

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
OFFICE OF WASTE MANAGEMENT AND RADIOLOGICAL PROTECTION
IONIZING RADIATION RULES FOR RADIOACTIVE MATERIAL

(By authority conferred on the director of the department of environmental quality by section 13521 of 1978 PA 368, MCL 333.13521, and Executive Reorganization Order No. 1996-1, MCL 330.33101)

PART 1. GENERAL PROVISIONS

R 325.5001 Purpose and scope

Rule 1. These rules, except as otherwise specifically provided, apply to all persons who own, receive, acquire, possess, use or transfer any source of radiation in this state. Regulation by the state of source material, byproduct material and special nuclear material in quantities not sufficient to form a critical mass is subject to an agreement between the state and the NRC and to 10 CFR Part 150 of NRC regulations. These rules do not apply to a person to the extent that the person is subject to regulation by the NRC. A person is subject to these rules unless specifically exempted under the act.

History: 1979 AACS.

R 325.5002 Hearing procedure.

Rule 2. (1) Prior to the issuance of an order, the department shall afford opportunity for hearing which shall be conducted pursuant to the administrative procedures act of 1969, 1969 PA 306, MCL 24.201 to 24.328.

(2) In a contested case, the department shall conduct a hearing as provided in the administrative procedures act of 1969, 1969 PA 306, MCL 24.201 to 24.328.

History: 1979 AACS; 2016 AACS.

R 325.5003 Definitions; Ab to Ai.

Rule 3. (1) "Absorbed dose" means the energy imparted to matter by radiation per unit mass of irradiated material at the place of interest. The special unit of absorbed dose is the rad.

(2) "Accelerator" or "particle accelerator" means a radiation machine designed for or capable of accelerating electrically charged particles such as electrons, protons, or deuterons with an electrical potential in excess of 1 MeV. Radiation machines designed and used exclusively for the production of electron beams or x-radiation for any of the following purposes, except those capable of producing radioactive material in excess of exempt quantities listed in schedule B of Rule 147, are excluded from this definition:

- (a) The diagnosis or treatment of patients.
- (b) Industrial radiography.
- (c) Examination of the microscopic structure of materials.

- (d) Manufacturing process control.
- (e) Research and development.
- (f) Demonstration of scientific principles for educational purposes.

(3) "Accelerator material" means any material made radioactive by exposing it in a particle accelerator.

(4) "Act" means 1978 PA 368, MCL 333.1101 to 333.25211. The terms defined in the act have the same meanings when used in these rules.

(5) "Agreement material" means "byproduct material", "source material", or "special nuclear material in quantities not sufficient to form a critical mass" which is subject to regulation by this state under an agreement between the NRC and this state pursuant to section 274 of the federal atomic energy act of 1954, as amended, being 42 U.S.C. 2011 to 2297H-13.

(6) "Agreement state" means a state with which the NRC has entered into an effective agreement pursuant to section 274b of the atomic energy act of 1954, 42 U.S.C. 2011 to 2297H-13.

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

(8) "Airborne radioactivity area" means a room, enclosure, or operating area in which airborne radioactive material exists in concentrations in excess of the amounts specified in column 1, table I of Rules 261 to 269 or a room, enclosure, or operating area in which airborne radioactive material exists in concentrations which, averaged over the number of hours in any week during which individuals are in the area, exceed 25% of the amounts specified in column 1, table I of Rules 261 to 269.

History: 1979 AACCS; 2016 AACCS.

R 325.5004 Definitions; Al to Au.

Rule 4. "Authorized recipient" means any person licensed or otherwise authorized in writing by the department, the federal government or any agency thereof, or an agreement state to possess radioactive material or as authorized to the extent permitted by exemption from these rules.

History: 1979 AACCS; 2016 AACCS.

R 325.5005 Definitions; B.

Rule 5. (1) "Barrier" includes a primary protective barrier, a secondary protective barrier, or a personnel barrier.

(2) "Beam axis" means a line from the source through the centers of the gamma-ray fields.

(3) "Beam-limiting device" means a device which provides a means to restrict the dimensions of the gamma-ray field.

(4) "Byproduct material" means any radioactive material, except special nuclear material, yielded in or made radioactive by exposing it to the radiation incident to the process of producing or utilizing special nuclear material.

History: 1979 AACCS; 2016 AACCS.

R 325.5006 Definitions; C.

Rule 6. (1) "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 arranged so that a day is not included in more than 1 calendar quarter nor is a day in any 1 year omitted from inclusion within a calendar quarter. A licensee or registrant shall not change the method observed by him or her of determining calendar quarters for purposes of these rules except at the beginning of a calendar year.

(2) "Controlled area" means a restricted area.

(3) "Curie" means the quantity of radioactive material that decays at the rate of 3.7×10^{10} disintegrations per second (dps). Commonly used submultiples of the curie (Ci) are the millicurie (mCi), the microcurie (μ Ci) and the nanocurie (nCi). One millicurie = 0.001 curie = 3.7×10^7 dps. One microcurie = 0.000001 curie = 3.7×10^4 dps. One nanocurie = 0.000000001 curie = 37 dps. Curie is the special unit of measurement of radioactivity.

History: 1979 AACS; 2016 AACS.

R 325.5007 Definitions; D.

Rule 7. (1) "Department" means the department of environmental quality.

(2) "Dose" means absorbed dose or dose equivalent as appropriate.

(3) "Dose equivalent" means the absorbed dose in rads times certain modifying factors and is a quantity that expresses on a common scale for all radiation a measure of the postulated effect on a given organ from small amounts of radiation. The special unit of dose equivalent is the rem.

History: 1979 AACS; 2016 AACS.

R 325.5008 Definitions; E, F.

Rule 8. (1) "Exposure" means the quotient of dQ by dm where dQ is the absolute value of the total charge of the ions of 1 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.

(2) "Exposure rate" means the exposure per unit of time, such as R/min, mR/h.

(3) "Facility" means the location at which 1 or more devices or sources of radiation are installed or located within 1 building or under 1 roof and are under the same administrative control.

History: 1979 AACS; 2016 AACS.

R 325.5009 Definitions; G, H.

Rule 9. (1) "High radiation area" means an area, accessible to individuals, in which there exists such radiation, that an individual could receive in any 1 hour a dose in excess of 100 millirems.

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

History: 1979 AACCS; 2016 AACCS.

R 325.5010 Definitions; I.

Rule 10. (1) "Individual" means a human being.

(2) "Inspection" means an official examination or observation to determine compliance with the act, these rules, license conditions, registration conditions, or orders of the department.

(3) "Installation" means a location, having boundaries specified by the licensee or registrant, where for a period of more than 30 days, 1 or more sources of radiation are used, operated, or stored. A part of a building, an entire building, a plant, or plant site may be designated as an installation.

History: 1979 AACCS; 2016 AACCS.

R 325.5011 Definitions; L.

Rule 11. (1) "Level" means radiation flux or intensity at a specific point. It is sometimes expressed in terms of the dose an individual would receive if he or she were at that point or location.

(2) "License" means a license issued pursuant to part 2 except where otherwise specified.

History: 1979 AACCS; 2016 AACCS.

R 325.5012 Definitions; M to O.

Rule 12. (1) "Manufactured" means produced or prepared for use or sale by an industrial manufacturing process. It includes factory assembly of components but does not include assembly of manufactured parts at the site of use.

(2) "Naturally occurring material" means radioactive material found radioactive in the normal isotopic distribution of elements rather than rendered radioactive by artificial means.

(3) "Nuclear regulatory commission" or "NRC" means the United States nuclear regulatory commission established by section 201 of the federal energy reorganization act of 1974, being Public Law 93-438.

(4) "Occupational dose" means the dose received in the course of occupational exposure as calculated or estimated from dosimeters.

(5) "Occupational exposure" means radiation exposure received by an individual in a restricted area, or in the course of employment in which the individual's duties involve being exposed to radiation. It does not include exposure of an individual to radiation for the purpose of diagnosis or therapy of the individual.

History: 1979 AACCS; 2016 AACCS.

R 325.5013 Definitions; P.

Rule 13. (1) "Particle accelerator" or "accelerator" means a radiation machine designed for or capable of accelerating electrically charged particles such as electrons, protons, or deuterons, with an electrical potential in excess of 1 MeV. Radiation machines designed and used exclusively for the production of electron beams or x-radiation for any of the following purposes, except those capable of producing radioactive material in excess of exempt quantities listed in schedule B of Rule 147, are excluded from this definition:

- (a) The diagnosis or treatment of patients.
- (b) Industrial radiography.
- (c) Examination of the microscopic structure of materials.
- (d) Manufacturing process control.
- (e) Research and development.
- (f) Demonstration of scientific principles for educational purposes.

(2) "Personnel barrier" means a barrier which restricts personnel from potential radiation exposure by restricting access to the vicinity of a source of radiation.

(3) "Personnel monitoring equipment" means a device such as a film badge, pocket dosimeter, or thermoluminescent dosimeter (TLD) designed to be worn or carried by an individual for the purpose of estimating the radiation dose received by him or her.

(4) "Primary protective barrier" means the material, excluding filters, placed in the useful beam to reduce the radiation exposure for protection purposes.

History: 1979 AACCS; 2016 AACCS.

R 325.5014 Definitions; Ra.

Rule 14. (1) "Rad" means 1/100 of a joule of absorbed radiation energy per kilogram of material, or 100 ergs per gram and is the special unit of absorbed dose.

(2) "Radiation" means ionizing radiation.

(3) "Radiation area" means an area, accessible to individuals, in which there exists such radiation that an individual could receive in any 1 hour a dose in excess of 5 millirems, or in any 5 consecutive days a dose in excess of 100 millirems.

(4) "Radiation monitoring" means the periodic or continuous determination of the exposure rate or contamination level in an area (area monitoring) or of the dose received by an individual (personnel monitoring).

(5) "Radiation protection supervisor" means the individual specified by the licensee or registrant who has the authority and the responsibility for radiation protection.

(6) "Radiation worker" means an individual assigned work with or around sources of radiation or who, during the performance of his or her assigned duties, receives or is likely to receive a dose in any calendar quarter in excess of 300 millirems.

(7) "Radioactivity" means the property of certain isotopes of the basic elements of spontaneously emitting nuclear particles or gamma radiation or of emitting x-radiation following orbital electron capture or of undergoing spontaneous fission.

History: 1979 AACCS; 2016 AACCS.

R 325.5016 Definitions; Re to Ro.

Rule 16. (1) "Rem" means the absorbed dose in rads multiplied by appropriate modifying factors which are determined by the quality of radiation and the conditions of exposure and is the special unit of dose equivalent. For the purpose of these regulations, each of the following is considered to be equivalent to a dose of 1 rem:

- (a) An exposure of 1 roentgen of x or gamma radiation.
- (b) A dose of 1 rad due to x, gamma, or beta radiation.
- (c) A dose of 0.1 rad due to neutrons or high energy protons.*

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

* If it is more convenient to measure the neutron flux, or equivalent, than to determine the neutron absorbed dose in rads, 1 rem of neutron radiation may, for purposes of these regulations, be assumed to be equivalent to 14 million neutrons per square centimeter incident upon the body; or, if there exists sufficient information to estimate with reasonable accuracy the approximate distribution in energy of the neutrons, the incident number of neutrons per square centimeter equivalent to 1 rem may be estimated from the following table:

Neutron Flux Dose Equivalents

| Neutron Energy (MeV) | Number of neutrons per square centimeter for a dose equivalent of 1 rem (neutrons/cm ²) | Average flux to deliver 100 millirem in 40 hours (neutrons/cm ² per second) |
|----------------------|---|--|
| Thermal | 970 x 10 ⁶ | 670 |
| 0.0001 | 720 x 10 ⁶ | 500 |
| 0.005 | 820 x 10 ⁶ | 570 |
| 0.02 | 400 x 10 ⁶ | 280 |
| 0.1 | 120 x 10 ⁶ | 80 |
| 0.5 | 43 x 10 ⁶ | 30 |
| 1.0 | 26 x 10 ⁶ | 18 |
| 2.5 | 29 x 10 ⁶ | 20 |
| 5.0 | 26 x 10 ⁶ | 18 |
| 7.5 | 24 x 10 ⁶ | 17 |
| 10 | 24 x 10 ⁶ | 17 |
| 10 to 30 | 14 x 10 ⁶ | 10 |

(2) "Research and development" means theoretical analysis, exploration, or 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. This definition does not apply to human use.

(3) "Restricted area" or "controlled area" means an area access to which is controlled by a licensee or registrant for purposes of protection of individuals from exposure to radiation or radioactive materials. It does not include an area used for residential quarters, although a separate room in a residential building may be set apart as a restricted area.

(4) "Roentgen" means 2.58×10^{-4} Coulombs/kilogram of air and is the special unit of exposure.

History: 1979 AACCS; 2016 AACCS.

R 325.5017 Definitions; Se to So.

Rule 17. (1) "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.

(2) "Secondary protective barrier" means the material placed in the path of scattered and leakage radiation to reduce the radiation exposure for protection purposes.

(3) "Shall" means required to comply with these rules pursuant to the act and enforceable under the act and the administrative procedures act of 1969, 1969 PA 306, MCL 24.201 to 24.328.

(4) "Should" means recommended when practicable to meet optimum radiation safety standards.

(5) "Source material" means uranium or thorium, or any combination thereof, in any physical or chemical form; or ores which contain by weight 1/20 of 1% (0.05%) or more of uranium, thorium or any combination thereof. Source material does not include special nuclear material.

(6) "Source of radiation" means any radioactive material, or any device or equipment containing radioactive material.

History: 1979 AACCS; 2016 AACCS.

R 325.5018 Definitions; Sp to Su.

Rule 18. (1) "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 the ratios for all of the kinds of special nuclear material in combination shall not exceed "1" (i.e., unity). For example, the following quantities in combination would not exceed the limitation and are within the formula:

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

(2) "Stationary equipment" means equipment that is installed in a fixed location.

(3) "Survey" means a critical evaluation of a facility or area incident to the production, use, release, disposal, or presence of sources of radiation under a specific set of conditions to determine actual or potential radiation hazards. When appropriate, the evaluation includes tests, physical examination, source inventory and accountability, and measurements of levels of radiation or concentration of radioactive material present.

History: 1979 AACCS; 2016 AACCS.

R 325.5019 Definitions; T.

Rule 19. (1) "Test" means a procedure for determining the characteristics or condition of a source of radiation, or circumstances relative thereto.

(2) "Thermoluminescent dosimeter" or "TLD" means a device used for radiation monitoring which measures integrated dose by the principle of thermoluminescence.

(3) "These rules" means all parts.

History: 1979 AACS; 2016 AACS.

R 325.5020 Definitions; U, V.

Rule 20. (1) "Unrefined and unprocessed ore" means ore in its natural form before any processing, such as grinding, roasting, beneficiating or refining.

(2) "Unrestricted area" or "uncontrolled area" means an area access to which is not controlled by a licensee or registrant for purposes of protection of individuals from exposure to radiation or radioactive materials, or an area used for residential quarters.

History: 1979 AACS; 2016 AACS.

R 325.5021. Rescinded.

History: 1979 AACS; 2016 AACS.

R 325.5025. Prefixes.

