in Table 1 to this Article. Failure to file a small entity certification in a timely manner may result in the denial of any refund.

**Historical Note**
Adopted effective November 5, 1993 (Supp. 93-4). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by exempt rulemaking at 14 A.A.R. 4243, effective November 17, 2008 (Supp. 08-4).

**R12-1-1305. Method of Payment**

**A.** An applicant licensee or registrant shall pay fees by check or money order, payable to the "State of Arizona" at the address shown on the application, license, registration, or renewal notice.

**B.** Once a license or registration has been issued, no portion of the application fee or any annual fee will be refunded.

**Historical Note**
Adopted effective November 5, 1993 (Supp. 93-4). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2).

**R12-1-1306. Table of Fees**

**A.** The application and annual fee for each category and type are shown in Table 13-1.

Table 13-1

| Category | Type | Annual fee |
|---|---|---|
| A1. | Broad academic class A | $5,800 |
| A2. | Broad academic class B | $5,800 |
| A3. | Broad academic class C | $5,800 |
| A4. | Limited academic | $1,000 |
| B1. | Broad medical | $11,000 |
| B2. | Medical materials class A | $1,900 |
| B3. | Medical materials class B | $1,900 |
| B4. | Medical materials class C | $1,900 |
| B5. | Medical teletherapy | $5,200 |
| B6. | General medical | $250 |
| C1. | Broad industrial class A | $11,400 |
| C2. | Broad industrial class B | $11,400 |
| C3. | Broad industrial class C | $3,200 |
| C4. | Limited industrial | $700 |
| C5. | Portable gauge | $1,000 |
| C6. | Fixed gauge class A | $1,000 |
| C7. | Fixed gauge class B | $1,000 |
| C8. | Leak detector | $1,330 |
| C9. | Gas chromatograph | $1,000 |
| C10. | General industrial | No Fee |
| C11. | Industrial radiography class A | $5,500 |
| C12. | Industrial radiography class B | $5,500 |
| C13. | Open field irradiator | $3,000 |
| C14. | Self-shielded irradiator | $1,500 |
| C15. | Well logging | $2,000 |
| C16. | Research and development | $2,100 |
| C17. | Laboratory | $1,000 |
| D1. | Distribution | $2,600 |
| D2. | Nuclear pharmacy | $4,600 |
| D3. | Nuclear laundry | $10,300 |
| D4. | General industrial (with fee) | $300 |
| D5. | General depleted uranium | $200 |
| D6. | Veterinary medicine | $1,000 |
| D7. | General veterinary medicine | $200 |
| D8. | Health physics class A | $3,200 |
| D9. | Health physics class B | $1,000 |
| D10. | Secondary uranium recovery | $5,100 |
| D11. | Low-level radioactive waste disposal site | (3) |
| D12. | Waste processor class A | $4,600 |
| D13. | Waste processor class B | $3,600 |
| D14. | Additional storage and use site | (1) |
| D15. | Possession only | (2) |
| D16. | Reciprocal | (3) |
| D17. | Reserved | |
| D18. | Unclassified | Full Cost |
| D19. | NORM commercial disposal site | $600,000 |
| E1. | X-ray machine class A (per tube) | $75 |
| E2. | X-ray machine class B (per tube) | $51 |
| E3. | X-ray machine class C (per tube) | $42 |
| E4. | Industrial radiation machine (per device) | $42 |
| E5. | Accelerator facility | $750 |
| E6. | Other ionizing radiation machine | Full Cost |
| F1. | Tanning device (per device) | $28 |
| F2. | Class A (1 to 10 laser devices) | $175 |
| F3. | Class B (11 to 49 laser devices) | $408 |
| F4. | Class C (50 or more laser devices) | $699 |
| F5. | Laser light show or laser demonstration | $408 |
| F6. | Medical laser (per laser device) | $47 |
| F7. | Class II surgical (per device) | $47 |
| F8. | Medical RF surgical and cosmetic (per device) | $47 |
| F9. | Class A industrial (1 to 5 radiofrequency devices) | $70 |
| F10. | Class B industrial (6 to 20 radiofrequency devices) | $210 |
| F11. | Class C industrial more than 20 radiofrequency devices) | $349 |
| F12. | Class A medical (1 or 2 non-cosmetic radiofrequency devices) (per device) | $0 |
| F13. | Class B medical (3 to 9 non-cosmetic radiofrequency devices) | $0 |
| F14. | Class C medical (10 to 19 non-cosmetic radiofrequency devices) | $0 |
| F15. | Class D medical (20 or more non-cosmetic radiofrequency devices) | $0 |
| F16. | Other nonionizing radiation device or other device | Full Cost |

Notes: (1) An additional 30% of the annual base fee is added to the annual base fee for each additional site.

(2) The fee is 50% of the annual base fee for the category under which the radioactive material will be stored.
(3) See R12-1-1307.

**B.** The application fee for a licensee or registrant is the annual fee as shown in R12-1-1306. "Full Cost" is based on professional personnel time for preparation, travel, onsite inspection, any reports, review of findings, and preparation of the license or registration or denial charged at $99 per hour and mileage charged at 44.5¢ per mile. The Agency shall assess the licensee or registrant 90% of the estimated full cost of issuing the license or registration. The Agency will assess for any remaining costs when it is prepared to issue the license, registration, denial, or if Agency costs for the requested activity exceed $10,000.

**C.** The annual fee for a licensee or registrant for which the scheduled fee is "Full Cost" is based on professional personnel time for preparation, travel, onsite inspection, preparation of reports, review of findings, and preparation for any inspections or completion of any amendments to the license, registration or denials charged at $99 per hour and mileage charged at 44.5¢ per mile for the preceding 12 months.

**Historical Note**
Amended effective November 5, 1993 (Supp. 93-4). 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 9 A.A.R. 1126, effective May 9, 2003 (Supp. 03-1). Amended by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4). Amended by exempt rulemaking at 14 A.A.R. 4243, effective November 17, 2008 (Supp. 08-4). Amended by final rulemaking at 21 A.A.R. 289, effective April 6, 2015 (Supp. 15-1).

**R12-1-1307. Special License Fees**

**A.** The fee for a Type D16 license providing reciprocal recognition under R12-1-320 of a radioactive materials license issued by the U.S. NRC or another state is half of the annual fee for an Arizona license of the appropriate type. The fee is due and payable at the time reciprocity is requested, and the general license does not become current until the fee is paid.

**B.** For a low-level radioactive waste disposal site the initial application fee is $6,000,000. The annual fee for the second through fifth years is $6,000,000. The Agency shall promulgate a new fee rule for years subsequent to year five. Based on data gathered during the first five years, the Agency shall set a reasonable fee after consideration of the following factors:
1. Unrecovered costs which the Agency may charge under A.R.S. § 30-654(B)(18).
2. Actual costs incurred by the Agency.

**Historical Note**
Adopted effective November 5, 1993 (Supp. 93-4). Amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by exempt rulemaking at 14 A.A.R. 4243, effective November 17, 2008 (Supp. 08-4).

**R12-1-1308. Fee for Requested Inspections**

**A.** A licensee or registrant may request an inspection of its facility at any time. The Agency shall assess the licensee or registrant the full cost of the inspection, based on personnel time for preparation, travel, onsite inspection, review of findings, and preparation of a report, charged at $99 per hour and mileage charged at 44.5¢ per mile.

**B.** The fee specified in this Section does not apply to:
1. Regular inspections as scheduled by the Agency,
2. Enforcement reinspections conducted to ensure the correction of violations or safety hazards, or
3. Inspections requested by workers pursuant to R12-1-1007.

**Historical Note**
Adopted effective November 5, 1993 (Supp. 93-4). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by exempt rulemaking at 14 A.A.R. 4243, effective November 17, 2008 (Supp. 08-4).

**R12-1-1309. Abandonment of License or Registration Application**

**A.** Any license or registration application for which the applicant has been provided a written notification of deficiencies in the application and for which the applicant does not make a written attempt to supply the requested information or request an extension in writing within 90 days of the date of the written notice of deficiencies, is considered abandoned and will not be processed.

**B.** If an applicant does not act in the time-frame specified in subsection (A), the applicant shall submit a new application with the appropriate fee.

**Historical Note**
New Section adopted by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2).

**Table 1. Small Entity Fees[1]**

| | |
|---|---|
| Small Businesses Not Engaged in Manufacturing and Small Not-for-profit Organizations (Gross Annual Receipts, three-year average): | |
| >$6.5 million | Pay the fee listed in R12-1-1306 |
| $350,000 to $6.5 million | $2,200 |
| <$350,000 | $500 |
| Manufacturing Entities that Have an Annual Average of 500 Employees or Less: | |
| >500 employees | Pay the fee listed in R12-1-1306 |
| 35 to 500 employees | $2,200 |
| <35 employees | $500 |
| Small Government Jurisdictions (including publicly supported educational institutions) (Population in Jurisdiction): | |
| >50,000 | Pay the fee listed in R12-1-1306 |
| 20,000 to 50,000 | $2,200 |
| <20,000 | $500 |
| Educational Institutions that Are Not State or Publicly Supported, and Have 500 Employees or Less: | |
| >500 employees | Pay the fee listed in R12-1-1306 |
| 35 to 500 employees | $2,200 |
| <35 employees | $500 |

1. A licensee who seeks to establish status as a small entity for the purpose of paying the annual fees required under R12-1-1304 as shown in R12-1-1306 must file a certification statement with the Agency each year. The licensee must file the required certification on Agency Form 333 for each license under which it was billed. Agency Form 333 can be accessed through the Agency web site at http://www.azrra.gov. For licensees who cannot access the Agency web site, Agency Form 333 may be obtained by writing to the Agency or by telephoning the Agency at (602) 255-4845, or by e-mailing the Agency at webcontactform@arrawebsite.com.

**Historical Note**
New Table made by exempt rulemaking at 14 A.A.R. 4243, effective November 17, 2008 (Supp. 08-4).

## ARTICLE 14. REGISTRATION OF NONIONIZING RADIATION SOURCES AND STANDARDS FOR PROTECTION AGAINST NONIONIZING RADIATION

**R12-1-1401. Registration of Nonionizing Radiation Sources and Service Providers**

**A.** A person shall not use a nonexempt nonionizing radiation source, unless the source is registered by the Agency.

**B.** A person who possesses a nonexempt nonionizing source shall submit to the Agency an application for registration within 30 days of its first use.
1. A person who possesses a nonexempt source listed in R12-1-1302(F) shall register the source with the Agency.
2. A person applying for the registration of a nonexempt source shall use an application form provided by the Agency.
3. An applicant shall provide the information identified in Appendix B of this Article.

**C.** A registrant shall notify the Agency within 30 days of any change to the information contained in the registration, or sale of a source that results in termination of the activities conducted under the registration.

**D.** In addition to the application form, an applicant shall remit the applicable registration fee, specified in R12-1-1306.

**E.** A person who is operating more than one facility, where one or more nonexempt nonionizing sources are used, shall apply for a separate registration for each facility.

**F.** A person in the business of installing or servicing nonexempt nonionizing sources shall apply to the Agency for registration 30 days before furnishing the service. The person shall apply for registration on a form furnished by the Agency and shall provide the information required by A.R.S. § 30-672.01.

**Historical Note**

Adopted effective April 2, 1990 (Supp. 90-2). Repealed effective January 2, 1996 (Supp. 96-1). New Section made by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (04-4). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

**R12-1-1402. Definitions**

General definitions:

"Controlled area" means any area to which human access is restricted for the purpose of protection from nonionizing radiation.

"Direct supervision" means that a licensed practitioner supervises the use of a source for medical purposes while the practitioner is present inside the facility where the source is being used.

"Indirect supervision" means: for lasers or IPL devices used for hair removal procedures, there is at a minimum, responsible supervision and control by a licensed practitioner who is easily accessible by telecommunication.

"Licensed practitioner" (See R12-1-102)

"Medical director" means a licensed practitioner, as defined in R12-1-102, who delegates a laser, IPL, or other light-emitting medical device procedure to a non-physician and is qualified to perform the procedure within the scope of practice of the license.

"Nonexempt nonionizing source" means any system or device that contains a nonionizing source listed in R12-1-1302(F).

"Operator" means a person who is trained in accordance with this Article and knowledgeable about the control and function of a nonionizing device regulated under this Article.

"Other cosmetic procedure" means a method of using medical lasers or intense pulse light (IPL) devices approved by the Federal Food and Drug Administration (FDA), for the cosmetic purpose of spider vein removal, skin rejuvenation, non-ablative skin resurfacing, skin resurfacing, port wine stain removal, epidermal pigmented skin lesion removal, or tattoo removal; and does not include hair removal.

Laser definitions:

"Accessible emission limit (AEL)" means the maximum accessible emission level of laser or collateral radiation permitted within a particular class.

"Accessible radiation" means laser or collateral radiation to which human access is possible.

"Angular subtense" means the apparent visual angle, a, as calculated from the source size and distance from the eye.

"Aperture" means an opening in the protective housing or other enclosure of a laser product, through which laser or collateral radiation is emitted, allowing human access to the radiation.

"Aperture stop" means an opening serving to limit the size and to define the shape of the area over which radiation is measured.

"Certified laser product" means that the product is certified by a manufacturer in accordance with the requirements of 21 CFR 1040.10, April 1, 2004, which is 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. This incorporation by reference contains no future editions or amendments.

"CDRH" means the Center for Devices and Radiological Health.

"Classes of lasers" means the following categories of lasers, defined in 21 CFR 1040.10, April 1, 2004, which is 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: Class 1, Class 2, Class 2a, Class 3, Class 3a, Class 3b, and Class 4. This incorporation by reference contains no future editions or amendments.

"Collateral radiation" means any electronic product radiation, except laser radiation, emitted by a laser product as a result of operation of the laser or any component of the laser product that is physically necessary for operation of the laser. The accessible emission limits for collateral radiation are specified in 21 CFR 1040.10, April 1, 2004, which is 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. This incorporation by reference contains no future editions or amendments.

"Continuous wave" (cw) means the output of a laser that is operated in a continuous rather than a pulsed mode. For purposes of this Article, a laser operating with a continuous output for a period $\geq 0.25$ seconds, is regarded as a cw laser.

"Cosmetic procedure protocol" means a delegated written authorization to select specific laser or IPL settings, initiate a laser or IPL procedure, and conduct necessary follow-up procedures.