Rule 25. The following prefixes are used in these rules to mean the numbers indicated:

| Symbol | Prefix | Quantity | Symbol | Prefix | Quantity |
|--------|--------|-----------------------|--------|--------|----------------------|
| d | deci | (=10 ⁻¹) | da | deka | (=10) |
| c | centi | (=10 ⁻²) | h | hecto | (=10 ²) |
| m | milli | (=10 ⁻³) | k | kilo | (=10 ³) |
| μ | micro | (=10 ⁻⁶) | M | mega | (=10 ⁶) |
| n | nano | (=10 ⁻⁹) | G | giga | (=10 ⁹) |
| p | pico | (=10 ⁻¹²) | T | tera | (=10 ¹²) |
| f | femto | (=10 ⁻¹⁵) | | | |
| a | atto | (=10 ⁻¹⁸) | | | |

History: 1979 AACS.

EXEMPTIONS

R 325.5031 Departmental action.

Rule 31. Upon application or upon its own initiative, the department may grant exemptions or exceptions from the requirements of these rules as it determines are authorized by law and will not result in undue hazard to public health and safety or property.

History: 1979 AACS; 2016 AACS.

R 325.5032 Carriers.

Rule 32. A common or contract carrier, freight forwarder, warehouseman, and the United States postal service are exempt from these rules to the extent that they transport or store agreement material in the regular course of carriage for another or storage incident thereto.

History: 1979 AACS; 2016 AACS.

R 325.5033 Nuclear regulatory commission contractors.

Rule 33. An NRC contractor or subcontractor of the following categories operating in this state is exempt from these rules to the extent that the contractor or subcontractor under his or her contract receives, acquires, possesses, uses, or transfers sources of radiation:

(a) A prime contractor performing work for the NRC at United States government-owned or controlled sites.

(b) A prime contractor performing research in, or development, manufacture, storage, testing, or transportation of, atomic weapons or components thereof.

(c) A prime contractor using or operating nuclear reactors or other nuclear devices in a United States government-owned vehicle or vessel.

(d) Any other prime contractor or subcontractor when the state and the NRC jointly determine 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 and that the exemption of such contractor or subcontractor is otherwise appropriate.

History: 1979 AACS; 2016 AACS.

RECORDS, INSPECTIONS, TESTS AND ENFORCEMENT

R 325.5041 Records.

Rule 41. A licensee or registrant shall keep records showing the receipt, transfer, and disposal of all sources of radiation. Additional record requirements are specified elsewhere in these rules.

History: 1979 AACS; 2016 AACS.

R 325.5042 Inspections.

Rule 42. (1) Under authority of section 13517(1) of the act, the department may enter at all reasonable times upon private or public property to conduct compliance investigations.

(2) Under authority of section 13517(2) of the act, the department may obtain a warrant if necessary for search of property or seizure of sources of radiation or evidence of a violation of the act or any rule or license.

(3) A licensee or registrant shall make available to the department for inspection, all records maintained pursuant to these rules.

History: 1979 AACCS; 2016 AACCS.

R 325.5043 Impounding.

Rule 43. Sources of radiation are subject to impounding pursuant to section 13517(2) of the act.

History: 1979 AACCS; 2016 AACCS.

R 325.5044 Tests.

Rule 44. A licensee or registrant shall perform upon instructions from the department and shall permit the department to perform such reasonable tests as the department deems appropriate or necessary, including tests of the following:

(a) Sources of radiation.

(b) Facilities wherein sources of radiation are used or stored.

(c) Radiation detection and monitoring instruments.

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

History: 1979 AACCS; 2016 AACCS.

R 325.5045. Additional requirements.

Rule 45. The department, by rule or order, may impose upon a licensee or registrant requirements in addition to those set forth in these rules that it deems appropriate or necessary to minimize danger to public health and safety or property.

History: 1979 AACCS.

R 325.5046 Violations.

Rule 46. (1) Under authority of section 13536 of the act, the department may seek a court order enjoining violation of or directing compliance with the act or any rule or order issued thereunder.

(2) Under authority of section 13535 of the act, a person who performs any act for which licensing or registration is required pursuant to these rules when that person is not licensed, registered, or exempted, is guilty of a misdemeanor and may be fined, imprisoned or both.

History: 1979 AACS; 2016 AACS.

R 325.5047 Communications.

Rule 47. Communications and reports concerning these rules, and applications filed thereunder, should be addressed to the Michigan Department of Environmental Quality, Office of Waste Management and Radiological Protection, Constitution Hall, 525 West Allegan Street, P.O. Box 30241, Lansing, Michigan 48909.

History: 1979 AACS; 2016 AACS.

R 325.5049. Rescinded.

History: 1979 AACS; 2016 AACS.

PART 2. LICENSING OF RADIOACTIVE MATERIAL

R 325.5051 Purpose and scope.

Rule 51. (1) This part provides for the licensing of radioactive material. A person shall not own, receive, acquire, possess, use, or transfer radioactive material except as authorized in a specific or general license issued pursuant to this part or as otherwise provided in this part.

(2) In addition to the requirements of this part, a licensee is subject to the requirements of parts 1 and 5.

History: 1979 AACS; 2016 AACS.

**EXEMPTIONS
SOURCE MATERIAL**

R 325.5052 Source material as low percentage of weight.

Rule 52. A person is exempt from this part to the extent that he or she receives, possesses, uses, or transfers source material in any chemical mixture, compound, solution, or alloy in which the source material is by weight less than 1/20 of 1% (0.05%) of the mixture, compound, solution, or alloy.

History: 1979 AACS; 2016 AACS.

R 325.5053 Unprocessed ore containing source material.

Rule 53. A person is exempt from this part to the extent that he or she receives, possesses, uses, or transfers unrefined and unprocessed ore containing source material. However, the person shall not refine or process such ore except as authorized in a specific license.

History: 1979 AACCS; 2016 AACCS.

R 325.5054 Thorium used in certain articles.

Rule 54. A person is exempt from this part to the extent that he or she receives, possesses, uses, or transfers any quantity of thorium contained in the following:

- (a) Incandescent gas mantles.
- (b) Vacuum tubes.
- (c) Welding rods.
- (d) Electric lamps for illuminating purposes if each lamp does not contain more than 50 milligrams of thorium.
- (e) Germicidal lamps, sunlamps, and lamps for outdoor or industrial lighting if each lamp does not contain more than 2 grams of thorium.
- (f) Rare earth metals and compounds, mixtures, and products containing not more than 0.25% by weight thorium, uranium, or any combination of these.

History: 1979 AACCS; 2016 AACCS.

R 325.5055 Source material contained in ceramic and other articles.

Rule 55. A person is exempt from this part to the extent that he or she receives, possesses, uses, or transfers the following:

- (a) Source material contained in the following products:
 - (i) Glazed ceramic tableware, if the glaze contains not more than 20% by weight source material.
 - (ii) Glassware, glass enamel, and glass enamel frit containing not more than 10% by weight source material; but not including commercially manufactured glass brick, pane glass, ceramic tile, or other glass, glass enamel, or ceramic used in construction.
 - (iii) Piezoelectric ceramic containing not more than 2% by weight source material.
- (b) Photographic film, negatives, and prints containing uranium or thorium.
- (c) A finished product or part fabricated of, or containing, tungsten-thorium or magnesium-thorium alloys, if the thorium content of the alloy does not exceed 4% by weight. The exemption contained in this paragraph does not authorize the chemical, physical, or metallurgical treatment or processing of any such product or part.

History: 1979 AACCS; 2016 AACCS.

R 325.5056 Uranium contained in counterweights.

Rule 56. (1) A person is exempt from this part to the extent that he or she receives, possesses, uses or transfers uranium contained in counterweights installed in aircraft,

marinecraft, rockets, projectiles, and missiles, or stored or handled in connection with installation or removal of such counterweights if all of the following conditions are met:

(a) The counterweights are manufactured in accordance with a specific license issued by the department, the NRC, or an agreement state authorizing distribution by the licensee pursuant to this rule or equivalent regulations of the NRC or an agreement state.

(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".

(2) The requirements specified in subrule (1)(b) and (c) of this rule need not be met by counterweights manufactured before December 31, 1969 if the counterweights are impressed with the legend, "CAUTION - RADIOACTIVE MATERIAL - URANIUM", as previously required by applicable regulations.

(3) The exemption in this rule does not authorize the chemical, physical, or metallurgical treatment or processing of counterweights other than repair or restoration of any plating or other covering.

History: 1979 AACS; 2016 AACS.

R 325.5057 Uranium contained in shipping container shields.

Rule 57. A person is exempt from this part to the extent that he or she receives, possesses, uses, or transfers uranium used as shielding constituting part of any shipping container which is conspicuously and legibly impressed with the legend "CAUTION - RADIOACTIVE SHIELDING - URANIUM" and which meets the specifications for containers for radioactive materials prescribed by section 178.250, specification 55, part 178, of the regulations published by the United States department of transportation, 49 CFR 178.250.

History: 1979 AACS; 2016 AACS.

R 325.5058 Thorium contained in lenses.

Rule 58. A person is exempt from this part to the extent that he or she receives, possesses, uses, or transfers thorium contained in finished optical lenses, if each lens does not contain more than 30% by weight of thorium. The exemption in this rule does not authorize either of the following:

(a) The shaping, grinding, or polishing of such lens or manufacturing processes other than the assembly of such lens into optical systems and devices without any alteration of the lens.

(b) The receipt, possession, use, or transfer of thorium contained in contact lenses, in spectacles or in eyepieces in binoculars or other optical instruments.

History: 1979 AACS; 2016 AACS.

R 325.5059 Uranium contained in fire detection units.

Rule 59. A person is exempt from this part to the extent that he or she receives, possesses, uses, or transfers uranium contained in detector heads for use in fire detection units, if each detector head contains not more than 5 nanocuries of uranium.

History: 1979 AACS; 2016 AACS.

R 325.5060 Thorium contained in aircraft engine parts.

Rule 60. A person is exempt from this part to the extent that he or she receives, possesses, uses, or transfers thorium contained in any finished aircraft engine part containing nickel-thoria alloy, if both of the following conditions are met:

(a) The thorium is dispersed in the nickel-thoria alloy in the form of finely divided thoria (thorium dioxide).

(b) The thorium content in the nickel-thoria alloy does not exceed 4% by weight.

History: 1979 AACS; 2016 AACS.

R 325.5061 Exemptions do not authorize manufacture.

Rule 61. The exemptions in Rules 54 to 60 do not authorize the manufacture of any of the products described.

History: 1979 AACS; 2016 AACS.

R 325.5065 Exempt concentrations.

Rule 65. Except as provided in Rule 66, a person is exempt from this part to the extent that he or she owns, receives, acquires, possesses, uses, or transfers products or materials containing radioactive material in concentrations not in excess of those listed in Rule 146.

History: 1979 AACS; 2016 AACS.

R 325.5066. Material transferred to exempt persons.

Rule 66. 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 Rule 65 or equivalent regulations of the NRC or an agreement state.

History: 1979 AACS; 2016 AACS.

R 325.5067 Items containing tritium, promethium-147, or radium.

Rule 67. Except for persons who apply tritium, promethium-147, or radium to, or persons who incorporate tritium, promethium-147, or radium into, the following products, a person is

exempt from these rules to the extent that he or she owns, receives, acquires, possesses, uses, or transfers the following products:

(a) Timepieces or timepiece hands or dials containing not more than the following specified quantities of radioactive material and not exceeding the following specified levels of radiation:

(i) 25 millicuries of tritium per timepiece.

(ii) 5 millicuries of tritium per hand.

(iii) 15 millicuries of tritium per dial; bezels when used shall be considered as part of the dial.

(iv) 100 microcuries of promethium-147 per watch or 200 microcuries of promethium-147 per any other timepiece.

(v) 20 microcuries of promethium-147 per watch hand or 40 microcuries of promethium-147 per other timepiece hand.

(vi) 60 microcuries of promethium-147 per watch dial or 120 microcuries of promethium-147 per other timepiece dial; bezels when used shall be considered as part of the dial.

(vii) The levels of radiation from hands and dials containing promethium-147 will not exceed, when measured through 50 milligrams per square centimeter of absorber, the following:

(aa) For wrist watches, 0.1 millirad per hour at 10 centimeters from any surface.

(bb) For pocket watches, 0.1 millirad per hour at 1 centimeter from any surface.

(cc) For any other timepiece, 0.2 millirad per hour at 10 centimeters from any surface.

(b) Timepieces or timepiece hands or dials containing not more than the following specified quantities of radium and meeting the following expressed conditions:

(i) 0.15 microcuries of radium per watch.

(ii) 0.03 microcuries of radium per watch hand.

(iii) 0.09 microcuries of radium per watch dial.

(iv) 0.20 microcuries of radium per clock.

(v) 0.04 microcuries of radium per clock hand.

(vi) 0.12 microcuries of radium per clock dial.

(vii) The timepiece is not a pocket watch.

(viii) Timepieces or timepiece hands or dials containing radium that were manufactured before the effective date of these rules.

(ix) The timepiece is marked or coded to identify the date of manufacture and that it contains radium.

(x) The timepiece emits sufficient luminosity, omitting photoactivation, that its dial can be read in the dark during its entire design lifetime.

(c) Lock illuminators containing not more than 15 millicuries of tritium or not more than 2 millicuries of promethium-147 installed in automobile locks. The levels of radiation from each lock illuminator containing promethium-147 will not exceed 1 millirad per hour at 1 centimeter from any surface when measured through 50 milligrams per square centimeter of absorber.

(d) Precision balances containing not more than 1 millicurie of tritium per balance or not more than 0.5 millicurie of tritium per balance part.

(e) Automobile shift quadrants containing not more than 25 millicuries of tritium.

(f) Marine compasses containing not more than 750 millicuries of tritium gas and other marine navigational instruments containing not more than 250 millicuries of tritium gas.

(g) Thermostat dials and pointers containing not more than 25 millicuries of tritium per thermostat.

(h) Electron tubes, including 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 currents, if the level of radiation due to radioactive material contained in each electron tube does not exceed 1 millirad per hour at 1 centimeter from any surface when measured through 7 milligrams per square centimeter of absorber and if each tube does not contain more than 1 of the following specified quantities of radioactive materials:

(i) 150 millicuries of tritium per microwave receiver protector tube or 10 millicuries of tritium per any other electron tube.

(ii) 1 microcurie of cobalt-60.

(iii) 5 microcuries of nickel-63.

(iv) 30 microcuries of krypton-85.

(v) 5 microcuries of cesium-137.

(vi) 30 microcuries of promethium-147.

(i) Ionizing radiation measuring instruments containing, for purposes of internal calibration or standardization, a source of radioactive material not exceeding the applicable quantity set forth in Rule 147.

History: 1979 AACS; 2016 AACS.

R 325.5071 Resins containing scandium-46 for sand consolidation in oil wells.

Rule 71. A person is exempt from these rules to the extent that he or she owns, receives, acquires, possesses, uses, or transfers synthetic plastic resins containing scandium-46 which are designed for sand consolidation in oil wells if the resins were manufactured or imported in accordance with a specific license issued by the NRC, or were manufactured in accordance with the specifications contained in a specific license issued by the department or an agreement state to the manufacturer of such resins pursuant to licensing requirements equivalent to those in sections 32.16 and 32.17 of 10 CFR Part 32 of the regulations of the NRC. This exemption does not authorize the manufacturer of resins containing scandium-46.

History: 1979 AACS; 2016 AACS.

R 325.5072 Gas and aerosol detectors.

Rule 72. Except for persons who manufacture, process, or produce gas and aerosol detectors, a person is exempt from these rules to the extent that he or she owns, receives, acquires, possesses, uses, or transfers the following:

(a) Byproduct material in gas and aerosol detectors designed to protect life or property from fires and airborne hazards, if the detectors containing byproduct material were manufactured, imported, or transferred in accordance with a specific license issued by the NRC pursuant to section 32.26 of 10 CFR Part 32, which license authorizes the transfer of the detectors to persons who are exempt from regulatory requirements.

(b) Naturally occurring material in gas and aerosol detectors designed to protect life or property from fires and airborne hazards, if the detectors containing naturally occurring material were manufactured, imported, or transferred in accordance with a specific license issued by the

department or an agreement state pursuant to equivalent conditions as in section 32.26 of 10 CFR Part 32, which license authorizes the transfer of the detectors to persons who are exempt from regulatory requirements.

History: 1979 AACCS; 2016 AACCS.

R 325.5073 Self-luminous products containing tritium, krypton-85, promethium-147, or radium-226.

Rule 73. (1) Except for a person who manufactures, processes, or produces self-luminous products, a person is exempt from these regulations to the extent that he or she owns, receives, acquires, possesses, uses, or transfers the following:

(a) Tritium, krypton-85, or promethium-147 in self-luminous products manufactured, processed, imported, or transferred in accordance with a specific license issued by the NRC pursuant to section 32.22 of 10 CFR Part 32, which license authorizes the transfer of the product to persons who are exempt from regulatory requirements.

(b) Naturally occurring material in self-luminous products manufactured, processed, imported, or transferred in accordance with a specific license issued by the department or an agreement state pursuant to equivalent conditions as in section 32.22 of 10 CFR Part 32.

(2) The exemptions in subrule (1) of this rule do not apply to tritium, krypton-85, promethium-147, or naturally occurring material used in products for frivolous purposes or in toys or adornments.

History: 1979 AACCS; 2016 AACCS.

**EXEMPTIONS
RADIOACTIVE MATERIAL OTHER THAN SOURCE MATERIAL**

R 325.5074 Exempt quantities.

Rule 74. (1) Except as provided in subrules (3) and (4) of this rule, a person is exempt from these rules to the extent that he or she owns, receives, acquires, possesses, uses, or transfers a byproduct, naturally occurring, or accelerator material in individual quantities each of which does not exceed the applicable quantity set forth in Rule 147.

(2) A person who possesses radioactive material formerly received or acquired under the general license provided in 10 CFR Part 31, § 31.4 of the NRC regulations is exempt from the requirements for a license set forth in this part to the extent that he or she owns, possesses, uses, or transfers such radioactive material.

(3) Subrule (1) of this rule does not authorize the production, packaging, or repackaging of radioactive material for purposes of commercial distribution, or the incorporation of radioactive material into products intended for commercial distribution.

(4) A person, for purposes of commercial distribution, shall not transfer radioactive material in the individual quantities set forth in Rule 147, knowing or having reason to believe that such quantities of radioactive material will be transferred to persons exempt under subrule (1) of this rule or equivalent regulations of the NRC or an agreement state, except in accordance with a specific license issued by the NRC pursuant to section 32.18 of 10 CFR Part 32 which license

states that the radioactive material may be transferred by the licensee to persons exempt under subrule (1) of this rule or the equivalent regulations of the NRC or an agreement state.

History: 1979 AACS; 2016 AACS.

GENERAL LICENSES

R 325.5081 Types of licenses.

Rule 81. Licenses for radioactive materials are of 2 types: general or specific. General licenses provided in this part are effective without the filing of applications with the department or the issuance of licensing documents to particular persons. Specific licenses are issued to named persons upon applications filed pursuant to this part.

History: 1979 AACS; 2016 AACS.

R 325.5082 Rescinded.

History: 1979 AACS; 2016 AACS.

R 325.5083 Rescinded.

History: 1979 AACS; 2016 AACS.

R 325.5084 Rescinded.

History: 1979 AACS; 2016 AACS.

R 325.5085 Rescinded.

History: 1979 AACS; 2016 AACS.

R 325.5086 Rescinded.

History: 1979 AACS; 2016 AACS.

R 325.5087 Ownership of radioactive material.

Rule 87. This rule is a general license issued to own radioactive material without regard to quantity. Notwithstanding any other provisions of this part, this general license does not

authorize the manufacture, production, transfer, receipt, possession, or use of radioactive material.

History: 1979 AACS; 2016 AACS.

R 325.5088 Rescinded.

History: 1979 AACS; 2016 AACS.

R 325.5089 Rescinded.

History: 1979 AACS; 2016 AACS.

R 325.5090 Rescinded.

History: 1979 AACS; 2016 AACS.

R 325.5091 Rescinded.

History: 1979 AACS; 2016 AACS.

R 325.5092 Rescinded.

History: 1979 AACS; 2016 AACS.

SPECIFIC LICENSES

R 325.5101 Applications.

Rule 101. (1) An application for a specific license shall be filed on a form prescribed by the department and shall be accompanied by the appropriate license fee as specified in Rules 141 to 145.

(2) The application shall be signed by the applicant or licensee or a person authorized to act for and on his or her behalf.

(3) An application for a license may include a request for a license authorizing 1 or more activities.

(4) In his or her application, the applicant may incorporate by reference information contained in previous applications, statements, or reports filed with the department if the references are clear and specific.

(5) The department, at any time after the filing of the original application, and before the expiration of the license, may require further statements in order for the department to determine

whether the application will be granted or denied or whether a license will be modified or revoked.

(6) The department may make available the application and documents submitted to the department for public inspection except that the department may withhold any document or part thereof 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.

History: 1979 AACS; 2016 AACS.

R 325.5102 General requirements for specific licenses.

Rule 102. The department shall approve a license application if it determines all of the following:

(a) The applicant or the designated individual user is qualified by reason of training and experience to use the material in question for the purpose requested in accordance with these rules in such a manner as to minimize danger to public health and safety or property.

(b) The applicant's proposed equipment, facilities, and procedures are adequate to minimize danger to public health and safety or property.

(c) The issuance of the license will not be inimical to the health and safety of the public.

(d) The applicant satisfies any applicable special requirements in Rule 117a.

History: 1979 AACS; 2016 AACS.

R 325.5103 Rescinded.

History: 1979 AACS; 2016 AACS.

R 325.5104 Rescinded.

History: 1979 AACS; 2016 AACS.

R 325.5105 Rescinded.

History: 1979 AACS; 2016 AACS.

R 325.5106 Rescinded.

History: 1979 AACS; 2016 AACS.

R 325.5107 Rescinded.

History: 1979 AACS; 2016 AACS.

R 325.5108 Rescinded.

History: 1979 AACCS; 2016 AACCS.

R 325.5109 Rescinded.

History: 1979 AACCS; 2016 AACCS.

R 325.5110 Rescinded.

History: 1979 AACCS; 2016 AACCS.

R 325.5111 Rescinded.

History: 1979 AACCS; 2016 AACCS.

R 325.5111a Rescinded.

History: 1979 AACCS; 2016 AACCS.

R 325.5111b Rescinded.

History: 1979 AACCS; 2016 AACCS.

R 325.5111c Rescinded.

History: 1979 AACCS; 2016 AACCS.

R 325.5112 Rescinded.

History: 1979 AACCS; 2016 AACCS.

R 325.5113 Rescinded.

History: 1979 AACCS; 2016 AACCS.

R 325.5114 Rescinded.

History: 1979 AACCS; 2016 AACCS.

R 325.5115 Rescinded.

History: 1979 AACCS; 2016 AACCS.

R 325.5116 Rescinded.

History: 1979 AACCS; 2016 AACCS.

R 325.5117 Rescinded.

History: 1979 AACCS; 2016 AACCS.

SPECIAL REQUIREMENTS FOR ISSUANCE OF CERTAIN SPECIFIC LICENSES

R 325.5117a Particle accelerator licenses.

Rule 117a. (1) A particle accelerator capable of producing radioactive material in excess of exempt quantities listed in schedule B of Rule 147 shall not be operated in a manner likely to produce such quantities of radioactive material unless a person is authorized to operate in a specific license issued pursuant to this rule.

(2) Subject to Rule 122 a person shall submit an application for a specific license to operate a particle accelerator subject to this rule in accordance with Rule 101.

(3) The department shall issue a specific license for a particle accelerator subject to licensing under this rule when it determines all of the following:

(a) The applicant will have an adequate program for training accelerator operators and submits to the department a schedule or description of the program which specifies the following:

- (i) Initial training.
- (ii) Periodic training.
- (iii) On-the-job training.

(iv) Means to be used by the licensee to determine the operator's knowledge and understanding of and ability to comply with department rules and licensing requirements, and the operating and emergency procedures of the applicant.

(b) The applicant has established and submits to the department satisfactory written operating and emergency procedures.

(c) The applicant will have an adequate internal inspection system, or other management control, to assure that license provisions, rules, and the applicant's operating and emergency procedures are followed by operators and all other individuals associated with the accelerator operation.

(d) The applicant submits to the department a description of his or her overall organizational structure pertaining to the particle accelerator program, including specified delegations of authority and responsibility for operation of the program.

(e) The applicant has applied for or has been issued a valid license to own, receive, acquire, possess, use, and transfer radioactive material produced or used in connection with accelerator operation.

History: 1979 AACS; 2016 AACS.

R 325.5118 Issuance of specific licenses.

Rule 118. (1) As used in this rule, "as it deems appropriate or necessary" means as the department determines is appropriate or necessary in order to minimize danger to public health and safety or property; and prevent loss or theft of material subject to this part.

(2) Upon a determination that an application meets the requirements of the act and these rules the department shall issue a specific license authorizing the proposed activity in such form and containing such conditions and limitations as it deems appropriate or necessary.

(3) The department may incorporate in any license at the time of issuance, or thereafter, by appropriate rule or order, such additional requirements and conditions with respect to the licensee's receipt, possession, use, and transfer of radioactive material subject to this part as it deems appropriate or necessary.

(4) The department may require such reports and the keeping of such records, and may provide for such inspections of activities under the license as it deems appropriate or necessary.

History: 1979 AACS; 2016 AACS.

R 325.5119 Specific terms and conditions of licenses.

Rule 119. (1) A license issued under this part is subject to all the provisions of the act, now or hereafter in effect, and to all rules and orders of the department.

(2) A license issued or granted under this part and a right to possess or utilize radioactive material granted by a license issued under this part shall not be transferred, assigned, or in any manner disposed of, either voluntarily or involuntarily, directly or indirectly, through transfer of control of any license to any person unless the department, after securing full information, finds that the transfer is in accordance with the provisions of the act, and gives its consent in writing.

(3) A person licensed by the department under this part shall confine his or her use and possession of the material licensed to the locations and purposes authorized in the license.

History: 1979 AACS; 2016 AACS.

R 325.5120 Expiration, renewal, and amendment of licenses.

Rule 120. (1) Except as provided in subrule (3) of this rule, each specific license expires at the end of the day, in the months and year stated therein.

(2) An application for renewal of a specific license shall be filed in accordance with Rule 101.

(3) If a licensee, not less than 30 days before expiration of his or her existing license, has filed an application in proper form for renewal or for a new license authorizing the same

activities, the existing license does not expire until the application has been finally determined by the department.

(4) An application for amendment of a license shall be filed in accordance with Rule 101 and shall specify the respects in which the licensee desires his or her license to be amended and the grounds for such amendment.

(5) In considering an application by a licensee to renew or amend his or her license, the department shall apply the criteria set forth in Rules 102 and 117a.

History: 1979 AACCS; 2016 AACCS.

R 325.5121 Rescinded.

History: 1979 AACCS; 2016 AACCS.

R 325.5122 Rescinded.

History: 1979 AACCS; 2016 AACCS.

R 325.5123 Transfer of material.

Rule 123. (1) A licensee shall not transfer radioactive material except as authorized pursuant to this rule.

(2) Preparation for shipment and transport of radioactive material shall be in accordance with the provisions of Rule 255.

(3) A licensee may transfer radioactive material to the following:

(a) The department.

(b) The NRC.

(c) A person exempt from the rules in this part to the extent permitted under the exemption.

(d) A person authorized to receive the material under terms of a general license or its equivalent, or a specific license or equivalent licensing document, issued by the department, the NRC, or an agreement state, or to a person otherwise authorized to receive the material by the federal government or any agency thereof, the department, or an agreement state.

(e) As otherwise authorized by the department in writing.

History: 1979 AACCS; 2016 AACCS.

R 325.5124 Modification, revocation, and termination of licenses.

Rule 124. (1) The terms and conditions of a license are subject to amendment, revision, or modification or the license may be suspended or revoked by reason of amendments to the act, or by reason of rules and orders issued by the department.

(2) A license may be revoked, suspended, or modified, in whole or in part, for the following:

(a) A material false statement in the application or any statement of fact required under the act.

(b) A condition revealed by the application or statement of fact or any report, record, or inspection or other means which would warrant the department to refuse to grant a license on an original application.

(c) A violation of, or failure to observe, any of the terms and conditions of the act, the license, or any rule or order of the department.

(3) Except in a case of willfulness or where the public health, interest, or safety requires otherwise, a license shall not be modified, suspended, or revoked unless, before the institution of proceedings therefor, facts or conduct which may warrant the action have been called to the attention of the license in writing and the licensee has been accorded an opportunity to demonstrate or achieve compliance with all lawful requirements.

(4) The department may terminate a specific license upon request submitted by the licensee to the department in writing.

History: 1979 AACCS; 2016 AACCS.

R 325.5125 Environmental impact report.

Rule 125. An application for a license to receive and possess radioactive material for commercial waste disposal by land burial in this state or for the conduct of any other activity which the department determines will significantly affect the quality of the environment shall be filed at least 9 months before the beginning of construction of the plant or facility in which the activity will be conducted and shall be accompanied by an environmental report. The report shall contain information similar to the information specified in Rules 212 and 238.

History: 1979 AACCS; 2016 AACCS.

RECIPROCITY

R 325.5131 General license for limited period.

Rule 131. This rule is a general license issued to a person who holds a specific license from the NRC or an agreement state issued by the agency having jurisdiction where the licensee maintains an office for directing the licensed activity and at which radiation safety records are normally maintained, to conduct the activities authorized in the license in this state for a period not in excess of 180 days in any calendar year if all of the following conditions are met:

(a) The license does not limit the activity authorized by it to specified installations or locations.

(b) The licensee notifies the department in writing at least 3 days prior to engaging in the activity. The notification shall indicate the location, period, and type of proposed possession and use within this state, and shall be accompanied by a copy of the pertinent license. If, for a specific case, the 3-day period would impose an undue hardship on the licensee, he or she may obtain permission to proceed sooner upon application to the department. The department may waive the requirement for filing additional written notifications during the remainder of the

calendar year following the receipt of the initial notification from a person engaging in activities under the general license provided in this rule.

(c) The licensee complies with all applicable rules of the department and with all the terms and conditions of his or her license, except terms and conditions which may be inconsistent with applicable rules of the department.

(d) The licensee supplies such other information as the department may request.

(e) The licensee does not transfer or dispose of radioactive material possessed or used under the general license provided in this rule except by transfer to a person specifically licensed by the department or by the NRC to receive such material, or exempt from the requirements for a license for such material under Rule 65.

History: 1979 AACS; 2016 AACS.

Editor's Note: An obvious error in R 325.5131 was corrected at the request of the promulgating agency, pursuant to Section 56 of 1969 PA 306, as amended by 2000 PA 262, MCL 24.256. The rule containing the error was published in Michigan Register, 2016 MR 10. The memorandum requesting the correction was published in Michigan Register, 2016 MR 16.