"Demonstration laser" means any laser manufactured, designed, intended, or used for purposes of demonstration, entertainment, advertising display, or artistic composition.

"Embedded laser" means an enclosed laser with an assigned class number higher than the inherent capability of the laser system in which it is incorporated, where the system's lower classification is due to engineering features that limit accessible emission.

"Enclosed laser" means a laser that is contained within its own protective housing or the protective housing of a laser or laser system in which it is incorporated. Opening or removing the protective housing provides more access to laser radiation above the applicable MPE than is possible with the protective

housing in place. (An embedded laser is a type of enclosed laser.)
"Federal performance standards for light-emitting products" means the regulations in 21CFR 1040.10, April 1, 2004, which is 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. This incorporation by reference contains no future editions or amendments.
"Human access" means the capacity to intercept laser or collateral radiation by any part of the human body.
"Incident" means an event or occurrence that results in actual or suspected accidental exposure to laser radiation that has caused or is likely to cause biological damage.
"Integrated radiance" means radiant energy per unit area of a radiating surface per unit solid angle of emission, expressed in joules per square centimeter per steradian.
"Irradiance" means the time-averaged radiant power incident on an element of a surface divided by the area of that element, expressed in watts per square centimeter.
"Laser" See the definition in Article 1.
"Laser energy source" means any device intended for use in conjunction with a laser to supply energy for the operation of the laser. General energy sources, such as electrical supply mains or batteries, are not considered laser energy sources by the Agency.
"Laser facility" means a facility where one or more lasers are used. For purposes of this definition a Class 1 facility is a facility that has one or more Class 1 lasers; a Class 2 facility is a facility that has one or more Class 2 or 2a lasers; a Class 3 facility is a facility that has one or more Class 3, 3a, or 3b lasers, and a Class 4 facility is a facility that has one or more Class 4 lasers. Facilities that contain more than one laser class are classified according to the highest laser class in use at the facility.
"Laser product" means any manufactured product or assemblage of components that constitutes, incorporates, or is intended to incorporate a laser or laser system. A laser or laser system that is intended for use as a component of an electronic product is itself considered a laser product.
"Laser protective device" means any device used to reduce or prevent exposure of personnel to laser radiation. This includes: protective eyewear, garments, engineering controls, and operational controls.
"Laser radiation" means all electromagnetic radiation emitted by a laser product, within the spectral range specified in the definition of "laser," which is produced as a result of controlled stimulated emission or that is detectable with radiation so produced through the appropriate aperture stop and within the appropriate solid angle of acceptance.
"Laser Safety Officer (LSO)" - means any individual, qualified by training and experience in the evaluation and control of laser hazards, who is designated by the registrant and has the authority and responsibility to establish and administer the laser radiation protection program for a particular class of facility.
"Laser system" means a laser in combination with an appropriate laser energy source with or without additional incorporated components.
"Limited exposure duration ($T_{max}$)" means an exposure duration that is specifically limited by design or intended use.
"Maintenance" means performance of those adjustments or procedures specified in operator information provided by the manufacturer with the laser product, which are to be performed by the operator to ensure the intended performance of the product. The term does not include operation or service as defined in this Section.
"Maximum permissible exposure (MPE)" means the level of laser radiation to which a person may be exposed without hazardous effect or adverse biological changes in the eye or skin. MPE values for eye and skin exposure are listed in ANSI Z136.1-2000, American National Standard for Safe Use of Lasers, 2000 edition, which is incorporated by reference, published by the Laser Institute of America, 13501 Ingenuity Drive, Suite 128, Orlando, FL 32826, and on file with the Agency. This incorporation by reference contains no future editions or amendments.
"Medical laser product" means any laser product that is a medical device defined in 21 U.S.C. 321(h) and is manufactured, designed, intended, or promoted for in vivo laser irradiation of any part of the human body for the purpose of: diagnosis, surgery, therapy, or relative positioning of the human body.
"Operation" means the performance of the laser product over the full range of its function. It does not include maintenance or service as defined in this Section.
"Protective housing" means those portions of a laser product that are designed to prevent human access to laser or collateral radiation in excess of the prescribed accessible emission limits under conditions specified in this Article.
"Pulse duration" means the time increment measured between the half-peak-power points at the leading and trailing edges of a pulse.
"Pulse interval" means the period of time between identical points on two successive pulses.
"Radiance" means the time-averaged radiant power per unit area of a radiating surface per unit solid angle of emission, expressed in watts per square centimeter per steradian.
"Radiant energy" means energy emitted, transferred, or received in the form of radiation, expressed in joules.
"Radiant exposure" means the radiant energy incident on an element of a surface divided by the area of that element, expressed in joules per square centimeter.
"Radiant power" means the time-averaged power emitted, transferred, or received in the form of radiation, expressed in watts.
"Rule of nines" means a method for estimating the extent of burns, expressed as a percentage of total body surface. In this method the body is divided into sections of 9 percent or multiples of 9 percent, each: head and neck, 9 percent; anterior trunk, 18 percent; posterior trunk, 18 percent; upper limbs, 18 percent; lower limbs, 36 percent; and genitalia and perineum, 1 percent.
"Safety interlock" means a device associated with the protective housing of a laser product to prevent human access to excessive radiation.
"Sampling interval" means the time interval during which the level of accessible laser or collateral radiation is sampled by a measurement process. The magnitude of the sampling interval in units of seconds is represented by the symbol "t".
"Secured enclosure" means an area to which casual access is impeded by various means, such as a door secured by a lock, latch, or screws.
"Service" means the performance of those procedures or adjustments described in the manufacturer's service instructions that may affect any aspect of the product's performance. The term does not include maintenance or operation as defined in this Section.
"$T_{max}$" See limited exposure duration.
"Uncertified laser product" means any laser that has not been certified in accordance with the requirements of 21CFR 1040.10, April 1, 2004, which is 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. This incorporation by reference contains no future editions or amendments.

Radio frequency and microwave radiation definitions:

"Accessible emission level" means the level of radio frequency radiation emitted from any source, expressed in terms of power density in milliwatts per square centimeter or electric and magnetic field strength, as applicable, and to which human access is normally possible.

"Far field region" means the area in which locally uniform distribution of electric and magnetic field strengths exists in planes transverse to the direction of propagation. The far field region is presumed to exist at distances greater than $2D^2/\lambda$ from the antenna, where $\lambda$ is the wavelength and D is the largest antenna aperture dimension.

"Maximum permissible exposure MPE" means the rms and peak electric and magnetic field strengths, their squares, or the plane-wave equivalent power densities associated with these fields and the induced and contact currents to which a person may be exposed without harmful effect and with an acceptable safety factor.

"Near field region" means the area near an antenna in which the electric and magnetic field components vary considerably in strength from point to point. For most antennas the outer boundary of the region is presumed to exist at a distance $\lambda/2\pi$ from the antenna surface, where $\lambda$ is the wavelength.

"Radio frequency controlled area" means any location to which access is controlled for the purpose of protection from radio frequency radiation.

"Radio frequency source" means a source or system that produces electromagnetic radiation in the radio frequency spectrum.

"Radio frequency radiation" means electromagnetic radiation (including microwave radiation) with frequencies in the range of 0.3 megahertz to 100 gigahertz.

"Root-mean-square (rms)" means the effective value, or the value associated with joule heating, of a periodic electromagnetic wave. The rms is obtained by taking the square root of the mean of the squared value of a function.

"Safety device" means any mechanism incorporated into a radio frequency source that is designed to prevent human access to excessive levels of radio frequency radiation.

Ultraviolet, high intensity light, and intense pulsed light source definitions:

"EPA" means the United States Environmental Protection Agency.

"FDA" means the United States Food and Drug Administration.

"High intensity mercury vapor discharge (HID) lamp" means any lamp, including a mercury vapor or metal halide lamp that incorporates a high-pressure arc discharge tube with a fill that consists primarily of mercury and is contained within an outer envelope, except the tungsten filament self-ballasted mercury vapor lamp.

"Intense pulsed light device (IPL)" means, for purposes of R12-1-1438, any lamp-based device that produces an incoherent, filtered, and intense light.

"Maximum exposure time" means the greatest continuous exposure time interval recommended by the manufacturer of a product.

"Protective sunlamp eyewear" means any device designed to be worn by a user of a product to reduce exposure of the eyes to radiation emitted by the product.

"Sanitize" means treat the surfaces of equipment and devices using an EPA or FDA registered product that provides a specified concentration of chemicals, for a specified period of time, to reduce the bacterial count, including pathogens, to a safe level.

"Self-extinguishing lamp" means any HID lamp that ceases operation in conformance with the requirements of the performance standard in 21 CFR 1040.30(d), April 1, 2004, which is 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. This incorporation by reference contains no future editions or amendments.

"Sunlamp product" means any electronic product designed to incorporate one or more ultraviolet lamps and intended for irradiation of any part of the living human body, by ultraviolet radiation with wavelengths in air between 200 and 400 nanometers, to induce skin tanning.

"Timer" means any device incorporated into a product that terminates radiation emission after a preset time interval.

"Ultraviolet lamp" means any light source that produces ultraviolet radiation and that is intended for use in any sunlamp product.

"Ultraviolet radiation" means electromagnetic radiation in the wavelength interval from 200 to 400 nanometers in air.

"User" means any member of the public who is provided access to a tanning device in exchange for a fee or other compensation, or any individual who, in exchange for a fee or other compensation, is afforded use of a tanning device as a condition or benefit of membership or access.

**Historical Note**

Adopted effective April 2, 1990 (Supp. 90-2). Amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4). Amended by final rulemaking at 11 A.A.R. 978, effective April 3, 2005 (05-1).

**R12-1-1403. General Safety Provisions and Exemptions**

**A.** Based on consideration of the following factors, the Agency may waive compliance with specific requirements of this Article:

1. Whether compliance requires product replacement or substantial modification of a product's current installation, and
2. Whether the registrant provided information requested by the Agency to determine if there are alternative methods of achieving the same or a greater level of radiation protection.

**B.** The registrant shall:

1. Ensure that any nonionizing source is operated by an individual who is trained and has demonstrated competence in the safe use of the source.
2. Provide safety rules to each individual who operates a nonionizing radiation source and determine whether the individual is aware of operating restrictions and procedures associated with the safe use of the source.
3. Make, or cause to be made, any physical radiation surveys required by this Article.
4. Maintain the following records for three years for Agency review:
   a. Results of any physical survey or calibration required by this Article;
   b. Radiation source inventories;
   c. Maintenance, service, and modification records; and
   d. Incident reports of known or suspected exposure to nonionizing radiation that exceeds any MPE specified in this Article.

**C.** A registrant shall not operate a nonionizing radiation source unless the source complies with all of the applicable requirements of this Article.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Section heading amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1404. Radio Frequency Equipment**

**A.** A registrant shall operate a radiation source that emits radio frequency radiation in a radio frequency controlled area, in a manner that will prevent human exposure that exceeds the MPE specified in IEEE Std C95.1-1999, Institute of Electrical and Electronics Engineers Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300 GHz, 1999 edition, which is incorporated by reference, published by the Institute of Electrical and Electronic Engineers, Inc., 345 East 47th Street, New York, NY 10017, and on file with the Agency. This incorporation by reference contains no future editions or amendments. The registrant shall post each point of access into a radio frequency controlled area according to R12-1-1406.

**B.** If a registrant is required to operate a radio frequency source in a controlled area, the registrant shall employ visual or audible emission indicators that function only during production of radiation.

**C.** If a source of radio frequency emissions is physically separate from the source's means of activation by a distance greater than 2 meters, the registrant shall place a visual or an audible emission indicator at the source and the point of activation.

**D.** A registrant shall place each visual emission indicator so that the location of the indicator does not require human exposure to radio frequency radiation that exceeds the applicable MPE.

**E.** A registrant shall inspect each safety device designed to prevent human exposure to excessive radio frequency radiation for proper operation at intervals that do not exceed one month.

**F.** If a machine emits mechanically scanned radio frequency radiation, a registrant shall ensure that the machine cannot, as the result of scan failure or any other malfunction, cause a change in angular velocity or amplitude, allowing human exposure that exceeds the applicable MPE.

**G.** A registrant shall physically secure each radio frequency sources to prevent unauthorized use and tampering.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1405. Radio Frequency Radiation: Maximum Permissible Exposure**

**A.** A registrant shall not expose a person to radio frequency radiation that exceeds the applicable MPE specified in IEEE Std C95.1-1999, Institute of Electrical and Electronics Engineers Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300 GHz, 1999 edition, which is incorporated by reference, published by the Institute of Electrical and Electronic Engineers, Inc., 345 East 47th Street, New York, NY 10017, and on file with the Agency. This incorporation by reference contains no future editions or amendments.