R 325.5132 Rescinded.

History: 1979 AACS; 2016 AACS.

R 325.5133 Limited acceptance of reciprocal licenses.

Rule 133. The department may withdraw, limit, or qualify its acceptance of a specific license or equivalent licensing document issued by another agency, or any product distributed pursuant to such licensing document, upon determining that the action is necessary to prevent undue hazard to public health and safety or property.

History: 1979 AACS; 2016 AACS.

LICENSE FEES

R 325.5141 Application fees.

Rule 141. (1) A license application for which a fee is prescribed in Rule 144 shall be accompanied by a remittance in the full amount of the fee unless the applicant has been exempted from fee payment under Rule 143.

(2) An application will not be accepted for filing or processed before payment of the full amount specified unless exempted from fee payment. An application for which a remittance is not received may be returned to the applicant.

(3) All application fees shall be retained irrespective of the department's disposition of the application or a withdrawal of the application.

(4) The application fee serves as the license fee for the first year after issuance of the license irrespective of the time interval between date of application and date of issuance.

History: 1979 AACCS; 2016 AACCS.

R 325.5142. Annual fees.

Rule 142. (1) An annual license fee is payable 1 year after the date of issuance of the license and annually thereafter.

(2) The annual fee shall be submitted in a timely manner so that its receipt is assured on or before the due date in order to maintain the license in effect.

History: 1979 AACCS..

R 325.5143 Exemptions.

Rule 143. (1) Application fees or annual fees are not required for licenses applied for by, or issued to the following:

(a) An agency of this state or any political subdivision thereof for radioactive material or accelerators to be used primarily for services rendered on a charitable basis or in connection with a facility used primarily for charitable purposes.

(b) A nonprofit educational institution for radioactive material or accelerators to be used exclusively for teaching or training purposes or in connection with a facility used exclusively for teaching or training purposes.

(2) Application fees or annual fees are not required for licenses authorizing the use of source material as shielding only in devices and containers, but all other licensed radioactive material in the device or container is subject to the fees prescribed in Rule 144 unless otherwise exempted under this rule.

History: 1979 AACCS; 2016 AACCS.

R 325.5144 Fee schedule.

Rule 144. Applicants for specific radioactive material licenses and licensees issued these licenses shall pay the appropriate license fees and shall be subject to the footnotes specified in the following fee schedule unless exempted under Rule 143.

| SCHEDULE OF RADIOACTIVE MATERIAL LICENSE FEES | | |
|--|------------------------------|---------------------------|
| Category of License ¹ | Application Fee ² | Annual Fee ^{3 4} |
| 1. Radioactive Material Other than Special Nuclear, Byproduct, or Source Material: | | |
| A. All other specific radioactive material licenses except those in categories 2A or 2B. | \$50.00 | \$50.00 |
| 2. Waste Disposal: | | |
| A. Waste disposal licenses specifically authorizing the receipt of waste radioactive material from other persons for the purpose of commercial disposal by the waste disposal licensee by land burial. | \$3,000.00 | \$3,000.00 |

| Category of License ¹ | Application Fee ² | Annual Fee ^{3,4} |
|---|------------------------------|---------------------------|
| B. Waste disposal licenses specifically authorizing the receipt of waste radioactive material from other persons for the purpose of commercial disposal by the waste disposal licensee by transfer to another person authorized to receive such material. | \$400.00 | \$400.00 |

FOOTNOTES

to

SCHEDULE OF RADIOACTIVE MATERIAL LICENSE FEES

- ¹ Amendments based on applications filed after the due date of the annual license fee reducing the scope of a licensee's program or cancelling a license, will not entitle the licensee to a partial refund of an annual fee that has been paid by the licensee for the year in which such amendment or cancellation occurs. Applications for amendments increasing the scope of a program to a higher fee category will not be accepted for filing unless accompanied by the prescribed fee less the amount of the currently prescribed fee for the activities already licensed.
- ² Applications for specific licenses covering more than 1 fee category shall be accompanied by the prescribed fee for each category.
- ³ Payment of the prescribed annual fee does not automatically renew the license for which the fee is paid. Renewal applications shall be filed in accordance with the requirements of Rule 120. Applications for reissuance of licenses that have expired because a timely renewal application was not filed shall be accompanied by the prescribed application fee.
- ⁴ The annual fee will be waived where an application is filed to cancel the license prior to the due date of the annual fee, and the amount of the annual fee will be reduced where an application is filed to amend the license to reduce its scope before the due date of the annual fee. *However*, an annual fee will not be waived or reduced unless the application filed before the due date of the fee contains all the information necessary to permit the department to complete the requested action

History: 1979 AACS; 2016 AACS.

R 325.5145 Payment of fees.

Rule 145. (1) License fee payments shall be by check, draft, or money order payable to the "State of Michigan".

(2) In any case where the department finds that a licensee has failed to pay the applicable annual fee required in this part, the department may suspend or revoke the license or may issue such order with respect to licensed activities as the department determines to carry out these rules and the act.

History: 1979 AACS; 2016 AACS.

SCHEDULES A AND B

R 325.5146 Schedule A - Exempt concentrations.

Rule 146. See Rule 65.

| Element (atomic number) | Radionuclide | Column I Gas concentration $\mu\text{Ci/ml}^*$ | Column II Liquid and solid concentration $\mu\text{Ci/ml}^{**}$ |
|-------------------------|--------------|---|--|
| Antimony (51) | Sb 122 | | 3×10^{-4} |
| | Sb 124 | | 2×10^{-4} |
| | Sb 125 | | 1×10^{-3} |
| Argon (18) | Ar 37 | 1×10^{-3} | |
| | Ar 41 | 4×10^{-7} | |
| Arsenic (33) | As 73 | | 5×10^{-3} |
| | As 74 | | 5×10^{-4} |
| | As 76 | | 2×10^{-4} |
| | As 77 | | 8×10^{-4} |
| Barium (56) | Ba 131 | | 2×10^{-3} |
| | Ba 140 | | 3×10^{-4} |
| Beryllium (4) | Be 7 | | 2×10^{-2} |
| Bismuth (83) | Bi 206 | | 4×10^{-4} |
| Bromine (35) | Br 82 | 4×10^{-7} | 3×10^{-3} |
| Cadmium (48) | Cd 109 | | 2×10^{-3} |
| | Cd 115m | | 3×10^{-4} |
| | Cd 115 | | 3×10^{-4} |
| Calcium (20) | Ca 45 | | 9×10^{-5} |
| | Ca 47 | | 5×10^{-4} |
| Carbon (6) | C 14 | 1×10^{-6} | 8×10^{-3} |
| Cerium (58) | Ce 141 | | 9×10^{-4} |
| | Ce 143 | | 4×10^{-4} |
| | Ce 144 | | 1×10^{-4} |
| Cesium (55) | Cs 131 | | 2×10^{-2} |
| | Cs 134m | | 6×10^{-2} |
| | Cs 134 | | 9×10^{-5} |
| Chlorine (17) | Cl 38 | 9×10^{-7} | 4×10^{-3} |
| Chromium (24) | Cr 51 | | 2×10^{-2} |
| Cobalt (27) | Co 57 | | 5×10^{-3} |
| | Co 58 | | 1×10^{-3} |
| | Co 60 | | 5×10^{-4} |
| Copper (29) | Cu 64 | | 3×10^{-3} |
| Dysprosium (66) | Dy 165 | | 4×10^{-3} |
| | Dy 166 | | 4×10^{-4} |

| Element (atomic number) | Radionuclide | Column I Gas concentration $\mu\text{Ci/ml}^*$ | Column II Liquid and solid concentration $\mu\text{Ci/ml}^{**}$ |
|-------------------------|--------------------------------|---|--|
| Erbium (68) | Er 169 | | 9×10^{-4} |
| | Er 171 | | 1×10^{-3} |
| Europium (63) | Eu 152 ($T_{1/2}=9.2$ hrs) | | 6×10^{-4} |
| | Eu 155 | | 2×10^{-3} |
| Fluorine (9) | F 18 | 2×10^{-6} | 8×10^{-3} |
| Gadolinium (64) | Gd 153 | | 2×10^{-3} |
| | Gd 159 | | 8×10^{-4} |
| Gallium (31) | Ga 72 | | 4×10^{-4} |
| Germanium (32) | Ge 71 | | 2×10^{-2} |
| Gold (79) | Au 196 | | 2×10^{-3} |
| | Au 198 | | 5×10^{-4} |
| | Au 199 | | 2×10^{-3} |
| Hafnium (72) | Hf 181 | | 7×10^{-4} |
| Hydrogen (1) | H 3 | 5×10^{-6} | 3×10^{-2} |
| Indium (49) | In 113m | | 1×10^{-2} |
| | In 114m | | 2×10^{-4} |
| Iodine (53) | I 126 | 3×10^{-9} | 2×10^{-5} |
| | I 131 | 3×10^{-9} | 2×10^{-5} |
| | I 132 | 8×10^{-8} | 6×10^{-4} |
| | I 133 | 1×10^{-8} | 7×10^{-5} |
| | I 134 | 2×10^{-7} | 1×10^{-3} |
| Iridium (77) | Ir 190 | | 2×10^{-3} |
| | Ir 192 | | 4×10^{-4} |
| | Ir 194 | | 3×10^{-4} |
| Iron (26) | Fe 55 | | 8×10^{-3} |
| | Fe 59 | | 6×10^{-4} |
| Krypton (36) | Kr 85m | 1×10^{-6} | |
| | Kr 85 | 3×10^{-6} | |
| Lanthanum (57) | La 140 | | 2×10^{-4} |
| Lead (82) | Pb 203 | | 4×10^{-3} |
| Lutetium (71) | Lu 177 | | 1×10^{-3} |
| Manganese (25) | Mn 52 | | 3×10^{-4} |
| | Mn 54 | | 1×10^{-3} |
| | Mn 56 | | 1×10^{-3} |
| Mercury (80) | Hg 197m | | 2×10^{-3} |
| | Hg 197 | | 3×10^{-3} |
| | Hg 203 | | 2×10^{-4} |
| Molybdenum (42) | Mo 99 | | 2×10^{-3} |

| Element (atomic number) | Radionuclide | Column I Gas concentration μCi/ml* | Column II Liquid and solid concentration μCi/ml** |
|-----------------------------|--------------|---------------------------------------|--|
| Neodymium (60) | Nd 147 | | 6×10^{-4} |
| | Nd 149 | | 3×10^{-3} |
| Nickel (28) | Ni 65 | | 1×10^{-3} |
| Niobium (41) (Columbium) | Nb 95 | | 1×10^{-3} |
| | Nb 97 | | 9×10^{-3} |
| Osmium (76) | Os 185 | | 7×10^{-4} |
| | Os 191m | | 3×10^{-2} |
| | Os 191 | | 2×10^{-3} |
| | Os 193 | | 6×10^{-4} |
| Palladium (46) | Pd 103 | | 3×10^{-3} |
| | Pd 109 | | 9×10^{-4} |
| Phosphorous (15) | P 32 | | 2×10^{-4} |
| Platinum (78) | Pt 191 | | 1×10^{-3} |
| | Pt 193m | | 1×10^{-2} |
| | Pt 197m | | 1×10^{-2} |
| | Pt 197 | | 1×10^{-3} |
| Polonium (84) | Po 210 | | 7×10^{-6} |
| Potassium (19) | K 42 | | 3×10^{-3} |
| Praseodymium(59) | Pr 142 | | 3×10^{-4} |
| | Pr 143 | | 5×10^{-4} |
| Promethium (61) | Pm 147 | | 2×10^{-3} |
| | Pm 149 | | 4×10^{-4} |
| Radium (88) | Ra 226 | | 1×10^{-7} |
| | Ra 228 | | 3×10^{-7} |
| Radon (86) | Rn 220 | | 1×10^{-8} |
| | Rn 222 | | 1×10^{-7} |
| Rhenium (75) | Re 183 | | 6×10^{-3} |
| | Re 186 | | 9×10^{-4} |
| | Re 188 | | 6×10^{-4} |
| Rhodium (45) | Rh 103m | | 1×10^{-1} |
| | Rh 105 | | 1×10^{-3} |
| Rubidium (37) | Rb 86 | | 7×10^{-4} |
| Ruthenium (44) | Ru 97 | | 4×10^{-3} |
| | Ru 103 | | 8×10^{-4} |
| | Ru 105 | | 1×10^{-3} |
| | Ru 106 | | 1×10^{-4} |
| Samarium (62) | Sm 153 | | 8×10^{-4} |
| Scandium (21) | Sc 46 | | 4×10^{-4} |
| | Sc 47 | | 9×10^{-4} |
| | Sc 48 | | 3×10^{-4} |

| Element (atomic number) | Radionuclide | Column I Gas concentration μCi/ml* | Column II Liquid and solid concentration μCi/ml** |
|----------------------------|--------------|---------------------------------------|--|
| Selenium (34) | Se 75 | 9 x 10 ⁻⁸ | 3 x 10 ⁻³ |
| Silicon (14) | Si 31 | | 9 x 10 ⁻³ |
| Silver (47) | Ag 105 | | 1 x 10 ⁻³ |
| | Ag 110m | | 3 x 10 ⁻⁴ |
| | Ag 111 | | 4 x 10 ⁻⁴ |
| Sodium (11) | Na 24 | | 2 x 10 ⁻³ |
| Strontium (38) | Sr 85 | | 1 x 10 ⁻³ |
| | Sr 89 | | 1 x 10 ⁻⁴ |
| | Sr 91 | | 7 x 10 ⁻⁴ |
| | Sr 92 | | 7 x 10 ⁻⁴ |
| Sulfur (16) | S 35 | | 6 x 10 ⁻⁴ |
| Tantalum (73) | Ta 182 | | 4 x 10 ⁻⁴ |
| Technetium (43) | Tc 96m | | 1 x 10 ⁻¹ |
| | Tc 96 | | 1 x 10 ⁻³ |
| Tellurium (52) | Te 125m | | 2 x 10 ⁻³ |
| | Te 127m | | 6 x 10 ⁻⁴ |
| | Te 127 | | 3 x 10 ⁻³ |
| | Te 129m | | 3 x 10 ⁻⁴ |
| | Te 131m | | 6 x 10 ⁻⁴ |
| | Te 132 | | 3 x 10 ⁻⁴ |
| | Terbium (65) | | Tb 160 |
| Thallium (81) | Tl 200 | | 4 x 10 ⁻³ |
| | Tl 201 | | 3 x 10 ⁻³ |
| | Tl 202 | 1 x 10 ⁻³ | |
| | Tl 204 | 1 x 10 ⁻³ | |
| Thulium (69) | Tm 170 | 5 x 10 ⁻⁴ | |
| | Tm 171 | 5 x 10 ⁻³ | |
| Tin (50) | Sn 113 | 9 x 10 ⁻⁴ | |
| | Sn 125 | 2 x 10 ⁻⁴ | |
| Tungsten (74) (Wolfram) | W 181 | 4 x 10 ⁻³ | |
| | W 187 | 7 x 10 ⁻⁴ | |
| Vanadium (23) | V 48 | 3 x 10 ⁻⁴ | |
| Xenon (54) | Xe 131m | 4 x 10 ⁻⁶ | |
| | Xe 133 | 3 x 10 ⁻⁶ | |
| | Xe 135 | 1 x 10 ⁻⁶ | |
| Ytterbium (70) | Yb 175 | 1 x 10 ⁻³ | |

| Element (atomic number) | Radionuclide | Column I Gas concentration μCi/ml* | Column II Liquid and solid concentration μCi/ml** |
|--|--------------|---------------------------------------|--|
| Yttrium (39) | Y 90 | 1 x 10 ⁻¹⁰ | 2 x 10 ⁻⁴ |
| | Y 91m | | 3 x 10 ⁻² |
| | Y 91 | | 3 x 10 ⁻⁴ |
| | Y 92 | | 6 x 10 ⁻⁴ |
| | Y 93 | | 3 x 10 ⁻⁴ |
| Zinc (30) | Zn 65 | | 1 x 10 ⁻³ |
| | Zn 69m | | 7 x 10 ⁻⁴ |
| | Zn 69 | | 2 x 10 ⁻² |
| Zirconium (40) | Zr 95 | | 6 x 10 ⁻⁴ |
| | Zr 97 | | 2 x 10 ⁻⁴ |
| Beta and/or gamma emitting radioactive material not listed above with half-life less than 3 years. | | | 1 x 10 ⁻⁶ |

* Values are given in Column 1 only for those materials normally used as gases.

** μCi/gm for solids.

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

NOTE 2: For purposes of Rule 65 where there is involved a combination of nuclides, the limit for the combination should be derived as follows: Determine for each nuclide in the product the ratio between the concentration present in the product and the exempt concentration established in Schedule A for the specific nuclide when not in combination. The sum of such ratios may not exceed "1" (i.e., unity).

EXAMPLE:

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

History: 1979 AACS; 2016 AACS.

R 325.5147 Schedule B - Exempt quantities.

Rule 147. See Rule 74.

| Radionuclide | Microcuries |
|-----------------------|-------------|
| Antimony 122 (Sb 122) | 100 |
| Antimony 124 (Sb 124) | 10 |

| | |
|-----------------------------|-------|
| Antimony 125 (Sb 125) | 10 |
| Arsenic 73 (As 73) | 100 |
| Arsenic 74 (As 74) | 10 |
| Arsenic 76 (As 76) | 10 |
| Arsenic 77 (As 77) | 100 |
| Barium 131 (Ba 131) | 10 |
| Barium 133 (Ba 133) | 10 |
| Barium 140 (Ba 140) | 10 |
| Bismuth 210 (Bi 210) | 1 |
| Bromine 82 (Br 82) | 10 |
| Cadmium 109 (Cd 109) | 10 |
| Cadmium 115m (Cd 115m) | 10 |
| Cadmium 115 (Cd 115) | 100 |
| Calcium 45 (Ca 45) | 10 |
| Calcium 47 (Ca 47) | 10 |
| Carbon 14 (C 14) | 100 |
| Cerium 141 (Ce 141) | 100 |
| Cerium 143 (Ce 143) | 100 |
| Cerium 144 (Ce 144) | 1 |
| Cesium 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 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 72 (Ga 72) | 10 |

| | |
|------------------------|-------|
| Germanium 71 (Ge 71) | 100 |
| 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 113m (In 113m) | 100 |
| Indium 114m (In 114m) | 10 |
| Indium 115m (In 115m) | 100 |
| Indium 115 (In 115) | 10 |
| 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 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 |
| 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 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 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 |
| Sulphur 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 48 (V 48) | 10 |
| Xenon 131m (Xe 131m) | 1,000 |
| Xenon 133 (Xe 133) | 100 |
| Xenon 135 (Xe 135) | 100 |
| Ytterbium 175 (Yb 175) | 100 |
| Yttrium 90 (Yb 90) | 10 |
| Yttrium 91 (Yb 91) | 10 |
| Yttrium 92 (Yb 92) | 100 |
| Yttrium 93 (Yb 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 not listed above other than alpha emitting radioactive material | 0.1 |

History: 1979 AACS; 2016 AACS.

R 325.5148 Rescinded.

History: 1979 AACS; 2016 AACS.

R 325.5149. Rescinded.

History: 1979 AACS; 2016 AACS.

PART 4. REGISTRATION OF RADIATION MACHINES

R 325.5181 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5182 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5183 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5184 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5185 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5186 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5187 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5188 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5189 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5191 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5192 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5193 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5194 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5195 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5196 Rescinded.

History: 1979 AC; 2016 AACS.

PART 5. STANDARDS FOR PROTECTION AGAINST RADIATION

R 325.5201 Purpose and scope.

Rule 201. (1) This part establishes standards for protection against radiation hazards. Except as otherwise specifically provided this part applies to all licensees and registrants.

(2) In addition to complying with requirements in this part, every reasonable effort should be made to maintain radiation levels in unrestricted areas and releases of radioactive materials in effluents to unrestricted areas, as far below the limits specified in this part as practicable. The term "as far below the limits specified in this part as practicable" means as low as is practicably achievable, taking into account the state of technology, and the economics of improvements in relation to benefits to the public health and safety and in relation to the use of sources of radiation in the public interest.

History: 1979 AACCS; 2016 AACCS.

R 325.5202 Intentional exposure of humans.

Rule 202. (1) Nothing in these rules shall be construed as limiting the intentional exposure of patients to radiation for the purpose of medical diagnosis, medical therapy, or medical research conducted by licensed members of the healing arts.

(2) Intentional exposure of individuals to radiation or concentrations of radioactive material for diagnostic or therapeutic purposes shall be limited to supervision or prescriptions by licensed members of the healing arts.

History: 1979 AACCS; 2016 AACCS.

PERMISSIBLE DOSES, LEVELS AND CONCENTRATIONS

R 325.5203 Exposure of individuals to radiation.

Rule 203. (1) Except as provided in subrules (3),(4), and (6) of this rule, a licensee or registrant shall not receive, possess, use, or transfer sources of radiation in a manner as to cause any individual to receive in any period from all sources of radiation in the licensee's or registrant's possession a dose in excess of the limits specified in table 1 of Rule 205. A licensee or registrant shall not be held liable for meeting the dose limit for fertile women (with respect to fetus) listed in table 1 until and unless the employee has submitted written notice to the licensee or registrant of the pregnant condition. Potential risk of exposure, if any, to the fetus before the written notice is received shall be assumed by the employee as a condition of employment as a radiation worker. Following receipt of written notice, the employee's dosimeter record shall be reviewed immediately and necessary steps shall be taken to meet the dose limit specified in table 1 of Rule 205.

(2) For determining the doses specified in Rules 203 to 215, a dose from x- or gamma rays up to 10 MeV may be assumed to be equivalent to the exposure measured by a properly calibrated appropriate instrument in air at or near the body surface of the region of the highest exposure rate.

(3) A licensee or registrant may permit an individual in a restricted area to receive a dose to the whole body greater than that permitted in subrule (1) of this rule, under any of the following conditions:

(a) The annual dose does not exceed 5 rems in any 1 year and during any calendar quarter the dose to the whole body from sources of radiation in the licensee's or registrant's possession does not exceed 3 rems.

(b) The dose to the whole body, when added to the accumulated occupational dose to the whole body, does not exceed 5 (N-18) rems where "N" equals the individual's age in years at his or her last birthday.

(c) The licensee or registrant has determined the individual's accumulated occupational dose to the whole body on Form RH-101, or on a clear and legible record containing all the information required in that form and has otherwise complied with the requirements of Rule 206.

(4) Upon application showing an operational need, the department may authorize radiation doses at a higher annual level than the limits set forth in subrule (1) of this rule, provided that the dose does not exceed 3 rems per quarter and that, based on the determination of the individual's prior radiation record, his or her accumulated occupational dose does not exceed 5 (N-18) rems where "N" equals the individual's age in years at his or her last birthday.

(5) As used in this part, "dose to the whole body" includes any dose to the whole body, gonads, active blood-forming organs, head and trunk, or lens of the eye.

(6) Nothing in this part shall be interpreted as limiting the exposure of members of emergency response teams to radiation under emergency circumstances for the purpose of minimizing danger to life or property. Teams may include police, fire, ambulance, and paramedical crews acting in the course of their assigned duties.

History: 1979 AACCS; 2016 AACCS.

R 325.5205 Dose limits.

Rule 205. Table 1

| Maximum Permissible Dose Equivalent for Occupational Exposure | |
|--|-----------------------------|
| Dose to the whole body* | 1.25 rem per quarter |
| Skin of whole body | 7.5 rems per quarter |
| Hands | 18.75 rems per quarter |
| Fertile women (with respect to fetus) | 0.5 rem in gestation period |
| Maximum Permissible Dose Equivalent for Non-Occupational Exposure | |
| Individual | 0.5 rem in any one year |
| Population Dose Limits | |
| Genetic | 0.17 rem average per year |
| Somatic | 0.17 rem average per year |

*If the dose distribution is not uniform the limiting dose shall be the highest dose received by any of the critical organs specified in subrule (5) of Rule 203.

History: 1979 AACCS; 2016 AACCS.

R 325.5206 Determination of accumulated dose.

Rule 206. (1) This rule applies to licensees or registrants who propose, pursuant to Rule 203 (3) or (4), to permit individuals in a restricted area to receive radiation doses in excess of the limits specified in table 1 of Rule 205.

(2) Before permitting an individual in a restricted area to be exposed to radiation in excess of the limits specified in table 1 of Rule 205, each licensee or registrant shall do all of the following:

(a) Obtain a certificate on Form RH-101, or on a clear and legible record containing all the information required in that form, signed by the individual, showing each period of time after the individual attained the age of 18 in which the individual received an occupational dose of radiation.

(b) Calculate on Form RH-101, in accordance with the instructions appearing therein, or on a clear and legible record containing all the information required in that form, the previously accumulated occupational dose received by the individual and the additional dose allowed for the individual under Rule 203 (3) or (4).

(3) In the preparation of Form RH-101, or on a clear and legible record containing all the information required in that form, the licensee or registrant shall make a reasonable effort to obtain reports of the individual's previously accumulated occupational dose. For each period for which the licensee or registrant obtains these reports, he or she shall use the dose shown in the report in preparing the form. Where a licensee or registrant is unable to obtain reports of the individual's occupational dose for a previous complete calendar quarter, it is assumed that the individual has received the occupational dose specified in whichever of the following columns apply:

| | <u>COLUMN 1</u> Assumed Dose in Rems for Calendar Quarters Before January 1, 1961 | <u>COLUMN 2</u> Assumed Dose in Rems For Calendar Quarters Beginning on or After January 1, 1961 |
|--|--|--|
| Part of Body | | |
| Whole body, gonads, active blood-forming organs, head and trunk, lens of the eye | 3.75 | 1.25 |

(4) The licensee or registrant shall retain and preserve records used in preparing Form RH-101. If calculation of the individual's accumulated occupational dose for all periods before January 1, 1961 yields a result higher than the applicable accumulated dose value for the individual as of that date, as specified in Rule 205, the excess may be disregarded.

History: 1979 AACS; 2016 AACS.

R 325.5208 Exposure of individuals to radioactive material in restricted areas.

Rule 208. (1) A licensee shall not receive, acquire, possess, use, or transfer radioactive material in such a manner as to cause an individual in a restricted area to be exposed to airborne radioactive material in an average concentration in excess of the limits specified in table I of appendix A in Rules 261 to 270. "Expose," as used in this rule, means that the individual is present in a region where an airborne concentration exist. An allowance shall not be made for the use of protective clothing or equipment, or particle size, except as authorized by the department pursuant to subrule (3) or (4) of this rule.

(2) The limits given in table I of appendix A in Rules 261 to 270, are based upon an individual being exposed to the specified concentrations for the reference period of 40 hours in any 7 consecutive days. In any such period where an individual has been exposed for less than the 40 hours, the limits specified may be increased proportionately. In any such period where an individual has been exposed for more than 40 hours, the limits specified in the table shall be decreased proportionately.

(3) The department may authorize a licensee to expose an individual in a restricted area to airborne concentrations in excess of the limits specified in table I of appendix A in Rules 261 to 270, upon receipt of an application demonstrating that the concentration is composed in whole or in part of particles of such size that the particles are not respirable and that the individual will not inhale the concentrations in excess of the limits established in the table. An application submitted pursuant to this subrule shall include an analysis of particle sizes in the concentrations and description of the methods used in determining the particle sizes.

(4) The department may authorize a licensee to expose an individual in a restricted area to airborne concentrations in excess of the limits specified in table I of appendix A in Rules 261 to 270, upon receipt of an application demonstrating that the individual will wear appropriate protective equipment and that the individual will not inhale, ingest, or absorb quantities of radioactive material in excess of those which might otherwise be permitted under this part for individuals in restricted areas during a 40-hour week. An application submitted pursuant to this subrule shall contain all of the following information:

(a) A description of the protective equipment to be employed, including the efficiency of the equipment for the material involved.

(b) Procedures for the fitting, maintenance, and cleaning of the protective equipment.

(c) Procedures governing the use of the protective equipment, including supervisory procedures and length of the time the equipment will be used by the individuals in each work week. The proposed periods for use of the equipment by any individual should not be of such duration as would discourage observance by the individual of the proposed procedures.

(d) The average concentrations present in the areas occupied by individuals.

(e) Procedures for bio-assay evaluation of the effectiveness of the proposed protective safeguards.

History: 1979 AACS; 2016 AACS.

R 325.5209 Orders requiring furnishing of bio-assay services.

Rule 209. Where necessary or desirable in order to aid in determining the extent to which an individual was or may be exposed to concentrations of radioactive material, the department may incorporate license provisions or issue an order requiring a licensee or registrant to make available to the individual appropriate bio-assay services and to furnish a copy of the reports of such services to the department.

History: 1979 AACS..

R 325.5210 Exposure of minors.

Rule 210. (1) A licensee or registrant shall not receive, acquire, possess, use, or transfer sources of radiation in a manner as to cause an individual who is under 18 years of age, to receive in any period of 1 calendar quarter from all sources of radiation in the licensee's or registrant's possession, a dose in excess of 10% of the quarterly occupational limit specified in Rule 205 (e.g. 125 mrems whole body).

(2) A licensee shall not receive, acquire, possess, use, or transfer radioactive material in such a manner as to cause any individual in a restricted area, who is under 18 years of age, to be exposed to airborne radioactive material in an average concentration in excess of the limits specified in table II of appendix A in Rules 261 to 270. For purposes of this subrule, concentrations may be averaged over periods not greater than 1 week (7 consecutive days).

(3) Rule 208 (1) shall apply where an individual is exposed subject to subrule (2) of this rule.

History: 1979 AC; 2016 AACCS.

R 325.5211 Radiation levels from external sources in unrestricted areas.

Rule 211. (1) Except as authorized by the department pursuant to subrule (2) of this rule, a licensee or registrant shall not receive, acquire, possess, use, or transfer sources of radiation in such a manner as to result in an individual in an unrestricted area receiving a dose in excess of the following:

- (a) Two millirems in any 1 hour.
- (b) One hundred millirems in any 7 consecutive days.
- (c) Five hundred millirems in any 1 year.

(2) A person may apply to the department for proposed limits upon levels of radiation in unrestricted areas in excess of those specified in subrule (1) of this rule resulting from the applicants possession or use of sources of radiation. The application shall include information as to anticipated average radiation levels and anticipated occupancy times for each unrestricted area involved. The department shall approve the proposed limits if the applicant demonstrates to the satisfaction of the department that the proposed limits are not likely to cause any individual to receive a dose to the whole body in any period of 1 calendar year in excess of 0.5 rem.