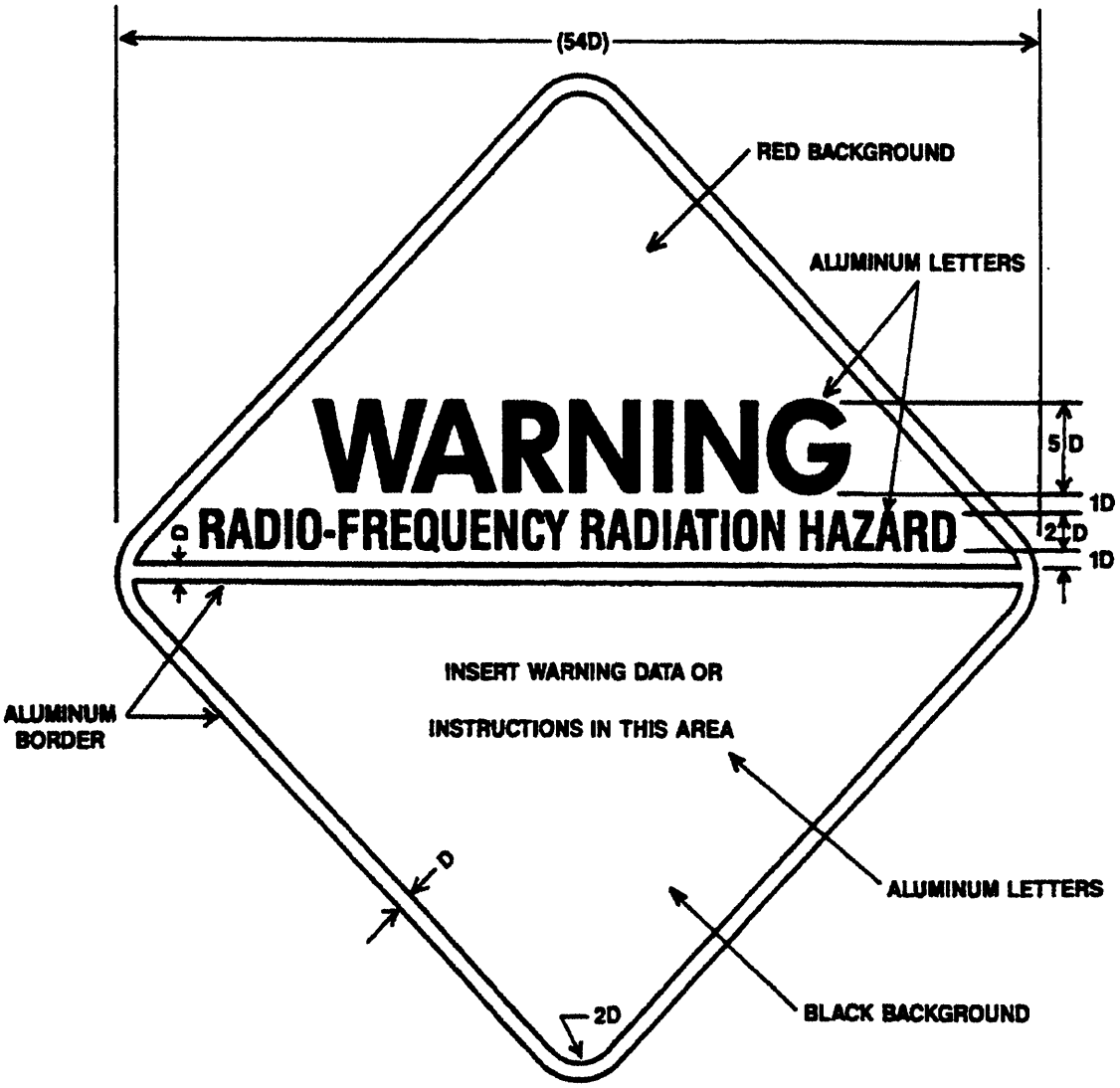
**B.** At frequencies between 300 kHz and 100 GHz a registrant may exceed the applicable MPE if exposure conditions can be shown by laboratory procedures to produce specific absorption rates (SARs) above 0.4 watts per kilogram, averaged over the whole body, and spatial peak SAR values above 8 watts per kilogram, averaged over 1 gram of tissue.

**C.** At frequencies between 300 kHz and 1 GHz, a registrant may exceed the applicable MPE, if the radio frequency input power to the radiating device is seven watts or less.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1406. Radio Frequency Hazard Caution Signs, Symbols, Labeling, and Posting**

**A.** A registrant shall post each point of access to a controlled area with caution signs of the type designated in Figure 1.




1. Place handling and mounting instructions on reverse side.
2. D = Scaling unit
3. Lettering: Ratio of letter height to thickness of letter lines.
   Upper triangle: 5 to 1 Large
   6 to 1 Medium
   Lower triangle: 4 to 1 Large
   6 to 1 Medium
4. Symbol is square, triangles are right-angle isosceles.

**Fig. 1**

**B.** A registrant shall post operating procedure restrictions or limitations, used to prevent unnecessary or excessive exposure to radio frequency radiation, in a location visible to the operator.

**C.** A registrant shall place each warning sign or label so that an observer is not exposed to radio frequency radiation that exceeds the applicable MPE.

**Historical Note**

Adopted effective April 2, 1990 (Supp. 90-2). Section heading amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1407. Microwave Ovens**

A person shall register with the Agency any microwave oven that does not meet the requirements in 21 CFR 1030.10, April 1, 2004, which is 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. This incorporation by reference contains no future editions or amendments.

**Historical Note**

Adopted effective April 2, 1990 (Supp. 90-2). Amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1408. Reporting of Radio Frequency Radiation Incidents**

**A.** A registrant shall report in writing to the Agency within 15 days of a known or suspected personnel exposure to radiation that exceeds the applicable MPE incorporated by reference in R12-1-1405.

**B.** A registrant shall report to the Agency within 24 hours of a known or suspected personnel exposure to radiation that exceeds 150% of an applicable MPE incorporated by reference in R12-1-1405.

**C.** A registrant shall immediately report to the Agency a known or suspected personnel exposure to radiation that exceeds 500% of an applicable MPE incorporated by reference in R12-1-1405.

**Historical Note**

Adopted effective April 2, 1990 (Supp. 90-2). Amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1409. Medical Surveillance for Workers Who May Be Exposed to Radio Frequency Radiation**

**A.** Upon request by the Agency, a registrant shall provide a medical examination to an individual exposed to radiation reported to the Agency according to R12-1-1408.

**B.** A registrant shall provide a copy of the results to the Agency if an individual undergoes a medical examination, requested under subsection (A).

**Historical Note**

Adopted effective April 2, 1990 (Supp. 90-2). Section heading amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1410. Radio Frequency Compliance Measurements**

**A.** For obtaining measurements to determine compliance with R12-1-1405, the Agency shall use an instrument capable of measuring the field strength and frequency of radiation.

**B.** The Agency shall ensure that each instrument used for compliance measurements is calibrated every 12 months. The calibration shall be performed in a manner that meets the standards in IEEE Std C95.1-1999, incorporated by reference in R12-1-1404(A).

**C.** For compliance measurements of exposure conditions in the near field, the Agency shall obtain measurements of both the electric and magnetic field components. The applicable protection standards for near field measurements are the mean squared electric and magnetic field strengths (using the applicable MPE) referenced in R12-1-1405.

**D.** If the Agency is obtaining measurements to determine compliance in far field exposure conditions, the Agency may use measurements of power density in milliwatts per square centimeter or the calculated equivalent plane wave power density, based on measurement of either the electric or magnetic field strength. The applicable protection standards are the power density values (using the applicable MPE) referenced in R12-1-1405.

**E.** In obtaining measurements in accordance with this Section, the Agency shall measure the electric and magnetic field strength:

1. Obtained at an emission frequency of 300 megahertz or less; and
2. Expressed in terms of power density.

**F.** For mixed or broadband fields at frequencies for which there are different protection standards, the Agency shall determine the fraction of the applicable MPE incurred within each frequency interval. To achieve compliance the sum of all the fractions shall not exceed unity (1).

**G.** The Agency shall obtain compliance measurements at a distance of five centimeters or greater from any object.

**H.** A registrant shall obtain measurements that are averaged over a six-minute period for pulsed and non-pulsed modes of radio frequency emission and make a correction for duty cycle in determining the average field strength.

**Historical Note**

Adopted effective April 2, 1990 (Supp. 90-2). Amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1411. Repealed**

**Historical Note**

Adopted effective April 2, 1990 (Supp. 90-2). Amended effective January 2, 1996 (Supp. 96-1). Section repealed by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1412. Tanning Operations**

A registrant shall establish and maintain written policies and procedures that are part of a radiation safety program to assure compliance with the requirements in R12-1-1412 through R12-1-1416.

**Historical Note**

Adopted effective April 2, 1990 (Supp. 90-2). Amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1413. Tanning Equipment Standards**

**A.** A registrant operating a tanning facility shall use sunlamp products that are certified by the manufacturer to comply with 21 CFR 1040.20, April 1, 2004, which is 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. This incorporation by reference contains no future editions or amendments. For sunlamp products in use before the effective date of this Article, the Agency shall determine compliance based on the standard in effect at the time of manufacture, as shown on the equipment identification label.

**B.** A registrant shall replace burned-out or defective lamps or filters, before any use of a tanning device.

**C.** A registrant shall replace a burned-out or defective lamp or filter with a lamp or filter intended for use in that equipment, as specified on the sunlamp product label, or that is equivalent to a lamp or filter specified on the sunlamp product label under the FDA regulations and polices applicable to the sunlamp product at the time of manufacture. If an equivalent lamp or filter is used instead of the Original Equipment Manufacturer (OEM) lamp or filter specified on the product label, the regis-

trant shall maintain a copy of the equivalency certification, provided by the lamp supplier, on file for review by Agency inspectors.

**D.** A registrant shall ensure that each sunlamp product has a timer and control system that complies with 21 CFR 1040.20(c), April 1, 2004, which is 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. This incorporation by reference contains no future editions or amendments. In addition the registrant shall ensure that:
1. The timer interval does not exceed the manufacturer's maximum, recommended exposure time;
2. The timer is functional and accurate to within +/- 10% of the maximum timer interval of the product;
3. The timer does not automatically reset and cause radiation emission to resume for a period greater than the unused portion of the timer cycle;
4. The timer is tested annually for accuracy;
5. For a new facility (including existing facilities with change of ownership) a remote timer control system is installed before operation of sunlamp products. For an existing facility that has sunlamp products not equipped with a remote timer control system, a remote timer control system (outside of the sunlamp product room) is installed no later than 6 months after the effective date of this Section; and
6. Each sunlamp product is equipped with an emergency shutoff mechanism that allows manual termination of the UV exposure by the user.

**E.** A registrant shall provide physical barriers between each sunlamp product to protect users from injury caused by touching or breaking a lamp.

**F.** A registrant that employs a stand-up sunlamp product shall:
1. Use physical barriers, handrails, floor markings, or other methods to indicate the proper exposure distance between the ultraviolet lamps and the user's skin;
2. Construct each tanning booth so that it can withstand the stress of use and the impact of a falling person;
3. Provide access to a tanning booth with doors of rigid construction that open outward, handrails, and non-slip floors; and
4. Control the interior temperature of a sunlamp product so that it never exceeds 100 degrees Fahrenheit (38 degrees Centigrade).

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1414. Tanning Equipment Operators**

**A.** A registrant shall ensure that at least one operator is present during operating hours. The operator shall:
1. Limit the occupancy of the tanning room to one person when the tanning equipment is in use;
2. Prevent use of the tanning equipment by anyone under 18 years of age unless the person has written permission from a parent or guardian;
3. Limit exposure time to the manufacturer's recommendation on the equipment label or in the operator's manual;
4. Limit exposure time during a 24-hour period to the maximum recommended for a 24-hour period by the manufacturer; and
5. Maintain a record of each user's total number of tanning visits and exposure times for Agency inspection. The registrant shall maintain the records for three years from the date on the record.

**B.** Before use of tanning equipment, an operator shall:
1. Provide the user sanitized protective sunlamp eyewear and directions for its use;
2. Demonstrate the use of any physical aids, necessary to maintain correct exposure distance for the user, as recommended by the manufacturer of the tanning equipment;
3. Set the exposure timer so that the user is not exposed to excess radiation;
4. Instruct the user on the maximum exposure time and correct distance from the radiation source as recommended by the manufacturer of the tanning equipment; and
5. Instruct the user about the location and correct operation of the emergency shutoff switch.

**C.** An operator shall control a sunlamp's timer. A registrant shall:
1. Provide training to operators that covers:
   a. The requirements of this Section;
   b. Facility operating procedures, including:
      i. Determination of skin type and associated duration of exposure;
      ii. Procedures for use of minor and adult user consent forms;
      iii. Potential harm associated with photosensitizing foods, cosmetics, and medications;
      iv. Requirements for use of protective eyewear by users of the equipment; and
      v. Proper sanitizing procedures for the facility, equipment, and eyewear;
   c. The manufacturer's procedures for operation and maintenance of tanning equipment;
   d. Recognition of injury or overexposure; and
   e. Emergency procedures used in the case of an injury.
2. Maintain records of training for Agency review, which include dates and material covered, for three years from the date the training is provided.
3. Post a list of operators at the facility.

**D.** Before the first use of a tanning facility in each calendar year by a user:
1. An operator shall request that the user read a copy of the warnings in R12-1-1415(A);
2. The operator shall obtain the user's signature on a statement as an acknowledgment that the user has heard or read and understands the warnings in R12-1-1415(A); and
3. For illiterate or visually handicapped persons, the operator shall read the warnings in R12-1-1415(A) in the presence of a witness. Both the witness and the operator shall sign the statement described in subsection (D)(2).

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1415. Tanning Facility Warning Signs**

**A.** A registrant shall post the warning sign shown in this subsection within 1 meter (39.37 inches) of each tanning device, ensuring that the sign is clearly visible and easily viewed by the user before the tanning device is operated.

**B.** A registrant shall post a warning sign, which contains the statement shown, at or near the reception area.
PERSONS UNDER AGE 18 ARE REQUIRED TO HAVE PARENT OR LEGAL GUARDIAN SIGN AN AUTHORIZATION TO TAN IN THE PRESENCE OF A TANNING FACILITY OPERATOR

**C.** The lettering on each warning sign shall be at least 10 millimeters high for all words shown in capital letters and at least 5 millimeters high for all lower case letters.

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DANGER - ULTRAVIOLET RADIATION

1. Follow instructions.
2. Avoid overexposure. As with natural sunlight, exposure can cause eye and skin injury and allergic reactions. Repeated exposure may cause premature aging of the skin, dryness, wrinkling, and skin cancer.
3. Wear protective eyewear.

FAILURE TO USE PROTECTIVE EYEWEAR MAY RESULT IN SEVERE BURNS OR LONG TERM INJURY TO THE EYES.

4. Medications or cosmetics may increase your sensitivity to the ultraviolet radiation. Consult a physician before using a sunlamp if you are using medications or have a history of skin problems or believe you are especially sensitive to sunlight.
5. If you do not tan in the sun, you are unlikely to tan from use of this device.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Section heading amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1416. Reporting of Tanning Injuries**

**A.** A registrant shall report any incident involving an eye injury; skin burn; fall injury, if the fall occurs within the tanning device or while entering or exiting the device; laceration; infection believed to have been transmitted by use of the tanning device; or any other injury reasonably related to the use of the tanning device.

**B.** A registrant shall provide a written report of an incident to the Agency within 10 working days of its occurrence or within 10 working days of the date the registrant became aware of the incident.

**C.** The report shall include:
1. The name of the user;
2. The name and location of the tanning facility;
3. A description of and the circumstances associated with the injury;
4. The name and address of the health care provider treating the user, if any; and
5. Any other information the registrant considers relevant to the incident.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1417. Repealed**

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Section repealed by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1418. High Intensity Mercury Vapor Discharge (HID) Lamps**

A person shall register with the Agency any HID lamp that does not meet the requirements in 21 CFR 1040.30, April 1, 2004, which is 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. This incorporation by reference contains no future editions or amendments.