History: 1979 AC; 2016 AACCS.

R 325.5212 Concentrations in effluents to unrestricted areas.

Rule 212. (1) A licensee shall not receive, acquire, possess, use, or transfer licensed material so as to release to an unrestricted area radioactive material in concentrations that exceed the limits specified in table II of appendix A in Rules 261 to 270, except as authorized pursuant to subrule (2) of this rule or Rule 238. For purposes of this rule, concentrations may be averaged over a period not greater than 1 year.

(2) An application for a license or amendment may include proposed limits higher than those specified in subrule (1) of this rule. The department shall approve the proposed limits if the applicant demonstrates both of the following:

(a) The applicant has made a reasonable effort to minimize the radioactivity contained in effluents to unrestricted areas.

(b) It is not likely that radioactive material discharged in the effluent would result in the exposure of an individual to concentrations of radioactive material in air or water exceeding the limits specified in table II of appendix A in Rules 261 to 270.

(3) An application for higher limits pursuant to subrule (2) of this rule shall include information demonstrating that the applicant has made a reasonable effort to minimize the radioactivity discharged in effluents to unrestricted areas, and shall include, as pertinent, the following:

(a) Information as to flow rates, total volume of effluent, peak concentration of each radionuclide in the effluent, and concentration of each radionuclide in the effluent averaged over a period of 1 year at the point where the effluent leaves a stack, tube, pipe, or similar conduit.

(b) A description of the properties of the effluents, including the following:

(i) Chemical composition.

(ii) Physical characteristics, including suspended solids content in liquid effluents, and nature of gas or aerosol for air effluents.

(iii) The hydrogen ion concentrations (pH) of liquid effluents.

(iv) The size range of particulates in effluents released into air.

(c) A description of the anticipated human occupancy in the unrestricted areas where the highest concentration of radioactive material from the effluent is expected, and, in the case of a river or stream, a description of water uses downstream from the point of release of the effluent.

(d) Information as to the highest concentration of each radionuclide in an unrestricted area, including anticipated concentrations averaged over a period of 1 year in the following:

(i) In air at any point of human occupancy.

(ii) In water at points of use downstream from the point of release of the effluent.

(e) The background concentration of radionuclides in the receiving river or stream before the release of liquid effluent.

(f) A description of the environmental monitoring equipment, including sensitivity of the system, and procedures and calculations to determine concentration of radionuclides in the unrestricted area and possible reconcentrating of radionuclides.

(g) A description of the waste treatment facilities and procedures used to reduce the concentration of radionuclides in effluents before their release.

(4) For the purposes of this rule, the concentration limits in table II of appendix A in Rules 261 to 270 apply at the boundary of the restricted area. The concentration of radioactive material discharged through a stack, pipe, or similar conduit may be determined with respect to the point where the material leaves the conduit. If the conduit discharges within the restricted area, the concentration at the boundary may be determined by applying appropriate factors for dilution, dispersion, or decay between the point of discharge and the boundary.

(5) In addition to limiting concentrations in effluent streams, the department may limit quantities of radioactive materials released in air or water during a specified period of time if it appears that the daily intake of radioactive material from air, water, and food by a suitable sample of an exposed population group, averaged over a period not exceeding 1 year, would otherwise exceed the daily intake resulting from continuous exposure to air or water containing 1/3 the concentration of radioactive materials specified in table II of appendix A in Rules 261 to 270.

(6) This rule does not apply to disposal of radioactive material into sanitary sewerage systems, which is governed by Rule 239.

History: 1979 AC; 2016 AACS.

NOTICES, INSTRUCTIONS, AND REPORTS TO WORKERS; INSPECTIONS

R 325.5213 General information.

Rule 213. Rules 214 to 220 apply to the following:

(a) Establish requirements for notices, instructions and reports by licensees or registrants to individuals engaged in work under a license or registration.

(b) Explain options available to individuals in connection with department investigations of licensees or registrants to ascertain compliance with the act, these rules or orders, licenses or registration certificates issued regarding radiological working conditions. Department investigations include investigations of complaints and routine inspections or compliance investigations.

(c) Apply to all persons who own, receive, acquire, possess, use, or transfer sources licensed by or registered with the department pursuant to part 2.

History: 1979 AC; 2016 AACS.

R 325.5214 Posting of notices to workers.

Rule 214. (1) A licensee or registrant shall post current copies of the following documents:

(a) The regulations in this part.

(b) The license, certificate of registration and conditions or documents incorporated by reference and amendments thereto.

(c) The operating procedures applicable to work under the license or registration.

(d) Any notice of violation involving radiological working conditions, proposed imposition of civil penalty, or order issued pursuant to part 1, and any response from the licensee or registrant.

(2) If posting of a document specified in subrule (1)(a), (b) or (c) of this rule is not practicable, the licensee or registrant may post a notice which describes the document and states where it may be examined.

(3) Form RH-100 "Notice to Employees" shall be posted by each licensee or registrant wherever individuals work in or frequent any portion of a restricted area.

(4) Documents, notices, or forms posted pursuant to this rule shall 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, shall be conspicuous, and shall be replaced if defaced or altered.

(5) Department documents posted pursuant to subrule(1)(d) of this rule shall be posted within 2 working days after receipt of the documents from the department. The licensee's or registrant's response, if any, shall be posted within 2 working days after dispatch from the licensee or registrant. The documents shall remain posted for a minimum of 5 working days or until action correcting the violation has been completed, whichever is later.

History: 1979 AC; 2016 AACS.

R 325.5215 Instructions to workers.

Rule 215. (1) A licensee or registrant shall do the following:

(a) Inform individuals working in or frequenting any portion of a restricted area of the occurrence of radiation or sources of radiation in those portions of the restricted area.

(b) Instruct workers in the following:

(i) The health protection problems associated with exposure to the sources of radiation and in precautions or procedures to minimize exposure.

(ii) The purposes and functions of protective devices employed.

(iii) Appropriate responses to warnings made in the event of any unusual occurrence or malfunction that may involve exposure to radiation or radioactive material.

(c) Instruct workers to observe, to the extent within the workers' control, the applicable rules and license or registration conditions for the protection of personnel from exposures to radiation or radioactive material.

(d) Advise workers of reports of radiation dose that they may request pursuant to Rule 216.

(e) Inform workers of their responsibility to report promptly to licensee or registrant any condition which may lead to or cause the following:

(i) A violation of department rules, licenses, or registration certificates.

(ii) Unnecessary exposure to radiation or radioactive material.

(2) The extent of instructions required by this rule shall be commensurate with potential radiological health protection problems in the restricted area.

History: 1979 AC; 2016 AACCS.

R 325.5216 Notifications and reports to individuals.

Rule 216. (1) Radiation exposure data for an individual and the results of any measurements, analyses, and calculations of radioactive material deposited or retained in the body of an individual shall be reported to the individual as specified in this rule. The information reported shall include data and results obtained pursuant to rules or orders, or license or registration conditions, as shown in records maintained by the licensee or registrant pursuant to rules. Each notification and report shall meet the following requirements:

(a) Be in writing.

(b) 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.

(c) Include the individual's exposure information.

(d) Contain the following statement:

"This report is furnished to you under the provisions of Part 5 of the Michigan Department of Environmental Quality rules entitled 'Standards for Protection Against Radiation'. You should preserve this report for future reference."

(2) At the request of any worker, employed by or associated with him or her, a licensee or registrant shall advise the worker annually of the worker's exposure to radiation or radioactive material as shown in records maintained by the licensee or registrant pursuant to Rule 245.

(3) At the request of a worker formerly engaged in work controlled by the licensee or the registrant, a licensee or registrant shall furnish to the worker a report of the worker's exposure to radiation or radioactive material. The report shall meet the following requirements:

(a) 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.

(b) 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 registered with, the department.

(c) Include the dates and locations of work under the license or registration certificate in which the worker participated during this period.

(4) When a licensee or registrant is required pursuant to Rule 250 to report to the department any exposure of an individual to radiation or radioactive material, the licensee or the registrant shall also provide the individual a report on his or her exposure data included therein. Reports shall be transmitted at a time not later than the transmittal to the department.

History: 1979 AC; 2016 AACS.

R 325.5217 Presence of representatives of licensees or registrants and workers during investigations.

Rule 217. (1) A licensee or registrant shall afford opportunity to a department representative, at all reasonable times, to inspect or investigate materials, machines, activities, facilities, premises, and records pursuant to these rules.

(2) A licensee or registrant, or his or her authorized representative, may accompany a department representative during all phases of an investigation except during consultation with workers as specified in Rule 218.

(3) If, at the time of investigation, an individual has been authorized by the workers to represent them during department investigations, the licensee or registrant shall notify the department representative of such authorization and shall give the workers' representative an opportunity to accompany the department representative during the investigation of physical working conditions.

(4) Each worker's representative shall be routinely engaged in work under control of the licensee or registrant and shall have received instructions as specified in Rule 215.

(5) Different representatives of licensees or registrants and workers may accompany the department representative during different phases of an investigation if there is no resulting interference with the conduct of the investigation. However, only 1 workers' representative at a time may accompany the department representative.

(6) 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 workers' representative, shall be afforded the opportunity to accompany the department representative during the investigation of physical working conditions.

(7) Notwithstanding the other provisions of this rule, a department representative may refuse to permit accompaniment by any individual who deliberately interferes with a fair and

orderly investigation. With regard to any area containing proprietary information, the workers' representative for that area shall be an individual previously authorized by the licensee or registrant to enter that area.

History: 1979 AC; 2016 AACCS.

R 325.5218 Consultation with workers during investigations.

Rule 218. (1) A department representative may consult privately with workers concerning matters of occupational radiation protection and other matters related to applicable provisions of rules and licenses to the extent the department representative deems necessary for the conduct of an effective and thorough investigation.

(2) During an investigation, a worker or authorized representative may bring privately to the attention of the department representative, either orally or in writing, any past or present condition that he or she has reason to believe may have contributed to or caused the following:

(a) A violation of the act, these rules or license or registration conditions.

(b) An unnecessary exposure of an individual to radiation from radioactive material under the licensee's or registrant's control.

(3) A written notice presented pursuant to subrule (2) of this rule shall comply with requirements of Rule 219(1).

(4) The provisions of subrule (2) of this rule shall not be interpreted as authorization to disregard instructions provided pursuant to Rule 215.

History: 1979 AC; 2016 AACCS.

R 325.5219 Requests by workers for investigations.

Rule 219. (1) A worker or representative of workers who believes that a violation of the act, these rules, or license or registration conditions exists or has occurred in work under a license or registration with regard to radiological working conditions in which the worker is engaged, may request an investigation by giving notice of the alleged violation to the department. Any notice shall be in writing, shall set forth the specific grounds for the notice, and shall be signed by the worker or representative of the workers. A copy shall be provided to the licensee or registrant by the department no later than at the time of investigation except that, upon the request of the worker giving notice, his or her name and the name of individuals referred to therein shall not appear in such copy or on any record published, released, or made available by the department, except for good cause shown.

(2) If, upon receipt of notice, the department determines that the complaint meets the requirements in subrule (1) of this rule and that there are reasonable grounds to believe that the alleged violations exists or has occurred, the department shall investigate as soon as practicable, to determine if such alleged violation exists or has occurred. An investigation pursuant to this rule need not be limited to matters referred to in the complaint.

(3) A licensee or registrant shall not discharge or in any manner discriminate against a worker because a worker has filed a complaint or instituted or caused to be instituted any proceeding under these rules or has testified, or is about to testify, in any proceeding or because of the exercise by a worker on behalf of himself or herself or others of any option afforded by this part.

History: 1979 AC; 2016 AACCS.

R 325.5220 Investigation not warranted; informal review.

Rule 220. (1) If the department determines, with respect to a complaint under Rule 219, that an investigation is not warranted because there are no reasonable grounds to believe that a violation exists or has occurred, the complainant shall be notified in writing of such determination. The complainant may obtain review of such determination by submitting a written statement of position with the director of the department who shall provide the licensee or registrant with a copy of the statement by registered mail, excluding, at the request of the complainant, the name of the complainant. The licensee or registrant may submit an opposing written statement of position with the director of the department who will provide the complainant with a copy of the statement by registered mail. Upon the request of the complainant, the department may hold an informal conference in which the complainant and the licensee or registrant may orally present his or her views. An informal conference may also be held at the request of the licensee or registrant, but disclosure of the identity of the complainant shall be made only following receipt of written authorization from the complainant. After considering all written or oral views presented, the director of the department, or his or her designated representative, shall affirm, modify, or reverse the determination of the department and furnish the complainant and the licensee or registrant a written notification of his or her decision and the reason.

(2) If the department determines that an investigation is not warranted because the requirements of Rule 219 (1) have not been met, the department shall notify the complainant in writing of the determination. The determination shall be without prejudice to the filing of a new complaint meeting the requirements of Rule 219 (1).

(3) If the decision resulting from informal review is contested, the department shall proceed pursuant to Rule 2 (2).

History: 1979 AC; 2016 AACCS.

PRECAUTIONARY PROCEDURES

R 325.5221 Surveys.

Rule 221. (1) As used in this rule, "survey" means a critical evaluation of a facility or area incident to the production, use, release, disposal, or presence of sources of radiation under a specific set of conditions to determine actual or potential radiation hazards. When appropriate, the evaluation includes tests, physical examination, source inventory and accountability, and measurements of levels of radiation or concentration of radioactive material present.

(2) Each licensee or registrant shall make or cause to be made surveys as may be necessary to establish compliance with these rules.

History: 1979 AC; 2016 AACS.

R 325.5222 Personnel monitoring.

Rule 222. (1) Each licensee or registrant shall supply appropriate personnel monitoring equipment to, shall require the use of such equipment by, and shall demonstrate compliance pursuant to this rule for the following:

(a) Each individual under such circumstances that he or she receives, or is likely to receive, a dose in any calendar quarter in excess of 25% of the quarterly occupational limit specified in Rule 205, (e.g. 300 mrems whole body).

(b) Each individual under 18 years of age under such circumstances that he or she receives, or is likely to receive, a dose in any calendar quarter in excess of 5% of the quarterly occupational limit specified in Rule 205, (e.g. 60 mrems whole body).

(c) Each individual, except a patient being intentionally irradiated, who enters a high radiation area.

(d) Each individual who is likely to receive a dose in excess of 100 millirems in any 5 consecutive days while in a room or area occupied by a patient while the patient is receiving therapy from any gamma-emitting radioactive material.

(e) Each individual for whom personnel monitoring is specifically required under other parts of these rules pertaining to specific uses of sources of radiation.

(2) Monitoring devices used to estimate whole body exposure shall normally be worn on the chest or abdomen. The dosimeter assigned for monitoring the trunk of the body shall not be used for any other purposes. If monitoring of other areas of the body (e.g. lens of the eye, extremity) is required by these rules or requested by the radiation worker because of the nature of exposure, a separate dosimeter shall be assigned for this purpose. The separate dosimeter shall be designated as an auxiliary dosimeter and the radiation record shall specify the specific area monitored.

(3) If auxiliary dosimeters are assigned in accordance with subrule (2) of this rule, the specific body area shall be monitored for a minimum 13 consecutive weeks. If this monitoring results in recorded exposures in excess of 25% of the applicable specified quarterly limit in Rule 205 (e.g. 300 mrems lens of the eye, 6.25 rems hands), the auxiliary dosimeter shall be permanently assigned to monitor that area.