**Historical Note**
New Section made by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1419. Reserved**

**R12-1-1420. Reserved**

**R12-1-1421. Laser Safety**

**A.** The requirements contained in this Section apply to laser products that are used in accordance with the manufacturer's classification and instructions. If certain engineering controls are impractical during manufacture or research and development activities, the LSO shall specify alternate requirements to obtain equivalent laser safety protection.

**B.** A registrant shall establish and maintain a laser radiation safety program.

**C.** If R12-1-1433 is applicable, a registrant shall conduct a laser radiation protection survey to ensure compliance with R12-1-1433 before initial use, following system modifications, and at intervals that do not exceed six months. During a survey the registrant shall:
1. Determine whether each laser protective device is labeled correctly, functioning within the design specifications, and meets required standards for the type and class of laser in use;
2. Determine whether each warning device is functioning within design specifications;
3. Determine whether each controlled area is identified, controlled, and posted with accurate warning signs in accordance with this Article;
4. Reevaluate potential hazards from surfaces that are associated with Class 3 and Class 4 beam paths; and
5. Evaluate the laser and collateral radiation hazard incident to the use of lasers.

**D.** The registrant shall maintain records of:
1. Results of all physical surveys made to determine compliance with this Article;
2. Any restriction in operating procedures necessary to prevent unnecessary or excessive exposure to laser or collateral radiation;
3. Any incident for which reporting to the Agency is required pursuant to R12-1-1436;
4. Results of medical surveillance to determine extent of injury resulting from exposure to laser or collateral radiation;
5. Inventory to account for all sources of radiation possessed by the licensee.

**E.** A registrant shall provide the Laser Safety Officer with training that covers the subjects listed in Appendix D.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended effective January 2, 1996 (Supp. 96-2). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4). Amended by final rulemaking at 11 A.A.R. 978, effective April 3, 2005 (Supp. 05-1).

**R12-1-1422. Laser Protective Devices**

**A.** A registrant shall ensure that each laser product has a protective housing that prevents access to laser and collateral radiation if it exceeds the exposure limits for Class 1 lasers in R12-1-1426. If a laser's accessible emission levels must exceed the limits for Class 1 lasers, the registrant shall use a laser from the lowest class that will enable the registrant to perform the intended function.

**B.** To prevent access to radiation above the applicable MPE, a registrant shall ensure that each laser has a safety interlock, which prevents operation of the laser if a person has removed any portion of the protective housing that can be removed or displaced without the use of tools during normal operation or maintenance. The registrant shall ensure that:
1. Service, testing, or maintenance of a laser does not render the interlocks inoperative or increase radiation outside the protective housing to levels that exceed the applicable MPE, unless a controlled area is established as specified in R12-1-1433;
2. For pulsed lasers, interlocks are designed to prevent the laser from firing;
3. For Class 3b and 4 continuous wave (cw) lasers, interlocks turn off the power supply or interrupt the beam.
4. An interlock does not allow automatic accessibility to radiation emission above the applicable MPE when the interlock is closed; and
5. Multiple safety interlocks or a means to preclude removal or displacement of the interlocked portion of the protective housing is provided if failure of a single interlock could result in:
   a. Human access to levels of laser radiation that exceed the radiant power accessible emission limit for Class 3a laser radiation, or
   b. Laser radiation that exceeds the accessible emission limit for Class 2, emitted directly through the opening created by removal or displacement of a portion of the protective housing.

**C.** A registrant shall ensure that a laser with viewing ports, viewing optics, or display screens, included as an integral part of the enclosed laser or laser system has:
1. A suitable means to attenuate laser and collateral radiation transmitted through the optical system to less than the accessible emission limit for collateral radiation required by 21 CFR 1040.10, April 1, 2004, which is 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. This incorporation by reference contains no future editions or amendments; and
2. Specific written administrative procedures developed by the LSO, and use controls, such as interlocks or filters, if there is increased hazard to the eye or skin associated with the use of optical systems such as lenses, telescopes, or microscopes.

**D.** A registrant shall ensure that each Class 3 or 4 laser product provides a visual or audible indication before the emission of accessible laser radiation that exceeds the limits for Class 1, as follows:
1. For Class 3, except for laser products that allow access to less than 5 milliwatts peak visible laser radiation, and Class 4 lasers, the indication occurs before the emission of the radiation and allows enough time for action to avoid exposure;
2. Any visual indicator is clearly visible through protective eyewear designed specifically for the wavelength of the emitted laser radiation;
3. If the laser and laser energy source are housed separately and can be operated at a separation distance of greater than 2 meters, both the laser and laser energy source incorporate visual or audible indicators; and
4. Any visual indicators are positioned so that viewing does not require human access to laser radiation that exceeds the applicable MPE.

**E.** In addition to the information signs, symbols, and labels prescribed in R12-1-1427, R12-1-1428, and R12-1-1429, each registrant shall provide, near the signs, symbols, and labels within the laser facility, operating procedure restrictions and any other safety information required to ensure compliance with this Article and minimize exposure to laser and collateral radiation.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Table referenced in subsection (A) was repealed effective January 2, 1996; Section amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1423. Laser Prohibitions**

**A.** A registrant shall not require or permit an individual to look directly into a laser beam or directly at specular reflections of a laser beam, or align a laser by eye while looking along the axis of the laser beam if the intensity of the beam or the beam's reflections exceeds the applicable MPE.

**B.** A registrant shall not permit an individual to enter a controlled area if the skin exposure exceeds the applicable MPE, unless the registrant provides and requires the use of protective clothing, gloves, and shields.

**C.** A registrant shall ensure that any laser product, emitting spatially scanned laser radiation, does not, as a result of scan failure or any other failure that causes a change in angular velocity or amplitude, permit human access to laser radiation that exceeds the accessible emission limits applicable to that class of product.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1424. Repealed**

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Repealed effective January 2, 1996 (Supp. 96-1).

**R12-1-1425. Laser Product Classification**

**A.** Each laser product is classified on the basis of emission level, emission duration, and wavelength of accessible laser radiation emitted over the full range of resulting operational capability, any time during the useful life of the product, according to the federal performance standards for light-emitting products contained in 21 CFR 1040.10, April 1, 2004, which is 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. This incorporation by reference contains no future editions or amendments.

**B.** Any person that modifies a certified laser product in a manner that affects any aspect of performance or intended functions of the product, shall recertify and reidentify the product in accordance with 21 CFR 1040.10, April 1, 2004, which is 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. This incorporation by reference contains no future editions or amendments.

**C.** Any laser system that is incorporated into a laser product that is subject to the requirements of this Article, and capable, without modification, of producing laser radiation when removed from the laser product, is considered a laser product, subject to the applicable requirements of this Article. Upon removal of the laser system described in this subsection, the laser product is classified on the basis of accessible laser radiation emission.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1426. Laser and Collateral Radiation Exposure Limits**

**A.** A registrant shall not use, or permit the use of a laser product that will result in a human exposure that exceeds the applicable MPE or accessible emission limit (AEL) listed in ANSI Z136.1-2000, American National Standard for Safe Use of Lasers, 2000 edition, which is incorporated by reference, published by the Laser Institute of America, 13501 Ingenuity Drive, Suite 128, Orlando, FL 32826, and on file with the Agency. Accessible emission limits are listed in 21 CFR 1040.10, April 1, 2004, which is 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. These incorporations by reference contain no future editions or amendments.

**B.** A registrant shall not allow exposure to collateral radiation that exceeds any accessible emission limit in 21 CFR 1040.10, April 1, 2004, which is 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. This incorporation by reference contains no future editions or amendments.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1427. Laser Caution Signs, Symbols, and Labels**

**A.** Except as otherwise authorized by the Agency, a registrant shall use signs, symbols, and labels prescribed by this Section and the design and colors specified in ANSI Z136.1-2000, American National Standard for Safe Use of Lasers, 2000 edition, which is incorporated by reference, published by the Laser Institute of America, 13501 Ingenuity Drive, Suite 128, Orlando, FL 32826, and on file with the Agency. This incorporation by reference contains no future editions or amendments.

**B.** A registrant shall ensure that the word "invisible" immediately precedes the word "radiation" on labels and signs required by this Section for lasers that only produce wavelengths of laser and collateral radiation that are outside of the range of 400 to 710 nanometers.

**C.** A registrant shall ensure that the words "visible and invisible" immediately precede the word "radiation" on labels and signs required by this Section for lasers that produce wavelengths of laser and collateral radiation that are both within and outside the range of 400 to 710 nanometers.

**D.** A registrant shall position any label placed on lasers or signs posted in laser facilities so that the reader of the label or sign is not exposed to laser or collateral radiation that exceeds the applicable MPE or accessible emission limit while reading the label or sign.

**E.** A registrant shall use labels and signs that are clearly visible, legible, and permanently attached to the laser or facility.

**F.** A registrant shall ensure that a permanent and legible label is affixed to each laser, identifying the classification of the laser in accordance with 21 CFR 1040.10, April 1, 2004, which is 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. This incorporation by reference contains no future editions or amendments.

**G.** For a Class 3 or Class 4 laser a registrant shall ensure that a permanent and legible label is affixed to each laser, specifying the maximum output of laser radiation, the pulse duration if applicable, and the laser medium or emitted wavelength.

**H.** For a Class 3 or Class 4 laser, used in the practice of medicine, a registrant shall ensure that a permanent and legible label is affixed to each laser providing one or more of the following warnings near each aperture that emits laser radiation or collateral radiation that exceeds the applicable MPE, as follows:

1. "AVOID EXPOSURE - Laser radiation is emitted from this aperture" if the radiation emitted through the aperture is laser radiation;
2. "AVOID EXPOSURE - Hazardous electromagnetic radiation is emitted from this aperture" if the radiation emitted through the aperture is collateral radiation; or
3. "AVOID EXPOSURE - Hazardous x-rays are emitted from this aperture" if the radiation emitted through the aperture is collateral x-ray radiation.

**I.** A registrant shall ensure that there is a label on each non-interlocked or defeatable interlocked portion of the protective housing or enclosure that permits human access to laser or collateral radiation. The label shall include one or more of the following warnings, as applicable:

1. For laser radiation that exceeds the applicable accessible emission limit for a Class 1 or Class 2 laser, but does not exceed the applicable accessible emission limit for a Class 3 laser, the warning: "DANGER - Laser radiation when open, AVOID DIRECT EXPOSURE TO THE BEAM."
2. For laser radiation that exceeds the applicable accessible emission limit for a Class 3 laser, the warning: "DANGER - Laser radiation when open, AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION."
3. For collateral radiation that exceeds an applicable accessible emission limit:
   a. If the applicable limit for collateral laser radiation is exceeded, the warning: "CAUTION - Hazardous electromagnetic radiation when open"; and
   b. If the applicable limit for collateral x-ray radiation is exceeded, the warning: "CAUTION - Hazardous x-ray radiation".
4. For a protective housing or an enclosure that has a defeatable interlock, the warning "and interlock defeated" in addition to the warnings in subsections (1) through (3).

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1428. Repealed**

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Repealed effective January 2, 1996 (Supp. 96-1).

**R12-1-1429. Posting of Laser Facilities**
Unless other methods are approved by the Agency, a registrant shall post each laser facility in accordance with ANSI Z136.1-2000, American National Standard for Safe Use of Lasers, 2000 edition, which is incorporated by reference, published by the Laser Institute of America, 13501 Ingenuity Drive, Suite 128, Orlando, FL 32826, and on file with the Agency. This incorporation by reference contains no future editions or amendments.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1430. Repealed**

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Repealed effective January 2, 1996 (Supp. 96-1).

**R12-1-1431. Repealed**

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Repealed effective January 2, 1996 (Supp. 96-1).

**R12-1-1432. Repealed**

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Repealed effective January 2, 1996 (Supp. 96-1).

**R12-1-1433. Laser Use Areas that are Controlled**
**A.** A registrant shall establish a controlled area for a laser if it is possible for a person to be exposed to laser radiation from a Class 3b laser, except a Class 3b laser of less than 5 milliwatts visible peak power, or a Class 4 laser that exceeds the applicable MPE or AEL in R12-1-1426.
**B.** A registrant shall ensure that a controlled area associated with a Class 3b laser is:
1. The responsibility of a LSO;
2. Posted in accordance with this Article; and
3. Access controlled by the LSO or a trained, designated representative.

**C.** A registrant shall ensure that a controlled area associated with a Class 4 laser is:
1. The responsibility of a LSO;
2. Posted in accordance with this Article;
3. Access controlled by the LSO or a trained, designated representative; and
4. If an indoor controlled area:
   a. Equipped with latches, interlocks, or another means of preventing unexpected entry into the controlled area;
   b. Equipped with a control-disconnect switch, panic button, or an equivalent device for deactivating the laser during an emergency;
   c. Operated so that the person in charge of the controlled area can momentarily override the safety interlocks during tests that require continuous operation to provide access to other personnel if there is no optical radiation hazard at the point of entry and the entering personnel are wearing required protective devices; and
   d. Controlled in a way that reduces the transmitted values of laser radiation through optical paths such as windows, to levels at or below the applicable ocular MPE and AEL in R12-1-1426. If a laser beam with an irradiance or radiant-exposure above the applicable MPE or AEL will exit the indoor controlled area (as in the case of exterior atmospheric beam paths), the registrant and the operator are responsible for ensuring that the beam path is limited to controlled air space or controlled ground space.

**D.** If a panel or protective cover is removed or an interlock bypassed for service, testing, or maintenance, a registrant shall establish an accessible controlled area. The registrant, through a LSO or a designated representative, shall comply with laser safety requirements for all potentially-exposed individuals.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1434. Laser Safety Officer (LSO)**
**A.** Each registrant shall designate a Laser Safety Officer (LSO).
**B.** The LSO shall administer the laser radiation protection program and shall:
1. Ensure that maintenance or service for Class 3b and Class 4 lasers is performed only by technicians trained to provide the maintenance or service by either the manufacturer's service organization or the registrant;
2. Approve or reject written service, maintenance, and operating procedures;
3. Investigate, document, and report all incidents as required by R12-1-1436;
4. Select protective eyewear as required by R12-1-1435, along with any other protective equipment;
5. For health care facilities, establish authorization and operating procedures, including preoperative and postoperative checklists, for use by operating room personnel;
6. Ensure that authorized personnel are trained in the assessment and control of laser hazards;
7. Select signs, symbols, and labels as required by R12-1-1427;
8. Perform laser radiation protection surveys as required by R12-1-1421 and R12-1-1441;
9. Classify or verify the classification of lasers and laser systems used under the LSO's jurisdiction;
10. Evaluate the hazard of laser use areas, treatment areas, and controlled areas, as required by R12-1-1421(C).

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1435. Laser Protective Eyewear**
**A.** A registrant shall require that protective eyewear, as specified by the LSO, be worn by an individual who has access to:
1. Class 4 laser radiation; or
2. Class 3b laser radiation.

**B.** A registrant shall, through the LSO, provide protective eyewear that is:

1. Marked with a label that indicates the optical density protection afforded for the relevant laser wavelength;
2. Maintained so that the protective properties of the eyewear are preserved;
3. Inspected at intervals that do not exceed six months to ensure integrity of the protective properties; and
4. Removed from service if the protective properties of the eyewear fall below the optical density on the label.

**C.** A registrant shall maintain records of protective eyewear maintenance, inspection, and removal from service for five years.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Section heading amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1436. Reporting Laser Incidents**

**A.** A registrant shall notify the Agency by telephone within 24 hours of any incident that has caused or may have caused:
1. Permanent loss of sight in either eye; or
2. Third-degree burns of the skin involving more than 5 percent of the body surface as estimated by the rule of nines.

**B.** A registrant shall notify the Agency by telephone within five working days of any incident that has or may have caused:
1. Any second-degree burn of the skin larger than one inch (2.54 centimeter) in greatest diameter; or
2. Any third-degree burn of the skin; or
3. An eye injury with any potential loss of sight.

**C.** Each registrant shall file a written report with the Agency of any known exposure of an individual to laser radiation or collateral radiation within 30 days of its discovery, describing:
1. Each exposure of the individual to laser or collateral radiation that exceeds the applicable MPE; and
2. Any incident that triggered a notice requirement in subsections (A) or (B).

**D.** Each report required by subsection (C) shall describe the extent of exposure to each individual including:
1. An estimate of the individual's exposure;
2. The level of laser or collateral radiation involved;
3. The cause of the exposure; and
4. The corrective steps taken or planned to prevent a recurrence.

**E.** A registrant shall not operate or permit the operation of any laser product or system that does not meet the applicable requirements in this Article.

*Editor's Note: The tables referenced in subsection (A) were repealed effective January 2, 1996.*

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended effective January 2, 1996 (Supp. 96-1); the tables previously referenced in subsection (A) were repealed effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1437. Special Lasers**

A registrant operating a laser system with an unenclosed beam path shall:
1. Conduct an evaluation before operating the laser to determine the expected beam path and the potential hazards from reflective surfaces. Based on the evaluation the registrant shall exclude reflective surfaces from the beam path at all points where the laser radiation exceeds an applicable MPE;
2. Evaluate the stability of the laser platform to determine the constraints placed upon the beam traverse and the extent of the range of control; and
3. Refrain from operating or making a laser ready for operation until the area along all points of the beam path, where the laser radiation will exceed the applicable MPE, is clear of individuals, unless the individuals are wearing the correct protective devices.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1438. Hair Reduction and Other Cosmetic Procedures Using Laser and Intense Pulsed Light**

**A.** Registration. A person who seeks to perform hair reduction or other cosmetic procedures shall apply for registration of any medical laser or IPL device that is a Class II surgical device, certified as complying with the labeling standards in 21 CFR 801.109, revised April 1, 2010, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments. The applicant shall provide all of the following information to the Agency with the application for registration:
1. Documentation demonstrating that the health professional is qualified in accordance with A.R.S. § 32-516 or 32-3233, has 24 hours of didactic training on the subjects listed in Appendix C, and has passed an Agency-approved exam on subjects covered with a minimum grade of 80%;
2. For any health professional in practice prior to October 1, 2010, proof of 24 hours of training on the subjects listed in Appendix C;
3. Documentation endorsed by the prescribing health professional, acknowledging responsibility for the minimum level of supervision required for hair reduction procedures as defined in R12-1-1402 under "indirect supervision";
4. Procedures to ensure that the registrant has a written order from a prescribing health professional before the application of radiation;
5. If authorized, procedures to ensure that, in the absence of a prescribing health professional at the facility, the registrant has established a method for emergency medical care and assumed legal liability for the service rendered by an indirectly-supervised certified laser technician; and
6. Documentation that the indirectly-supervised certified laser technician has participated in the supervised training required by A.R.S. § 32-516 or 32-3233.

**B.** Hair Reduction Procedures
1. If a registrant is using a medical laser or an IPL device that is a Class II surgical device, certified in accordance with the labeling standards in subsection (A), for hair reduction procedures, the registrant shall:
   a. Ensure that the device is only used by a health professional described in A.R.S. §§ 32-516(F)(3) and 32-3233(D)(1) or by a certified laser technician who is working under the indirect supervision of a health professional described in A.R.S. §§ 32-516(C)(1) and 32-3233(D) and (H)(1), and
   b. Ensure that a prescribing health professional purchases or orders the Class II surgical device that will be used for hair reduction procedures.
2. A registrant shall:

a. Not permit an individual to use a medical laser or IPL device for hair reduction procedures unless the individual:
   i. Completes an approved laser technician didactic training program of at least 40 hours duration. To successfully complete the training program, the individual shall pass a test that consists of at least 50 multiple choice questions on subjects covered with a minimum grade of 80%. The training program shall be provided by an individual who is a health professional acting within the health professional's scope of practice, or a certified laser technician with a minimum of 100 hours of hands-on experience per procedure being taught;
   ii. Is present in the room for at least 24 hours of hands-on training, conducted by a health professional or a certified laser technician as described in subsection (B)(2)(a)(i);
   iii. Performs or assists in at least 10 hair reduction procedures; and
   iv. Has the qualified health professional or qualified supervising certified laser technician certify that the laser technician has completed the training and supervision as described in subsection (B)(2)(a).
b. Ensure that the laser technician follows written procedure protocols established by a prescribing health professional; and
c. Ensure that the laser technician follows any written order, issued by a prescribing health professional, which describes the specific site of hair reduction.

3. A registrant shall maintain a record of each hair reduction procedure protocol that is approved and signed by a prescribing health professional, and ensure that each protocol is reviewed by a prescribing health professional, at least annually.
4. A registrant shall:
   a. Maintain each procedure protocol onsite, and ensure that the protocol contains instructions for the patient concerning follow-up monitoring; and
   b. Design each protocol to promote the exercise of professional judgment by the laser technician commensurate with the individual's education, experience, and training. The protocol need not describe the exact steps that a qualified laser technician should take with respect to a hair reduction procedure.
5. A registrant shall require that a prescribing health professional observe the performance of each laser technician during procedures at intervals that do not exceed six months. The registrant shall maintain a record of the observation for three years from the date of the observation.
6. A registrant shall verify that a health professional is qualified to perform hair reduction procedures by obtaining evidence that the health professional has received relevant training specified in subsection (A)(1) and in physics, safety, surgical techniques, pre-operative and post-operative care and can perform these procedures within the relevant scope of practice, as defined by the health professional's licensing board.
7. A registrant shall provide radiation safety training to all personnel involved with hair reduction procedures, designing each training program so that it matches an individual's involvement in hair reduction procedures. The registrant shall maintain records of the training program and make them available to the Agency for three years from the date of the program, during and after the individual's period of employment.

**C.** Other Cosmetic Procedures

1. If a registrant is using a medical laser or an IPL device that is a Class II surgical device, certified in accordance with the labeling standards in subsection (A), for other cosmetic procedures, the registrant shall.
   a. Ensure that the device is only used by a health professional described in A.R.S. §§ 32-516(F)(3) and 32-3233(D)(1) or by a certified laser technician who is directly supervised by a health professional as described in A.R.S. §§ 32-516(C)(2) and 32-3233(D) and (H)(2); and
   b. Ensure that a prescribing health professional purchases or orders the Class II surgical device that will be used for other cosmetic procedures.
2. A registrant shall not permit an individual to use a medical laser or IPL device for other cosmetic procedures unless the individual:
   a. Completes an approved laser technician didactic training program of at least 40 hours duration. To successfully complete the training program the individual shall pass a test that consists of at least 50 multiple choice questions on subjects covered with a minimum grade of 80%. The training program shall be provided by an individual who is a health professional acting within the health professional's scope of practice, or a certified laser technician with a minimum of 100 hours of hands-on experience per procedure being taught;
   b. Is present in the room for at least 24 hours of hands-on training, conducted by a health professional or a certified laser technician as described in subsection (C)(2)(a); and
   c. Performs or assists in at least 10 cosmetic procedures governed by subsection (C), for each type of procedure (for example: spider vein reduction, skin rejuvenation, non-ablative skin resurfacing); and
   d. Has the qualified health professional or qualified supervising certified laser technician certify that the laser technician has completed the training and supervision as described in subsection (C)(2).
3. A registrant shall maintain a record of each protocol for a cosmetic procedure governed by subsection (C) that is approved and signed by a prescribing health professional, and ensure that each protocol is reviewed by a prescribing health professional, at least annually. The registrant shall:
   a. Maintain each protocol onsite, and ensure that the protocol contains instructions for the patient concerning follow-up monitoring; and
   b. Design each protocol to promote the exercise of professional judgment by the laser technician commensurate with the individual's education, experience, and training. The protocol need not describe the exact steps that a qualified laser technician should take with respect to a cosmetic procedure governed by subsection (C).
4. A registrant shall verify that a health professional is qualified to perform laser, IPL, and related procedures, by obtaining evidence that the health professional has received relevant training specified in subsection (A)(1) and in physics, safety, surgical techniques, pre-operative and post-operative care and can perform these procedures within the relevant scope of practice, as defined by the health professional's licensing board.

5. A registrant shall provide radiation safety training to all personnel involved with cosmetic procedures governed by subsection (C), designing each training program so that it matches an individual's involvement in each procedure. The registrant shall maintain records of the training program and make them available to the Agency for three years from the date of the program, during and after the individual's period of employment.

**D.** Persons governed by this Section shall also comply with other applicable licensing and safety laws.

**E.** A laser shall be secured so that the laser cannot be removed from the facility and the on/off switch is turned to the "off" position with the key removed when a certified laser technician or a health professional is not present in the room where the laser is located.

**Historical Note**

Adopted effective April 2, 1990 (Supp. 90-2). Repealed effective January 2, 1996 (Supp. 96-1). New Section made by final rulemaking at 11 A.A.R. 978, effective April 3, 2005 (05-1). Amended by final rulemaking at 16 A.A.R. 1703, effective August 10, 2010; Manifest typographical errors corrected at the request of the Agency, filed August 31, 2010, file no. M10-342 (Supp. 10-3).

**R12-1-1438.01. Certification and Revocation of Laser Technician Certificate**

**A.** An applicant for a laser technician certificate shall submit a completed application and certification that the applicant has received the training specified in A.R.S. §§ 32-516(A) or 32-3233(E).

**B.** The applicant shall pay a nonrefundable fee of $30.00. A duplicate certificate may be requested at the time of initial application or renewal at a fee of $10.00 per certificate. To obtain a duplicate certificate at other times a laser technician shall pay $20.00 per certificate.

**C.** Initial certificates are issued for 12 months and expire on the last day of the month. A renewal application shall be accompanied by a renewal fee of $30.00 each year in addition to $10.00 per duplicate certificate requested.

**D.** Under A.R.S. § 32-3233(I) and (J), the Agency may take appropriate disciplinary action, including revocation of the certificate of a certified laser technician. The Agency may discipline a certified laser technician who has had a relevant professional license suspended or revoked, or been otherwise disciplined by a health professional board or the Board of Cosmetology. The Agency may also discipline the certified laser technician for falsifying documentation related to training, prescriptions, or other required documentation. As provided in Article 12 of this Chapter, the Agency may assess civil penalties, suspend, revoke, deny, or put on probation a certified laser technician.

**E.** A laser technician who has been using laser and IPL devices prior to November 24, 2009 may continue to do so if the technician applies for and receives a certificate from the Agency before October 1, 2010.

**F.** Certification may be issued for one or more of the following procedures:

1. Hair Reduction,
2. Skin Rejuvenation,
3. Non-Ablative Skin Resurfacing,
4. Spider Vein Reduction,
5. Skin Tightening,
6. Wrinkle Reduction,
7. Laser Peel,
8. Telangiectasia Reduction,
9. Acquired Adult Hemangioma Reduction,
10. Facial Erythema Reduction,
11. Solar Lentigo Reduction (Age Spots),
12. Ephelis Reduction (Freckles),
13. Acne Scar Reduction,
14. Photo Facial, or
15. Additional procedures as approved by the Agency after consultation with other health professional boards as defined in A.R.S. §§ 32-516(F)(3) or 32-3233(D)(1).

**G.** For any application relating to the certification of laser technicians, as described in A.R.S. § 41-1072, there is an administrative completeness review time-frame of 30 days and a substantive review time-frame of 30 days with an overall time-frame of 60 days.

**H.** Certified laser technicians shall display a valid original certificate as issued by the Agency in a location that is viewable by the public.

**Historical Note**

New Section made by final rulemaking at 16 A.A.R. 1703, effective August 10, 2010 (Supp. 10-3).

**R12-1-1439. Laser and IPL Laser Technician and Laser Safety Training Programs**

**A.** A person seeking to initiate a medical laser or IPL laser technician training program shall submit an application to the Agency for certification that contains a description of the training program. In addition, the person shall submit a syllabus and a test that consists of at least 50 multiple choice questions on subjects covered. In the program materials, the person shall address the subjects in R12-1-1438 through this Section, and Appendix C.

**B.** The Agency shall review the application and other documents required by subsections (A) and (E) in a timely manner, using an administrative completeness review time-frame of 40 days and a substantive review time-frame of 20 days with an overall time-frame of 60 days.

**C.** The Agency shall maintain a list of certified laser or IPL training programs.

**D.** Applicants for approval as a certified laser or IPL training program shall pay a nonrefundable $100.00 fee.

**E.** Initial certification shall be issued for 12 months and shall expire on the last day of the month. A renewal application shall be accompanied by a renewal fee of $100.00 each year.