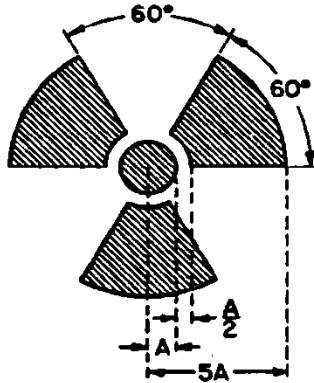
History: 1979 AC; 2016 AACS.

R 325.5224 Caution signs, labels, and signals.

Rule 224. (1) Except as otherwise authorized by the department, symbols prescribed by Rules 224 to 231 shall use the conventional radiation caution colors (magenta or purple on yellow background). The symbol prescribed is the conventional three-bladed design as follows:

RADIATION SYMBOL

1. Cross-hatched area is to be magenta or purple.
2. Background is to be yellow.



(2) In addition to the contents of signs and labels prescribed in Rules 224 to 231, a licensee or registrant may provide on or near these signs and labels any additional information which may be appropriate in aiding individuals to minimize being exposed to radiation.

History: 1979 AC; 2016 AACCS.

R 325.5225 Radiation area signs.

Rule 225. Each radiation area shall be conspicuously posted with 1 or more signs bearing the radiation caution symbol and the following words:

History: 1979 AACCS; 2016 AACCS.

CAUTION: RADIATION AREA

R 325.5226 High radiation area signs.

Rule 226. Each high radiation area shall be conspicuously posted with 1 or more signs bearing the radiation caution symbol and the following words:

History: 1979 AACCS; 2016 AACCS.

CAUTION: HIGH RADIATION AREA

R 325.5227 Controls for access to high radiation areas.

Rule 227. (1) Each entrance or access point to a high radiation area shall be equipped with a control device that complies with 1 of the following:

- (a) It causes that level of radiation to be reduced below that at which an individual might receive a dose of 100 millirems in 1 hour upon entry into the area.
- (b) It energizes a conspicuous visible and audible alarm signal in such a manner that the individual entering the high radiation area and the licensee, registrant, or a supervisor of the activity are made aware of the entry.
- (c) It is locked, except during periods when access to the area is required, with positive control over each individual entry.

(2) Controls shall be established in such a way that an individual will not be prevented from leaving a high radiation area.

(3) The controls required by subrule (1) (a) of this rule shall be constructed in such a manner that the primary radiation cannot be reactivated until all entrances have been secured, and the radiation on-off control is reset at the control panel.

(4) The controls required by subrule (1) (b) of this rule shall be constructed in such a manner that when the warning device is activated, it is necessary to shut off or secure the source of radiation and secure all tripped entrances before being able to inactivate the alarm system.

(5) In the case of a high radiation area established for a period of 30 days or less, direct surveillance to prevent unauthorized entry may be substituted for the controls required by this rule.

(6) A licensee, registrant, or applicant for a license or registration, may apply to the department for approval of methods not included in subrules (1) and (5) of this rule for controlling access to high radiation areas. The department may approve the proposed alternatives if the licensee, registrant, or applicant demonstrates that the alternative methods of control will prevent unauthorized entry into a high radiation area, and that the requirement of subrule (2) of this rule is met.

History: 1979 AC; 2016 AACCS.

R 325.5228 Airborne radioactivity area signs.

Rule 228. (1) As used in this rule, “airborne radioactivity area” means a room, enclosure, or operating area in which airborne radioactive material exists in concentrations in excess of the amounts specified in column 1, table I of Rules 261 to 269 or a room, enclosure, or operating area in which airborne radioactive material exists in concentrations which, averaged over the number of hours in any week during which individuals are in the area, exceed 25% of the amounts specified in column 1, table I of Rules 261 to 269.

(2) Each airborne radioactivity area shall be conspicuously posted with 1 or more signs bearing the radiation caution symbol and the following words:

**CAUTION
AIRBORNE RADIOACTIVITY AREA**

History: 1979 AC; 2016 AACCS.

R 325.5229 Area and room signs.

Rule 229. (1) Each area or room in which any radioactive material, other than natural uranium or thorium, is used or stored in an amount exceeding 10 times the quantity of radioactive material specified in Rule 271 shall be conspicuously posted with 1 or more signs bearing the radiation caution symbol and the following words:

**CAUTION
RADIOACTIVE MATERIAL**

(2) Each area or room in which natural uranium or thorium is used or stored in an amount exceeding 100 times the quantity specified in Rule 271 shall be conspicuously posted with a sign or signs bearing the radiation caution symbol and the following words:

History: 1979 AC; 2016 AACS.

R 325.5230 Container labels.

Rule 230. (1) Except as provided in subrule (3) of this rule each container of radioactive material shall bear a durable, clearly visible label identifying the radioactive contents.

(2) The label required shall bear the radiation caution symbol and the following words:

**CAUTION
RADIOACTIVE MATERIAL**

It shall also provide sufficient information (including as appropriate, radiation levels, kinds of material, estimate of activity, date for which activity is estimated, and the like) to permit individuals handling or using the containers, or working in their vicinity to take precautions to avoid or minimize being exposed.

(3) Notwithstanding subrule (1) of this rule, labeling is not required for the following:

(a) Containers that do not contain radioactive materials in quantities greater than the applicable quantities listed in Rule 271.

(b) Containers that contain only natural uranium or thorium in quantities no greater than 10 times the applicable quantities listed in Rule 271.

(c) Containers that do not contain radioactive materials in concentrations greater than the applicable concentrations listed in column 2, table I, of appendix A in Rules 261 to 269.

(d) Containers that are attended by an individual who takes the precautions necessary to prevent any individual from being exposed to radiation or radioactive materials in excess of the limits established by this part.

(e) Containers that are in transport and packaged and labeled in accordance with regulations published by the United States Department of Transportation.

(f) Containers that are accessible only to individuals authorized to handle or use them (for example, containers in locations such as water-filled canals, storage vaults, or hot cells) or to work in the vicinity thereof, if the contents are identified to such individuals by a readily available written record.

(g) Manufacturing and process equipment such as nuclear reactors, reactor components piping, and tanks.

History: 1979 AC; 2016 AACS.

R 325.5231 Alternate wording for warning signs.

Rule 231. The word DANGER may be used instead of CAUTION in a warning sign required by Rules 225, 226, 228, 229, and 230.

History: 1979 AC; 2016 AACS.

R 325.5232 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5233 Exemptions from posting and labeling requirements.

Rule 233. Notwithstanding Rules 225 to 230, the following apply:

(a) A room or other area containing radioactive material for periods of less than 8 hours is not required to be posted with a caution sign if either of the following apply:

(i) The material is constantly attended during these periods by an individual who shall take the precautions necessary to prevent any individual from being exposed to radiation or radioactive material in excess of the limits established in this part.

(ii) The room or area is subject to the licensee's or registrant's control.

(b) A room or other area is not required to be posted with a caution sign, and control is not required for each entrance or access point to a room or other area that is a high radiation area, solely because of the presence of radioactive material prepared for transport and packaged and labeled in accordance with regulations of the United States Department of Transportation.

History: 1979 AC; 2016 AACS.

R 325.5236 Storage of sources and procedures for receiving and opening of packages.

Rule 236. (1) Sources of radiation shall be secured against unauthorized removal from the place of storage.

(2) A licensee shall establish and maintain procedures for safely opening packages in which licensed material is received, and the licensee shall assure that such procedures are followed and due consideration is given to special instructions for the type of package being opened.

History: 1979 AC; 2016 AACS.

R 325.5237 Surface contamination.

Rule 237. (1) Pursuant to Rule 221, a licensee or registrant shall conduct surveys and measurements of radioactive surface contamination of facilities, equipment, and other property that may be contaminated. With regard to radioactive surface contamination, the philosophy and goal stated in Rule 201(2) may be considered presently satisfied by following the guidance in Rule 272.

(2) A facility, installation, equipment, or other property shall not be assigned, sold, leased, or transferred to an unlicensed person unless the property has been decontaminated below the applicable limits specified in Rule 272.

(3) The guidance in Rule 272 may be modified at the discretion of the department in any specific situation involving a specific radionuclide.

History: 1979 AC; 2016 AACS.

R 325.5238 Disposal of radioactive material.

Rule 238. (1) A licensee shall not dispose of any radioactive material except for either of the following:

- (a) By transfer to an authorized recipient as provided in Rule 123.
- (b) As authorized pursuant to subrule (2) of this rule or Rule 212, 239, or 240.

(2) A person may apply to the department for approval of proposed procedures to dispose of radioactive material in a manner not otherwise authorized in this part. The application shall include a description of the radioactive material, including the quantities and kinds of radioactive material and the levels of radioactivity involved, and the proposed manner and conditions of disposal. The application, where appropriate, should also include an analysis and evaluation of pertinent information as to the nature of the environment, including topographical, geological, meteorological, and hydrological characteristics; usage of ground and surface waters in the general area; the nature and location of other potentially affected facilities; and procedures to be observed to minimize the risk of unexpected or hazardous exposures.

(3) The department shall not approve an application for a license to receive radioactive material from other persons for disposal on land not owned by a state or the federal government.

History: 1979 AC; 2016 AACS.

R 325.5239 Disposal by release into sanitary sewerage systems.

Rule 239. (1) A licensee shall not discharge radioactive material into a sanitary sewerage system unless all of the following conditions exist:

- (a) It is readily soluble or dispersible in water.
- (b) The quantity of any radioactive material released into the system by the licensee in any 1 day does not exceed the larger of the following:

- (i) The quantity which, if diluted by the average daily quantity of sewage released into the sewer by the licensee, will result in an average concentration not greater than the limits specified in column 2, table I, of Rules 261 to 269.

- (ii) Ten times the quantity of such material specified in Rule 271.

- (c) The quantity of any radioactive material released in any 1 month, if diluted by the average monthly quantity of water released by the licensee, will not result in an average concentration exceeding the limits specified in column 2, table I, of Rules 261 to 269.

- (d) The gross quantity of radioactive material released into the sewerage system by the licensee does not exceed 1 curie per year.

(2) Excreta from individuals undergoing medical diagnosis or therapy with radioactive material shall be exempt from any limitations contained in this rule.

History: 1979 AC; 2016 AACS.

R 325.5240 Disposal by burial in soil or incineration.

Rule 240. (1) Burial sites shall be licensed by the department upon application submitted in accordance with Rules 101 and 102. Burial shall be in a controlled area.

(2) A licensee shall not incinerate radioactive material for the purpose of disposal or preparation for disposal except as specifically approved by the department pursuant to Rules 212 and 238.

History: 1979 AC; 2016 AACS.

R 325.5241 Use of safety equipment.

Rule 241. (1) Requirements for safety interlocks, protective enclosures, protective clothing, precautionary labels, or any other safety equipment presumes the proper use of such equipment. Unauthorized override of safety interlocks or other intentional misuse or non-use of required safety equipment shall be considered willful violation of these rules.

(2) The radiation supervisor shall request, in writing, from the department, authorization to override safety interlocks. The request shall include justification, precautionary procedures during override, and statement of immediate supervision by the radiation protection supervisor or his or her authorized representative. Prior approval by the department is required. Approval may be granted by written condition on the specific license or registration certificate or by telephone followed by written confirmation from the department.

History: 1979 AC; 2016 AACS.

RECORDS, REPORTS AND NOTIFICATION

R 325.5245 Records of surveys, radiation monitoring, disposal, and tests.

Rules 245. (1) A licensee or registrant shall maintain records showing the radiation doses of all individuals for whom personnel monitoring is required under Rule 222. Records shall be kept on department Form RH-102, in accordance with the instructions contained in that form, or on clear and legible records containing all the information required by Form RH-102. The doses entered on the forms or records shall be for periods of time not exceeding 1 calendar quarter.

(2) A licensee or registrant shall maintain records in the same units used in this part, showing the results of surveys required in Rule 221, disposals made under Rules 238 to 240, and surveys required by other parts of these rules.

(3) Records of individual exposure to radiation and to radioactive material that is maintained pursuant to subrule (1) of this rule and records of bio-assays, including results of whole body counting examinations, made pursuant to Rule 209 shall be preserved indefinitely or until the department authorizes their disposal.

(4) The discontinuance or curtailment of activities does not relieve the licensee or registrant of responsibility for retaining all records required by this rule. A licensee or registrant may, however, request the department to accept such records. The acceptance of the records by the department relieves the licensee or registrant of subsequent responsibility only in respect to its preservation as required by this rule.

(5) Records that are maintained pursuant to this part may be maintained in the form of microfilms.

History: 1979 AC; 2016 AACS.

R 325.5246 Reports of theft or loss of sources of radiation.

Rule 246. A licensee or registrant shall report by telephone and facsimile to the department the theft or loss of any source of radiation immediately after such occurrence becomes known to the licensee or registrant.

History: 1979 AC; 2016 AACS.

R 325.5247 Notification of incidents.

Rule 247. (1) A licensee or registrant shall immediately notify the department by telephone and facsimile if any incident involving any source of radiation possessed by him or her and that may have caused or threatens to cause any of the following:

(a) A dose to the whole body of any individual of 25 rems or more of radiation; a dose to the skin of the whole body of any individual of 150 rems or more of radiation; or a dose to the feet, ankles, hands, or forearms of any individual of 375 rems or more of radiation.

(b) The release of radioactive material in concentrations which, if averaged over a period of 24 hours, would exceed 5,000 times the limits specified for such materials in table II of Rules 261 to 269.

(c) A loss of 1 working week or more of the operation of any facilities affected due to contamination or other potential hazard from radioactive material.

(d) Damage to property in excess of \$100,000.00.

(2) A licensee or registrant shall within 24 hours notify the department by telephone and facsimile of any incident involving any source of radiation possessed by him or her and that may have caused or threatens to cause any of the following:

(a) A dose to the whole body of any individual of 5 rems or more of radiation; a dose to the skin of the whole body of any individual of 30 rems or more of radiation; or a dose to the feet, ankles, hands or forearms of 75 rems or more of radiation.

(b) The release of radioactive material in concentrations that, if averaged over a period of 24 hours, would exceed 500 times the limits specified for such materials in table II of Rules 261 to 269.

(c) A loss of 1 day or more of the operation of any facilities affected or damage to property in excess of \$1,000.00 due to contamination or other potential hazard from radioactive material.

(3) A report filed with the department pursuant to this rule shall be prepared in such a manner that names of individuals who have received exposure to radiation are stated in a separate part of the report.

History: 1979 AC; 2016 AACS.

R 325.5250 Reports of overdose and excessive levels and concentrations.

Rule 250. (1) In addition to any notification required by Rule 247 a licensee or registrant shall report all of the following in writing within 30 days to the department:

(a) Each radiation dose received by an individual or concentrations of radioactive material in excess of any applicable limit as set forth in this part or as otherwise approved by the department.

(b) Each incident for which notification is required by Rule 247.

(c) Levels of radiation or concentrations of radioactive material (not involving excessive exposure of any individual) in an unrestricted area in excess of 10 times any applicable limit as set forth in this part or as otherwise approved by the department.

(2) A report required in subrule (1) of this rule shall describe the extent of radiation dose received by individuals or exposure to radioactive material, including estimates of each individual's dose as required by subrule (3) of this rule; levels of radiation and concentrations of radioactive material involved; the cause of exposure, levels, or concentrations; and corrective steps taken or planned to assure against a recurrence.

(3) A report filed with the department pursuant to subrule (1) of this rule shall include for each individual exposed the name, social security number, and date of birth, and an estimate of the individual's dose. The report shall be prepared so that this information is stated in a separate part of the report.