**F.** A person seeking to initiate a medical laser or IPL laser technician safety training program shall submit an application to the Agency for certification that contains a description of the training program. In addition, the person shall submit a syllabus and a test that consists of at least 50 multiple choice questions on subjects covered. In the program materials, the person shall address the subjects in R12-1-1421 through R12-1-1444, Appendix C, and Appendix D, with emphasis on personal and public safety. The program shall also contain the training required by A.R.S. § 32-3233(E) or clearly state the portions of the training that are not provided or met if didactic certification is to take place in another program. The applicant shall conduct training in accordance with the program submitted to the Agency and certified by the Agency.

**Historical Note**

Adopted effective April 2, 1990 (Supp. 90-2). Amended effective January 2, 1996 (Supp. 96-1). Section repealed; new Section made by final rulemaking at 11 A.A.R. 978, effective April 3, 2005 (Supp. 05-1). Amended by final rulemaking at 16 A.A.R. 1703, effective August 10, 2010 (Supp. 10-3).

**R12-1-1440. Medical Lasers**

**A.** A registrant shall ensure that a Class 3 and Class 4 laser product used in the practice of medicine has a means for measuring the level of laser radiation with an error in measurement of no greater than +20%, when calibrated in accordance with the laser product manufacturer's calibration procedure.

**B.** A registrant shall calibrate a laser used in the practice of medicine according to the manufacturer's specified calibration procedure, at intervals that do not exceed those specified by the manufacturer.

**C.** In a medical facility where several medical disciplines or a number of different practitioners use Class 3b and Class 4 lasers, a registrant shall form a Laser Safety Committee to govern laser activity, establish use criteria, and approve operating procedures, as follows:
1. With regard to membership of the committee the registrant shall include at least one representative of the Nursing staff, the LSO, one management representative, and one representative of each medical discipline that uses the lasers;
2. The committee shall review actions by the LSO related to hazard evaluation and the monitoring and control of laser hazards; and
3. The committee shall approve or deny requests by potential operators and ancillary personnel to operate or assist in the operation of a laser under the direction of a licensed practitioner.

**D.** A registrant shall use Class 3b and Class 4 Lasers that have a guard mechanism on the switch to control patient exposure and prevent inadvertent exposure.

**E.** A registrant shall establish a written laser safety training program that provides a thorough understanding of established procedures for each type of laser in use and the medical procedures associated with use of the laser. The registrant shall make program documentation available for Agency review and, at minimum, address all of the following in the documentation:
1. Regulatory requirements and the laser classification system;
2. Fundamentals of laser operation and the significance of specular and diffuse reflections;
3. Biological effects of laser radiation on the eye and skin;
4. Non-beam hazards (for example: electrical, chemical, and reaction by-product hazards) and ionizing radiation hazards (for example: x-rays from power sources and target interactions, if applicable) of lasers; and
5. Responsibilities of management and employees regarding control measures.

**Historical Note**

Adopted effective April 2, 1990 (Supp. 90-2). Amended effective January 2, 1996 (Supp. 96-1). Section repealed; new Section made by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1441. Laser Light Shows and Demonstrations**

**A.** Before a conducting laser light show or laser demonstration, a registrant shall provide documentation to the Agency that a variance from 21 CFR 1040.10 has been obtained form the FDA.

**B.** A registrant shall notify the Agency in writing, at least three working days in before a proposed laser light show or demonstration, and include all of the following information:
1. The location, time, and date of the light show or demonstration;
2. Sketches showing the locations of each laser, operator, performer, laser beam path, viewing screen, wall, mirror ball, or any other reflective or diffuse surface that could be hit by or reflect the laser beam;
3. Scanning beam patterns, scan velocity, and frequency in occupied areas; and
4. Physical surveys and calculations made to comply with this Article.

**C.** A registrant shall supply any additional information required by the Agency for the safety evaluation of the proposed activity.

**D.** Before an outdoor laser light show, a registrant shall notify the Federal Aviation Administration of the proposed show.

**E.** If a light show or demonstration involves laser radiation emissions outside the spectral range of 400 to 700 nanometers, a registrant shall prevent the emissions from exceeding the applicable Class 1 accessible emission limit.

**F.** If it is likely that an audience member or any operator, performer, or employee will view laser or collateral radiation, a registrant shall prevent the radiation from exceeding the applicable Class 1 accessible emission limit.

**G.** Even if it is unlikely that an individual, including any operator, performer, or employee in the vicinity of a laser light show or demonstration will view or be exposed to laser or collateral radiation, a registrant shall prevent the radiation from exceeding the applicable Class 2 accessible emission limit.

**H.** A registrant shall identify any area where levels of laser radiation exceed the applicable Class 2 accessible emission limit by posting warning signs and using barriers or guards to prevent entry.

**I.** If a registrant uses a scanning device, the registrant shall not use a device which, as a result of scan failure or any other failure, can change its angular velocity or amplitude, permitting audience exposure to laser radiation that exceeds the applicable Class 1 accessible emission limit.

**J.** If a mirror ball is used with a scanning laser, a registrant shall meet the requirements of subsections (F) and (G) when the mirror ball is stationary or during any failure mode that results in a change in the rotational speed of the mirror ball.

**K.** A registrant shall ensure that an operator is at all times directly and personally supervising a laser light show or demonstration, except in cases where the maximum laser power output level is less than 5 milliwatts (all spectral lines) and the laser beam path is located at all times at least 6 meters above any surface upon which an individual in the audience is permitted to stand, and at any point, more than 2.5 meters in lateral separation from any position where an individual in the audience is permitted during the performance.

**L.** A registrant shall prevent laser radiation levels from exceeding the applicable Class 2 accessible emission limit at any point less than three meters above any surface upon which an individual in the audience is permitted to stand and 2.5 meters in lateral separation from any position where an individual in the audience is permitted, unless physical barriers are present that prevent human access to the radiation.

**M.** A registrant shall limit the maximum power output of any laser to a level sufficient to produce the desired effect.

**N.** If a registrant is required to limit output power to a level less than the available power to meet the requirements of this Article, the registrant shall adjust, measure, and record the laser output power before the laser light show or demonstration.

**O.** A registrant shall functionally test and evaluate all safety devices and procedures necessary to comply with this Article after setup, and before a laser light show or demonstration.

**P.** A registrant shall secure a laser system, when not in use, against unauthorized operation or tampering

**Q.** A registrant shall perform laser alignment procedures with the laser output power reduced to the lowest practicable level, and

ensure that any operator, performer, or other employee wears protective eyewear as necessary to prevent exposure to radiation levels that exceed the applicable MPE. The registrant shall only allow individuals who are performing the alignment be present during alignment procedures.

**R.** A registrant shall not conduct a laser light show or demonstration unless the Agency has specifically exempted the show or demonstration from the requirements of 21 CFR 1040.10, April 1, 2004, which is 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. This incorporation by reference contains no future editions or amendments.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended effective January 2, 1996 (Supp. 96-1). Section repealed; new Section made by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1442. Measurements and Calculations to Determine MPE Limits for Lasers**

A registrant shall take measurements to determine MPE values in a manner consistent with the procedures contained in ANSI Z136.1-2000, American National Standard for Safe Use of Lasers, 2000 edition, which is incorporated by reference, published by the Laser Institute of America, 13501 Ingenuity Drive, Suite 128, Orlando, FL 32826, and on file with the Agency. This incorporation by reference contains no future editions or amendments.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Repealed effective January 2, 1996 (Supp. 96-1). New Section made by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1443. Laser Compliance Measurement Instruments**

A registrant shall ensure that the radiation output measurement is performed with an instrument that is calibrated and designed for use with the laser that is being evaluated for compliance. The registrant shall specify the date of calibration, accuracy of calibration, wavelength range, and power or energy of calibration on a legible, clearly visible label attached to the instrument.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Section heading amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**R12-1-1444. Laser Classification Measurements**

**A.** A registrant shall measure accessible emission for classification:
1. Under the operational conditions and procedures that maximize accessible emission levels, including start-up, stabilized operation, and shutdown of the laser or laser facility;
2. With all controls and adjustments listed in the operating and service instructions adjusted for the maximum accessible emission level of laser radiation that is not expected to be detrimental to the functional integrity of the laser or enclosure;
3. At points in space to which human access is possible for a given laser configuration. If operations include the defeat of safety interlocks or removal of portions of the protective housing or enclosure, the registrant shall measure accessible emission at points accessible in that configuration;
4. With the measuring instrument detector positioned so that the maximum possible radiation is measured by the instrument; and
5. With the laser coupled to the type of laser energy source specified as compatible by the laser manufacturer and producing the maximum emission of accessible laser radiation.

**B.** A registrant shall perform measurements of accessible emission levels, used to classify laser and collateral radiation in accordance with 21 CFR 1040.10, April 1, 2004, which is 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. This incorporation by reference contains no future editions or amendments.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Section heading amended effective January 2, 1996 (Supp. 96-1). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**Appendix A. Radio Frequency Devices (Include, but are not limited to, the following)**

Dielectric heaters and sealers
Medical diathermy units
Radar
R.F. activated alarm systems
Sputter devices
R.F. activated lasers
Edge gluers
Industrial microwave ovens and dryers
Asher-etcher equipment
R.F. welding equipment
Medical surgical coagulators

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**Appendix B. Application Information**

The Agency shall issue a registration if an applicant provides the following information and fee as required in R12-1-1401(D). The Agency shall provide an application form to the applicant with a guide and upon request, assist the applicant to ensure that correct information is provided on the application form.

Name and mailing address of applicant
Person responsible for radiation safety program
Type of facility
Legal structure and ownership
Radiation source information
Shielding information
Equipment operator instructions and restrictions
Classification of professional in charge
Type of request: amendment, new, or renewal
Protection survey results, if applicable
Radiation Safety Officer name, if applicable
Laser class and type, if applicable
Information required by Article 14 for the specific source
Use location
Telephone number
Facility subtype
Signature of certifying agent
Equipment identifiers
Scale drawing
Physicist name and training, if applicable
Contact person

Applicable fee listed in Article 13 schedule

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Repealed effective January 2, 1996 (Supp. 96-1). Appendix repealed by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). New appendix made by final rulemaking at 11 A.A.R. 61, effective February 5, 2005 (Supp. 04-4).

**Appendix C. Hair Removal and Other Cosmetic Laser or IPL Operator Training Program**

1. General Considerations. An applicant shall ensure that:
   a. The training program is specific to the medical laser or IPL device in use and the clinical procedures to be performed;
   b. Program content is consistent with facility policy and procedure and applicable federal and state law; and
   c. The training program addresses hazards associated with laser or IPL device use.
2. Technical Considerations. The applicant's training program shall cover all of the following technical subjects:
   a. Laser and IPL device descriptions
   b. Definitions
   c. Laser and IPL device radiation fundamentals
   d. Laser mediums, types of lasers, and other light-emitting devices – solid, liquid, gas, and IPL devices
   e. Biological effects of laser or IPL device light
   f. Damage mechanisms
      i. Eye hazard
      ii. Skin hazard (includes information regarding skin type and skin anatomy)
      iii. Absorption and wavelength effects
      iv. Thermal effects
   g. Photo chemistry
   h. Criteria for setting the Maximum Permissible Exposure (MPE) for eye and skin associated hazards
   i. Explosive, electrical, and chemical hazards
   j. Photosensitive medications
   k. Fire, ionizing radiation, cryogenic hazards, and other hazards, as applicable
3. Medical Considerations. The applicant's training program shall cover all of the following medical subjects:
   a. Local anesthesia techniques, including ice, EMLA® cream, and other applicable topical treatments
   b. Typical laser and IPL device settings for hair removal and cosmetic procedures
   c. Expected patient response to treatment
   d. Potential adverse reactions to treatment
   e. Anatomy and physiology of skin areas to be treated
   f. Indications and contraindications for use of pigment and vascular-specific lasers for cutaneous procedures
4. General Laser or IPL device safety. The applicant's training program shall cover the following general safety subjects:
   a. Laser and IPL device classifications
   b. Control measures (includes information regarding protective equipment)
   c. Manager and operator responsibilities
   d. Medical surveillance practices
   e. Federal and state legal requirements
   f. Related safety issues
      i. Controlled access
      ii. Plume management
      iii. Equipment testing, aligning, and troubleshooting

**Historical Note**
New appendix made by final rulemaking at 11 A.A.R. 978, effective April 3, 2005 (Supp. 05-1).

**Appendix D. Laser Operator and Laser Safety Officer Training**

1. Operators and personnel that work around lasers:
   a. Fundamentals of laser operation (for example: physical principles, construction, and other basic information)
   b. Bioeffects of laser radiation on the eye and skin
   c. Significance of specular and diffuse reflections
   d. Non-beam hazards of lasers (for example: electrical, chemical, and reaction byproducts)
   e. Ionizing radiation hazards (includes information regarding x-rays from power sources and target interactions, if applicable)
   f. Laser and laser system classifications
   g. Control measures
   h. Responsibilities of managers and operators
   i. Medical surveillance practices (if applicable)
   j. CPR for personnel servicing lasers with exposed high voltages, the capability of producing potentially lethal electrical currents, or both.
2. The LSO or other individual responsible for the safety program, evaluation of hazards, and implementation of control measures, or any others, if directed by management to obtain a thorough knowledge of laser safety:
   a. The subjects covered in subsection (1)
   b. Laser terminology
   c. Laser types, wavelengths, pulse shapes, modes, power and energy
   d. Basic radiometric units and measurement devices
   e. MPE levels for eye and skin under all conditions
   f. Laser hazard evaluations, range equations, and other calculations
3. Technical Considerations
   a. Laser and IPL device descriptions
   b. Definitions
   c. Laser and IPL device radiation fundamentals
   d. Laser mediums, types of lasers, and other light-emitting devices (includes information regarding diodes and solid, liquid, gas, and IPL devices)
   e. Biological effects of laser or IPL device light
   f. Damage mechanisms
      i. Eye hazard
      ii. Skin hazard (includes information regarding skin type and skin anatomy)
      iii. Absorption and wavelength effects
      iv. Thermal effects
   g. Photo chemistry
   h. Photosensitive medications
   i. Criteria for setting the Maximum Permissible Exposure (MPE) levels for eye and skin associated hazards
   j. Explosive, electrical, and chemical hazards
   k. Fire, ionizing radiation, cryogenic hazards, and other hazards as applicable

**Historical Note**

New appendix made by final rulemaking at 11 A.A.R. 978, effective April 3, 2005 (Supp. 05-1).

## 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, 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);
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 the licensee's name, license number, and the package identification number specified in the package approval.
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
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 mate-

rial 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);
   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, 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.

**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 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, 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 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2). Amended by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

**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 16. RESERVED

## ARTICLE 17. WIRELINE SERVICE OPERATIONS AND SUBSURFACE TRACER STUDIES

**R12-1-1701. Definitions**

"Energy compensation source (ECS)" means a small sealed source, with activity that does not exceed 3.7 Mbq (100 microcuries), contained within a logging tool or other tool component.

"Tritium neutron generator target source" means a tritium source contained within a tritium neutron generator tube that produces neutrons for use in well logging applications.

**Historical Note**
New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-1702. Agreement with Well Owner or Operator**

**A.** A licensee that performs wireline service (well logging) with a sealed source shall enter into a written agreement with the employing well owner or operator that identifies the party responsible for complying with each of the following requirements. The responsible party shall:
1. Make a reasonable effort to recover any sealed source that may be lodged in the well;
2. Not attempt to recover a sealed source in a manner which, in the licensee's opinion, is likely to result in its rupture;
3. Perform the radiation monitoring required in R12-1-1723(A);
4. Decontaminate anyone or anything contaminated with licensed material before releasing personnel or equipment from the site or releasing the site for unrestricted use; and
5. If a source is classified by the Agency as irretrievable after reasonable efforts at recovery, implement the following requirements within 30 days:
   a. Immobilize the irretrievable well logging source and seal it in place with a cement plug;
   b. Provide a means to prevent inadvertent intrusion that could damage the source, unless the site is rendered inaccessible to subsequent drilling operations; and
   c. Mount a permanent identification plaque, constructed of long-lasting material, such as stainless steel, brass, bronze, or Monel, in a conspicuous location adjacent to the well. The responsible party shall ensure that the plaque size is at least 17 cm (7 inches) square and 3 mm (1/8 inch) thick and the following information is written on the plaque:
      i. The word "CAUTION,"
      ii. The radiation symbol (the color requirement in R12-1-428(A) does not apply),
      iii. The date the source was abandoned,
      iv. The name of the well owner or operator that employed the licensee;
      v. The well name and identification number or other designation,
      vi. An identification of each source by radionuclide and quantity of radionuclide,
      vii. The depth of the source and depth to the top of the plug, and
      viii. The following warning, "DO NOT RE-ENTER THIS WELL," and
   d. Notify the Oil and Gas Conservation Commission, Department of Water Resources, or Department of Environmental Quality of the abandoned source, as required by law.

**B.** A licensee shall maintain a copy of the agreement at the field station during logging operations. The licensee shall retain a copy of the written agreement for three years after completion of the well logging operation.

**C.** A licensee may apply in accordance with A.R.S. § 30-654(B)(13) for Agency approval, on a case-by-case basis, of proposed procedures to abandon an irretrievable well logging source in a manner not otherwise authorized in subsection (A)(5).

**D.** A written agreement between the licensee and the well owner or operator is not required if the licensee and the well owner or operator are employed by the same corporation or other business entity. If so, the licensee shall comply with the requirements in subsections (A)(1) through (A)(5).

**Historical Note**

Adopted effective April 2, 1990 (Supp. 90-2). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). Section repealed; new Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-1703. Limits on Levels of Radiation**

A person in possession of any source of radiation shall transport the source according to 12 A.A.C. 1, Article 15, and use or store the source in a manner that is consistent with the dose limits in 12 A.A.C. 1, Article 4.

**Historical Note**

Adopted effective April 2, 1990 (Supp. 90-2). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3).

**R12-1-1704. Reserved**

**R12-1-1705. Reserved**

**R12-1-1706. Reserved**

**R12-1-1707. Reserved**

**R12-1-1708. Reserved**

**R12-1-1709. Reserved**

**R12-1-1710. Reserved**

**R12-1-1711. Reserved**

**R12-1-1712. Storage Precautions**

**A.** A person storing or transporting a source of radiation shall place the source in an approved storage container, transport container, or both. The container or combination of containers shall have a lock, or tamper-proof seal for calibration sources, to prevent unauthorized removal of the source and exposure to radiation.

**B.** A person storing or transporting a source of radiation shall store the source in a manner that will minimize danger from explosion or fire.

**Historical Note**

Adopted effective April 2, 1990 (Supp. 90-2). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3).

**R12-1-1713. Transportation Precautions**

Each licensee shall ensure that transport containers are physically secured in the transporting vehicle to prevent accidental movement, loss, tampering, or unauthorized removal.

**Historical Note**

Adopted effective April 2, 1990 (Supp. 90-2). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

**R12-1-1714. Radiation Survey Instruments**

**A.** A licensee shall maintain at each field station and temporary job site a calibrated and operable radiation survey instrument capable of detecting beta and gamma radiation. The licensee shall ensure that the radiation survey instrument is capable of measuring 1.0 microsievert (0.1 millirem) per hour through 500 microsievert (50 millirem) per hour.

**B.** A licensee shall ensure that additional calibrated and operable radiation detection instruments are available as needed and that the instruments are sensitive enough to detect the low radiation and contamination levels that could be encountered if a sealed source is ruptured.

**C.** A licensee shall ensure that the radiation survey instrument required in subsection (A) is calibrated
1. At intervals not to exceed six months and after each instrument servicing;
2. At energies comparable to the energies of the radiation sources used;

3. For linear scale instruments, at two points located approximately 1/3 and 2/3 of full-scale on each scale or for logarithmic scale instruments, at mid-range of each decade, and at two points of at least one decade; and
4. So that accuracy within plus or minus 20 percent of the true radiation level can be demonstrated on each scale.

**D.** A licensee shall retain calibration records for a period of three years from the date of calibration.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3).

**R12-1-1715. Leak Testing of Sealed Sources**

**A.** A licensee that uses a sealed source shall ensure that the source is tested for leakage according to subsection (C). The licensee shall maintain a record of leak test results in units of Becquerels (Bq) or microcuries, for inspection by the Agency for three years after the leak test is performed.

**B.** A person authorized under R12-1-417(C) shall wipe a sealed source using a leak test kit or a similar method approved by the Agency, NRC, or another Agreement State. The authorized person shall take the wipe sample from the nearest accessible point to the sealed source where contamination might accumulate, and ensure the wipe sample is analyzed for radioactive contamination. The authorized person shall use a method of analysis capable of detecting the presence of 185 Bq (0.005 microcuries) of radioactive material on the test sample.

**C.** Test frequency.
1. A licensee shall ensure that each sealed source (except an energy compensation source (ECS)) is tested in accordance with R12-1-417. In the absence of a certificate from a transferor that a test has been performed within six months before transfer, a licensee shall not use the sealed source until it is tested.
2. A licensee shall ensure that each ECS that is not exempt from testing under subsection (E) is tested at intervals that do not exceed three years. In the absence of a certificate from a transferor that a test has been performed within three years before transfer, a licensee shall not use the ECS until it is tested.

**D.** Removal of leaking source from service.
1. If a test conducted according to this Section reveals the presence of 185 Bq (0.005 microcuries) or more of removable radioactive material, a licensee shall remove the sealed source from service immediately and have it decontaminated, repaired, or disposed of by an Agency, NRC, or Agreement State licensee that is authorized to perform these functions. The licensee shall check the equipment associated with the leaking source for radioactive contamination and, if the equipment is contaminated, have it decontaminated or disposed of by an Agency, NRC, or Agreement State licensee that is authorized to perform the chosen function.
2. A licensee shall submit a report to the Agency, within five days of receiving positive test results. The report shall describe the equipment involved in the leak, the test results, any contamination that resulted from the leaking source, and each corrective action taken up to the date on the report.

**E.** The following sealed sources are exempt from the periodic leak test requirements in subsections (A) through (D):
1. Hydrogen-3 (tritium) sources;
2. Sources that contain licensed material with a half-life of 30 days or less;
3. Sealed sources that contain licensed material in gaseous form;
4. Sources of beta- or gamma-emitting radioactive material with an activity of 3.7 MBq [100 microcuries] or less; and
5. Sources of alpha- or neutron-emitting radioactive material with an activity of 0.37 MBq [10 microcuries] or less.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended effective June 13, 1997 (Supp. 97-2). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). Amended by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-1716. Inventory**

A licensee shall conduct a physical inventory every six months to account for all licensed material received and possessed under the license. The licensee shall maintain records of the inventory for three years from the date of the inventory for inspection by the Agency. The inventory shall indicate the quantity and kind of licensed material, the location of the licensed material, the date of the inventory, and the name of each individual who conducted the inventory. Physical inventory records may be combined with leak test records.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). 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).

**R12-1-1717. Utilization Records**

Each licensee shall maintain records of use for three years from the date of the recorded event, that contain the following information for each source of radiation:
1. Make, model number, and serial number or a description of each source of radiation used;
2. The identity of the well-logging supervisor or the field unit to which the source is assigned;
3. Locations and dates of use; and
4. In the case of tracer materials and radioactive markers, the radionuclide and activity undertaken in a particular well.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3).

**R12-1-1718. Design and Performance Criteria for Sealed Sources**

**A.** A licensee shall use a sealed source for well logging applications if the sealed source:
1. Is doubly encapsulated;
2. Contains licensed material in a chemical and physical form that is insoluble and nondispersible; and
3. Meets the requirements of subsection (B), (C), or (D).

**B.** For a sealed source manufactured on or before July 14, 1989, a licensee may use a sealed source in well logging applications that meets the requirements of USASI N5.4-1968, Classification of Sealed Radioactive Sources, available from the American National Standards Institute at 25 West 43rd Street, 4th floor, New York, NY 10036, which is incorporated by reference and on file with the Agency, or the requirements in subsection (C) or (D). This incorporation by reference contains no future editions or amendments.

**C.** For a sealed source manufactured after July 14, 1989, a licensee may use a sealed source in well logging applications

that meets the oil-well logging requirements of ANSI/HPS N43.6-1997, Sealed Radioactive Sources--Classification, available from the American National Standards Institute at 25 West 43rd Street, 4th floor, New York, NY 10036, which is incorporated by reference and on file with the Agency. This incorporation by reference contains no future editions or amendments.

**D.** For a sealed source manufactured after July 14, 1989, a licensee may use a sealed source in well logging applications if the sealed source's prototype has been tested and found to maintain its integrity after each of the following required tests:
1. Temperature. The test source is held at -40× C for 20 minutes and 600× C for one hour, and then subjected to a thermal shock with a temperature drop from 600× C to 20× C within 15 seconds.
2. Impact. A 5 kg steel hammer, 2.5 cm in diameter, is dropped from a height of 1 m onto the test source.
3. Vibration. The test source is subjected to vibration in the 25 Hz to 500 Hz range at 5 g amplitude for 30 minutes.
4. Puncture. A 1 gram hammer with a pin, 0.3 cm in diameter, is dropped from a height of 1 m onto the test source.
5. Pressure. The test source is subjected to an external pressure of 1.695 x 107 pascals (24,600 pounds per square inch absolute).

**E.** The requirements in subsections (A), (B), (C), and (D) do not apply to a sealed source that contains licensed material in gaseous form.

**F.** The requirements in subsections (A), (B), (C), and (D) do not apply to an energy compensation source (ECS).

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). Section repealed; new Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-1719. Labeling**

**A.** A licensee shall mark each source, source holder, or logging tool that contains radioactive material with a durable, legible, and clearly visible marking or label, consisting at minimum of the standard radiation caution symbol, without the conventional color requirement, and the following wording:

DANGER (or: CAUTION)
RADIOACTIVE

This labeling is required for each component transported as a separate piece of equipment regardless of size.

**B.** A licensee shall permanently attach to each transport container a durable, legible, and a clearly visible label consisting at minimum, of the standard radiation caution symbol and the following wording:

DANGER (or: CAUTION)
RADIOACTIVE
NOTIFY CIVIL AUTHORITIES (or name of company)

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3).

**R12-1-1720. Inspection, Maintenance, and Opening of a Source or Source Holder**

**A.** Each licensee shall visually check source holders, logging tools, and source handling tools for defects before each use to ensure that the equipment is in good working condition and that required labeling is present. If defects are found, the licensee shall remove equipment from service until it is repaired, and make a record listing: date of check, name of inspector, equipment involved, each defect found, and repairs made. The licensee shall maintain each record for three years after a defect is found.

**B.** Each licensee shall have a program for semiannual visual inspection and routine maintenance of source holders, logging tools, injection tools, source handling tools, storage containers, transport containers, and uranium sinker bars to ensure that the required labeling is legible and that no physical damage is visible. If any defect is found, the licensee shall remove the equipment from service until it is repaired, and make a record listing; date of inspection, equipment involved, inspection and maintenance operations performed, each defect found, and each action taken to correct a defect. The licensee shall maintain each record for three years after a defect is found.

**C.** A licensee shall not remove a sealed source from a source holder or logging tool, or perform maintenance on a sealed source or source holder that contains a sealed source without written permission from the Agency.

**D.** If a sealed source is stuck in the source holder, a licensee shall not perform any operation, such as drilling, cutting, or chiseling, on the source holder unless the licensee is specifically authorized to perform the operation by the Agency.

**E.** The opening, repair, or modification of any sealed source is prohibited, unless authorized by the Agency, NRC, or an Agreement State.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). Section repealed; new Section made by final rulemaking at 10 A.A.R. 4458, effective December 4, 2004 (Supp. 04-4).

**R12-1-1721. Training**

**A.** A licensee shall not permit an individual to act as a logging supervisor until that person has:
1. Completed training in the subjects outlined in subsection (E);
2. Received copies of, and instruction in:
   a. The applicable rules contained in 12 A.A.C. 1;
   b. The Agency license under which the logging supervisor will perform well logging; and
   c. The licensee's operating and emergency procedures, required by R12-1-1722;
3. Completed on-the-job training and demonstrated competence during a field evaluation in the use of licensed materials, remote handling tools, and radiation survey instruments; and
4. Demonstrated understanding of the requirements in subsections (A)(1) and (A)(2) by successfully completing a written test.

**B.** The licensee shall not permit an individual to act as a logging assistant until that person has:
1. Received instruction in applicable rules of 12 A.A.C. 1;
2. Received copies of, and instruction in, the licensee's operating and emergency procedures required by R12-1-1722;
3. Demonstrated understanding of the materials listed in subsections (B)(1) and (B)(2) by successfully completing a written or oral test; and
4. Received instruction in the use of licensed materials, remote handling tools, and radiation survey instruments that is related to the logging assistant's intended job responsibilities.

**C.** A licensee shall provide a safety training review for logging supervisors and logging assistants at least once during each calendar year. Each logging supervisor and logging assistant

shall attend a safety training review at least once during the current calendar year.

**D.** A licensee shall maintain a record of each logging supervisor's and logging assistant's initial training and annual safety training review. The training records shall include copies of written tests and dates of oral tests given after the effective date of this Section. The licensee shall maintain the initial training records for three years following termination of employment, and maintain records of each annual safety training review, including a list of subjects covered during the review, for three years.

**E.** A licensee shall provide instruction in the following subjects in the training required by subsection (A)(1):

1. Fundamentals of radiation safety, including:
   a. Characteristics of radiation;
   b. Units of radiation dose and quantity of radioactivity;
   c. Hazards of exposure to radiation;
   d. Levels of radiation from licensed material;
   e. Methods of controlling radiation dose (time, distance, and shielding); and
   f. Radiation safety practices, including prevention of contamination and methods of decontamination;
2. Radiation detection instruments, including:
   a. Use, operation, calibration, and limitations of radiation survey instruments;
   b. Survey techniques; and
   c. Use of personnel monitoring equipment;
3. Equipment, including:
   a. Operation of equipment, including source handling equipment and remote handling tools;
   b. Storage, control, and disposal of licensed material; and
   c. Maintenance of equipment;
4. The requirements of pertinent federal and state law, and
5. Case histories of accidents in well logging.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended effective June 13, 1997 (Supp. 97-2). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). Amended by final rulemaking at 10 A.A.R. 4458, effective December 4, 2004 (Supp. 04-4).

**R12-1-1722. Operating and Emergency Procedures**

Each licensee shall develop operating and emergency procedures on the following subjects:

1. Procedures designed to prevent individuals from being exposed to radiation in excess of the limits in Article 4 of this Chapter. This subject includes:
   a. Use of a sealed source in a well without a surface casing for the purposes of protecting a fresh water aquifer, as appropriate;
   b. Methods employed to minimize exposure from inhalation or ingestion of licensed tracer materials; and
   c. Methods for minimizing exposure of individuals in the event of an accident;
2. Use of remote handling tools for manipulating a radioactive sealed source or tracer;
3. Methods and occasions for conducting a radiation survey;
4. Methods and occasions for locking and securing a source of radiation;
5. Personnel monitoring and the use of personnel monitoring equipment;
6. Transportation of a source to a temporary job site or field station, including packaging and placing the source of radiation in a vehicle, placarding the vehicle, and securing the source of radiation during transportation;
7. Procedure for notifying the Agency if there is an accident;
8. Maintenance of records;
9. Inspection and maintenance of source holders, logging tools, source handling tools, storage containers, transport containers, and injection tools;
10. Procedure required if a sealed source is:
    a. Lost or lodged downhole; or
    b. Ruptured, including safeguards to prevent job site and personnel contamination, inhalation; and ingestion
11. Procedures required for picking up, receiving, and opening packages that contain radioactive material; and
12. Procedures required for site and equipment surveys and decontamination following tracer studies.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3).

**R12-1-1723. Personnel Monitoring**

**A.** A licensee shall not permit an individual to act as a logging supervisor or logging assistant unless that person wears, at all times during the handling of licensed radioactive materials, a personnel dosimeter that is processed and evaluated by an accredited National Voluntary Laboratory Accreditation Program (NVLAP) processor.

**B.** A licensee shall assign a personnel dosimeter to each individual, who shall wear the assigned equipment.

**C.** A licensee shall replace film badges at least monthly and replace other personnel dosimeters at least quarterly. After replacement, a licensee shall promptly process each personnel dosimeter.

**D.** A licensee shall provide bioassay services to each individual who uses licensed materials in subsurface tracer studies if required by the license.

**E.** A licensee shall record exposures noted from personnel dosimeters required by subsection (A) and bioassay results and maintain these records for three years after the Agency terminates the radioactive material license.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended effective June 13, 1997 (Supp. 97-2). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). 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).

**R12-1-1724. Radioactive Contamination Control**

**A.** If a licensee detects evidence that a sealed source has ruptured or licensed materials have caused contamination, the licensee shall immediately initiate the emergency procedures required by R12-1-1722.

**B.** If contamination results from the use of licensed material in well logging, the licensee shall decontaminate all affected areas, equipment, and personnel.

**C.** During efforts to recover a source lodged in a well, the licensee shall continuously monitor, with a radiation detection instrument that complies with R12-1-1714 or a logging tool with a radiation detector, the well and any circulating fluids from the well to check for contamination resulting from damage to the source.

**Historical Note**
New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-1725. Uranium Sinker Bars**
A licensee may use a uranium sinker bar for a well logging application only if it is legibly impressed with the words "Caution Radioactive-Depleted Uranium" and "Notify Civil Authorities (or company name) if Found."

**Historical Note**
New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-1726. Energy Compensation Source**
**A.** A licensee may use an energy compensation source (ECS) in a logging tool, or other tool component, if the ECS contains a quantity of radioactive material that does not exceed 3.7 MBq (100 microcuries).
**B.** If used in a well with a surface casing, an ECS is subject to all Sections of this Article except R12-1-1702, R12-1-1728, and R12-1-1751.
**C.** If used in a well logging hole without a surface casing, an ECS is subject to all Sections of this Article.

**Historical Note**
New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-1727. Neutron Generator Source**
**A.** A licensee may use a tritium neutron generator source to produce neutrons for well logging applications.
**B.** If the activity of a tritium neutron generator source does not exceed 1.11 TBq (30 Curies) and the source is used in a well with a surface casing, the source is subject to all Sections of this Article except R12-1-1702 and R12-1-1751.
**C.** If the activity of a neutron generator source is equal to or exceeds 1.11 TBq (30 Curies) or the source is used in a well without a surface casing, the source is subject to all Sections of this Article.

**Historical Note**
New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-1728. Use of a Sealed Source in a Well Without a Surface Casing**
A licensee may use a sealed source in a well without a surface casing if the licensee follows a procedure for reducing the probability that the source will be lodged in the well. The procedure shall be separately approved by the Agency or in a license issued by the Agency, NRC, or another Agreement State.

**Historical Note**
New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

**R12-1-1729. Reserved**

**R12-1-1730. Reserved**

**R12-1-1731. Security**
**A.** A logging supervisor shall be physically present at a temporary job site whenever licensed material is being handled or is not stored and locked in a vehicle or storage place. The logging supervisor may leave the job site to obtain assistance if a source becomes lodged in a well.
**B.** During well logging, except when a radiation source is below ground or in a shipping or storage container, the logging supervisor or other individual designated by the logging supervisor shall maintain direct surveillance of the operation to prevent unauthorized entry into a restricted area, as defined in R12-1-102.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3).

**R12-1-1732. Handling tools**
The licensee shall provide and require the use of tools that will assure remote handling of sealed sources other than low-activity calibration sources.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2).

**R12-1-1733. Subsurface Tracer Studies**
**A.** Any person who handles radioactive tracer material shall wear protective gloves and other appropriate protective clothing and equipment. Precautions shall be taken to avoid ingestion or inhalation of radioactive material.
**B.** A licensee shall not inject radioactive material into potable aquifers without authority granted in a radioactive material license issued by the Agency.
**C.** A licensee shall dispose of tracer study waste contaminated with radioactive material in accordance with R12-1-434.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3).

**R12-1-1734. Use of a Sealed Source in a Well Without a Surface Casing and Particle Accelerators**
**A.** A licensee or registrant may use a sealed source in a well without a surface casing to protect a fresh water aquifer if the licensee follows the correct procedure for reducing the probability that the source will become lodged in the well.
**B.** A licensee or registrant shall not begin well logging operations in a well without a surface casing unless the Agency has approved the licensee's procedure for logging in an uncased hole.
**C.** A licensee or registrant shall not permit above-ground testing of a particle accelerator, designed for use in well-logging, which results in the production of radiation, unless the area or facility affected is controlled or shielded in a manner consistent with applicable requirements in Article 4 of this Chapter.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3).

**R12-1-1735. Reserved**

**R12-1-1736. Reserved**

**R12-1-1737. Reserved**

**R12-1-1738. Reserved**

**R12-1-1739. Reserved**

**R12-1-1740. Reserved**

**R12-1-1741. Radiation Surveys**
**A.** A licensee shall perform and make a record of a radiation survey using instruments or calculations of radiation levels in each area where radioactive material is stored.
**B.** A licensee shall make and record a radiation survey using instruments or calculations of radiation levels in occupied positions and on the exterior of each vehicle used to transport radioactive material. The survey or calculation shall include each source of radiation or combination of sources to be transported in the vehicle.
**C.** After removal of the sealed source from the logging tool and before departing the job site, a licensee shall ensure that the logging tool detector is energized, or a survey meter is used to

test the logging tool for contamination. The licensee shall record the test for contamination.

**D.** The licensee shall make and record each survey using an appropriate survey instrument for the radionuclide being used, at the job site or wellhead for each tracer operation, except those using Hydrogen-3, Carbon-14 and Sulfur-35. Each survey shall include measurements of radiation levels before and after each tracer operation.

**E.** Records of surveys conducted according to subsections (A) through (D) shall include the date of each survey, the identification of each individual making the survey, identification of each survey instrument used, each radiation measurement in millirem or microsievert per hour, and an exact description of the location of the survey. A licensee shall retain records of a survey for three years after completion of the survey.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3).

**R12-1-1742. Documents and Records Required at Field Stations**
Each licensee shall maintain the following documents and records at the field station:

1. A copy of 12 A.A.C. 1;
2. The license, authorizing use of licensed material;
3. Operating and emergency procedures required by R12-1-1722;
4. The record of radiation survey instrument calibrations required by R12-1-1714;
5. The record of leak test results required by R12-1-1715;
6. Physical inventory records required by R12-1-1716;
7. Utilization records required by R12-1-1717;
8. Records of inspection and maintenance required by R12-1-1720;
9. Training records required by R12-1-1721; and
10. Survey records required by R12-1-1741.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended effective June 13, 1997 (Supp. 97-2). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). Amended by final rulemaking at 10 A.A.R. 4458, effective December 4, 2004 (Supp. 04-4).

**R12-1-1743. Documents and Records Required at Temporary Job Sites**
Each licensee that conducts operations at a temporary job site shall maintain the following documents and records at the temporary job site until the well logging operation is completed:

1. Operating and emergency procedures required by R12-1-1722;
2. The most current calibration records for the radiation survey instruments in use at the site required by R12-1-1714;
3. The most current survey records required by R12-1-1741.
4. The shipping papers for transportation of radioactive materials required by license condition; and
5. If operating under reciprocity in accordance with R12-1-320, a copy of the Agency authorization for use of radioactive material in Arizona.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended effective June 13, 1997 (Supp. 97-2). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). Amended by final rulemaking at 10 A.A.R. 4458, effective December 4, 2004 (Supp. 04-4).

**R12-1-1744. Reserved**

**R12-1-1745. Reserved**

**R12-1-1746. Reserved**

**R12-1-1747. Reserved**

**R12-1-1748. Reserved**

**R12-1-1749. Reserved**

**R12-1-1750. Reserved**

**R12-1-1751. Notification of Incidents and Lost Sources; Abandonment Procedures for Irretrievable Sources**

**A.** If, after making a reasonable effort to recover a sealed source or device that contains radioactive material using methods that are not likely to result in damage or rupture and contamination, a licensee determines that the source or device is lodged in a well, the licensee shall:

1. Immediately notify the Agency by telephone of the circumstances that resulted in the inability to retrieve the source and, if there is no evidence of contamination, obtain the following from the Agency:
   a. A determination that the source is irretrievable and abandonment is necessary because further efforts to recover the source are likely to result in an immediate threat to public health and safety, and
   b. An approval to implement abandonment procedures;
2. Advise the well owner or operator, as applicable, of the abandonment procedures implemented under R12-1-1702(A) and (C); and
3. Either ensure that abandonment procedures are implemented within 30 days after the Agency classifies the source as irretrievable or request an extension of time if unable to complete abandonment procedures.

**B.** A licensee shall immediately notify the Agency by telephone and subsequently, within 30 days, by confirmatory letter if the licensee knows or has reason to believe that a sealed source has been ruptured or the well has otherwise been contaminated. The letter shall describe the well location, the magnitude and extent of radioactive contamination, the consequences of the rupture, and the efforts planned or initiated to mitigate the consequences.

**C.** A licensee shall notify the Agency of the theft or loss of any radioactive material, radiation overexposure, excessive levels and concentrations of radiation, and incidents as required by R12-1-443, R12-1-444, and R12-1-445.

**D.** A licensee shall, within 30 days after a sealed source has been classified as irretrievable, report in writing to the Agency. The licensee shall send a copy of the report to each state or federal agency that issued permits or otherwise approved of the drilling operation. The report shall contain the following information:

1. Date of occurrence;
2. A description of the irretrievable well logging source involved, including the name of the radionuclide and its quantity, and the chemical and physical form of the radionuclide;
3. Surface location and identification of the well;
4. Results of efforts to immobilize and seal the source in place;
5. A brief description of the attempted recovery effort;
6. Depth of the source;
7. Depth of the top of the cement plug;
8. Depth of the well;
9. The reasons why further efforts to recover the source are likely to result in an immediate threat to public health and safety, necessitating abandonment;

10. Information contained on the permanent identification plaque; and
11. State and federal agencies receiving a copy of the report.

**Historical Note**
Adopted effective April 2, 1990 (Supp. 90-2). Amended effective June 13, 1997 (Supp. 97-2). Amended by final rulemaking at 9 A.A.R. 4302, effective November 14, 2003 (Supp. 03-3). Section repealed; new Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

## ARTICLE 18. RESERVED

## 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, 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 inte-

grated 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.

**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, is available on the NRC's website at *http://nrc-stp.ornl.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.

**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**
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.

**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).