History: 1979 AC; 2016 AACS.

R 325.5253 Vacating premises.

Rule 253. A specific licensee, not less than 20 days before vacating or relinquishing possession or control of premises that may have been contaminated with radioactive material as a result of his or her activities, shall notify the department in writing of intent to vacate. When deemed necessary by the department, the licensee shall decontaminate or have decontaminated the premises in a manner required by the department.

History: 1979 AC; 2016 AACS.

TRANSPORTATION

R 325.5255 Intrastate transportation of radioactive materials.

Rule 255. (1) A licensee shall not transport any radioactive material outside of the confines of his or her plant or other authorized location of use, or deliver any radioactive material to a carrier for transportation, unless the licensee complies with 10 CFR Parts 20, 71; 14 CFR Part 103; 46 CFR Part 146; and 49 CFR Parts 173-179 to the same extent as if the transportation were subject to the rules and regulations of that agency.

(2) This rule applies to both of the following:

(a) The transportation of radioactive material.

(b) The delivery of radioactive material to a carrier for transportation that is not subject to the rules and regulations of the United States Department of Transportation and other agencies of the United States.

History: 1979 AC; 2016 AACS.

R 325.5256 Rescinded.

History: 1979 AC; 2016 AACS.

**R 325.5261 Appendix A1. Concentrations in air and water above natural background.
Elements A and B.**

Rule 261. (See notes in Rule 270.)

| Element (atomic number) | Radionuclide* | | TABLE I | | TABLE II | |
|----------------------------|---------------|-------|--|--|--|--|
| | | | Column 1 Air ($\mu\text{Ci/ml}$) | Column 2 Water ($\mu\text{Ci/ml}$) | Column 1 Air ($\mu\text{Ci/ml}$) | Column 2 Water ($\mu\text{Ci/ml}$) |
| Actinium (89) | Ac-227 | S | 2×10^{-12} | 6×10^{-5} | 8×10^{-14} | 2×10^{-6} |
| | | I | 3×10^{-11} | 9×10^{-3} | 9×10^{-13} | 3×10^{-4} |
| | Ac-228 | S | 8×10^{-8} | 3×10^{-3} | 3×10^{-9} | 9×10^{-5} |
| | | I | 2×10^{-8} | 3×10^{-3} | 6×10^{-10} | 9×10^{-5} |
| Americium (95) | Am-241 | S | 6×10^{-12} | 1×10^{-4} | 2×10^{-13} | 4×10^{-6} |
| | | I | 1×10^{-10} | 8×10^{-4} | 4×10^{-12} | 3×10^{-5} |
| | Am-242m | S | 6×10^{-12} | 1×10^{-4} | 2×10^{-13} | 4×10^{-6} |
| | | I | 3×10^{-10} | 3×10^{-3} | 9×10^{-12} | 9×10^{-5} |
| | Am-242 | S | 4×10^{-8} | 4×10^{-3} | 1×10^{-9} | 1×10^{-4} |
| | | I | 5×10^{-8} | 4×10^{-3} | 2×10^{-9} | 1×10^{-4} |
| | Am-243 | S | 6×10^{-12} | 1×10^{-4} | 2×10^{-13} | 4×10^{-6} |
| | | I | 1×10^{-10} | 8×10^{-4} | 4×10^{-12} | 3×10^{-5} |
| | Am-244 | S | 4×10^{-6} | 1×10^{-1} | 1×10^{-7} | 5×10^{-3} |
| | | I | 2×10^{-5} | 1×10^{-1} | 8×10^{-7} | 5×10^{-3} |
| Antimony (51) | Sb-122 | S | 2×10^{-7} | 8×10^{-4} | 6×10^{-9} | 3×10^{-5} |
| | | I | 1×10^{-7} | 8×10^{-4} | 5×10^{-9} | 3×10^{-5} |
| | Sb-124 | S | 2×10^{-7} | 7×10^{-4} | 5×10^{-9} | 2×10^{-5} |
| | | I | 2×10^{-8} | 7×10^{-4} | 7×10^{-10} | 2×10^{-5} |
| | Sb-125 | S | 5×10^{-7} | 3×10^{-3} | 2×10^{-8} | 1×10^{-4} |
| | | I | 3×10^{-8} | 3×10^{-3} | 9×10^{-10} | 1×10^{-4} |
| Argon (18) | A-37 | Sub** | 6×10^{-3} | ----- | 1×10^{-4} | ----- |
| | A-41 | Sub | 2×10^{-6} | ----- | 4×10^{-8} | ----- |
| Arsenic (33) | As-73 | S | 2×10^{-6} | 1×10^{-2} | 7×10^{-8} | 5×10^{-4} |
| | | I | 4×10^{-7} | 1×10^{-2} | 1×10^{-8} | 5×10^{-4} |
| | As-74 | S | 3×10^{-7} | 2×10^{-3} | 1×10^{-8} | 5×10^{-5} |
| | | I | 1×10^{-7} | 2×10^{-3} | 4×10^{-9} | 5×10^{-5} |
| | As-76 | S | 1×10^{-7} | 6×10^{-4} | 4×10^{-9} | 2×10^{-5} |
| | | I | 1×10^{-7} | 6×10^{-4} | 3×10^{-9} | 2×10^{-5} |

| | | | | | | |
|----------------|--------|---|---------------------|--------------------|---------------------|--------------------|
| | As-77 | S | 5×10^{-7} | 2×10^{-3} | 2×10^{-8} | 8×10^{-5} |
| | | I | 4×10^{-7} | 2×10^{-3} | 1×10^{-8} | 8×10^{-5} |
| Astatine (85) | At-211 | S | 7×10^{-9} | 5×10^{-5} | 2×10^{-10} | 2×10^{-6} |
| | | I | 3×10^{-8} | 2×10^{-3} | 1×10^{-9} | 7×10^{-5} |
| Barium (56) | Ba-131 | S | 1×10^{-6} | 5×10^{-3} | 4×10^{-8} | 2×10^{-4} |
| | | I | 4×10^{-7} | 5×10^{-3} | 1×10^{-8} | 2×10^{-4} |
| | Ba-140 | S | 1×10^{-7} | 8×10^{-4} | 4×10^{-9} | 3×10^{-5} |
| | | I | 4×10^{-8} | 7×10^{-4} | 1×10^{-9} | 2×10^{-5} |
| Berkelium (97) | Bk-249 | S | 9×10^{-10} | 2×10^{-2} | 3×10^{-11} | 6×10^{-4} |
| | | I | 1×10^{-7} | 2×10^{-2} | 4×10^{-9} | 6×10^{-4} |
| | Bk-250 | S | 1×10^{-7} | 6×10^{-3} | 5×10^{-9} | 2×10^{-4} |
| | | I | 1×10^{-6} | 6×10^{-3} | 4×10^{-8} | 2×10^{-4} |
| Beryllium (4) | Be-7 | S | 6×10^{-6} | 5×10^{-2} | 2×10^{-7} | 2×10^{-3} |
| | | I | 1×10^{-6} | 5×10^{-2} | 4×10^{-8} | 2×10^{-3} |
| Bismuth (83) | Bi-206 | S | 2×10^{-7} | 1×10^{-3} | 6×10^{-9} | 4×10^{-5} |
| | | I | 1×10^{-7} | 1×10^{-3} | 5×10^{-9} | 4×10^{-5} |
| | Bi-207 | S | 2×10^{-7} | 2×10^{-3} | 6×10^{-9} | 6×10^{-5} |
| | | I | 1×10^{-8} | 2×10^{-3} | 5×10^{-10} | 6×10^{-5} |
| | Bi-210 | S | 6×10^{-9} | 1×10^{-3} | 2×10^{-10} | 4×10^{-5} |
| | | I | 6×10^{-9} | 1×10^{-3} | 2×10^{-10} | 4×10^{-5} |
| | Bi-212 | S | 1×10^{-7} | 1×10^{-2} | 3×10^{-9} | 4×10^{-4} |
| | | I | 2×10^{-7} | 1×10^{-2} | 7×10^{-9} | 4×10^{-4} |
| Bromine (35) | Br-82 | S | 1×10^{-6} | 8×10^{-3} | 4×10^{-8} | 3×10^{-4} |
| | | I | 2×10^{-7} | 1×10^{-3} | 6×10^{-9} | 4×10^{-5} |

History: 1979 AC; 2016 AACS.

R 325.5262 Appendix A2. Concentrations in air and water above natural background.

Elements C.

Rule 262. (See notes in Rule 270.)

| Element (atomic number) | Radionuclide* | TABLE I | | TABLE II | | |
|----------------------------|---------------|--|--|--|--|--------------------|
| | | Column 1 Air ($\mu\text{Ci/ml}$) | Column 2 Water ($\mu\text{Ci/ml}$) | Column 1 Air ($\mu\text{Ci/ml}$) | Column 2 Water ($\mu\text{Ci/ml}$) | |
| Cadmium (48) | Cd-109 | S | 5×10^{-8} | 5×10^{-3} | 2×10^{-9} | 2×10^{-4} |
| | | I | 7×10^{-8} | 5×10^{-3} | 3×10^{-9} | 2×10^{-4} |
| | Cd-115m | S | 4×10^{-8} | 7×10^{-4} | 1×10^{-9} | 3×10^{-5} |
| | | I | 4×10^{-8} | 7×10^{-4} | 1×10^{-9} | 3×10^{-5} |
| | Cd-115 | S | 2×10^{-7} | 1×10^{-3} | 8×10^{-9} | 3×10^{-5} |
| | | I | 2×10^{-7} | 1×10^{-3} | 6×10^{-9} | 4×10^{-5} |
| Calcium (20) | Ca-45 | S | 3×10^{-8} | 3×10^{-4} | 1×10^{-9} | 9×10^{-6} |
| | | I | 1×10^{-7} | 5×10^{-3} | 4×10^{-9} | 2×10^{-4} |
| | Ca-47 | S | 2×10^{-7} | 1×10^{-3} | 6×10^{-9} | 5×10^{-5} |
| | | I | 2×10^{-7} | 1×10^{-3} | 6×10^{-9} | 3×10^{-5} |
| Californium (98) | Cf-249 | S | 2×10^{-12} | 1×10^{-4} | 5×10^{-14} | 4×10^{-6} |
| | | I | 1×10^{-10} | 7×10^{-4} | 3×10^{-12} | 2×10^{-5} |
| | Cf-250 | S | 5×10^{-12} | 4×10^{-4} | 2×10^{-13} | 1×10^{-5} |

| | | | | | | |
|---------------|--------------------|--------------------|---------------------|---------------------|---------------------|--------------------|
| | | I | 1×10^{-10} | 7×10^{-4} | 3×10^{-12} | 3×10^{-5} |
| | Cf-251 | S | 2×10^{-12} | 1×10^{-4} | 6×10^{-14} | 4×10^{-6} |
| | | I | 1×10^{-10} | 8×10^{-4} | 3×10^{-12} | 3×10^{-5} |
| | Cf-252 | S | 6×10^{-12} | 2×10^{-4} | 2×10^{-13} | 7×10^{-6} |
| | | I | 3×10^{-11} | 2×10^{-4} | 1×10^{-12} | 7×10^{-6} |
| | Cf-253 | S | 8×10^{-10} | 4×10^{-3} | 3×10^{-11} | 1×10^{-4} |
| | | I | 8×10^{-10} | 4×10^{-3} | 3×10^{-11} | 1×10^{-4} |
| | Cf-254 | S | 5×10^{-12} | 4×10^{-6} | 2×10^{-13} | 1×10^{-7} |
| | | I | 5×10^{-12} | 4×10^{-6} | 2×10^{-13} | 1×10^{-7} |
| Carbon (6) | C-14 | S | 4×10^{-6} | 2×10^{-2} | 1×10^{-7} | 8×10^{-4} |
| | (CO ₂) | Sub** | 5×10^{-5} | ----- | 1×10^{-6} | ----- |
| Cerium (58) | Ce-141 | S | 4×10^{-7} | 3×10^{-3} | 2×10^{-8} | 9×10^{-5} |
| | | I | 2×10^{-7} | 3×10^{-3} | 5×10^{-9} | 9×10^{-5} |
| | Ce-143 | S | 3×10^{-7} | 1×10^{-3} | 9×10^{-9} | 4×10^{-5} |
| | | I | 2×10^{-7} | 1×10^{-3} | 7×10^{-9} | 4×10^{-5} |
| | Ce-144 | S | 1×10^{-8} | 3×10^{-4} | 3×10^{-10} | 1×10^{-5} |
| | | I | 6×10^{-9} | 3×10^{-4} | 2×10^{-10} | 1×10^{-5} |
| Cesium (55) | Cs-131 | S | 1×10^{-5} | 7×10^{-2} | 4×10^{-7} | 2×10^{-3} |
| | | I | 3×10^{-6} | 3×10^{-2} | 1×10^{-7} | 9×10^{-4} |
| | Cs-134m | S | 4×10^{-5} | 2×10^{-1} | 1×10^{-6} | 6×10^{-3} |
| | | I | 6×10^{-6} | 3×10^{-2} | 2×10^{-7} | 1×10^{-3} |
| | Cs-134 | S | 4×10^{-8} | 3×10^{-4} | 1×10^{-9} | 9×10^{-6} |
| | | I | 1×10^{-8} | 1×10^{-3} | 4×10^{-10} | 4×10^{-5} |
| | Cs-135 | S | 5×10^{-7} | 3×10^{-3} | 2×10^{-8} | 1×10^{-4} |
| | | I | 9×10^{-8} | 7×10^{-3} | 3×10^{-9} | 2×10^{-4} |
| | Cs-136 | S | 4×10^{-7} | 2×10^{-3} | 1×10^{-8} | 9×10^{-5} |
| | | I | 2×10^{-7} | 2×10^{-3} | 6×10^{-9} | 6×10^{-5} |
| | Cs-137 | S | 6×10^{-8} | 4×10^{-4} | 2×10^{-9} | 2×10^{-5} |
| | | I | 1×10^{-8} | 1×10^{-3} | 5×10^{-10} | 4×10^{-5} |
| Chlorine (17) | Cl-36 | S | 4×10^{-7} | 2×10^{-3} | 1×10^{-8} | 8×10^{-5} |
| | | I | 2×10^{-8} | 2×10^{-3} | 8×10^{-10} | 6×10^{-5} |
| | Cl-38 | S | 3×10^{-6} | 1×10^{-2} | 9×10^{-8} | 4×10^{-4} |
| | | I | 2×10^{-6} | 1×10^{-2} | 7×10^{-8} | 4×10^{-4} |
| Chromium (24) | Cr-51 | S | 1×10^{-5} | 5×10^{-2} | 4×10^{-7} | 2×10^{-3} |
| | | I | 2×10^{-6} | 5×10^{-2} | 8×10^{-8} | 2×10^{-3} |
| Cobalt (27) | Co-57 | S | 3×10^{-6} | 2×10^{-2} | 1×10^{-7} | 5×10^{-4} |
| | | I | 2×10^{-7} | 1×10^{-2} | 6×10^{-9} | 4×10^{-4} |
| | Co-58m | S | 2×10^{-5} | 8×10^{-2} | 6×10^{-7} | 3×10^{-3} |
| | | I | 9×10^{-6} | 6×10^{-2} | 3×10^{-7} | 2×10^{-3} |
| | Co-58 | S | 8×10^{-7} | 4×10^{-3} | 3×10^{-8} | 1×10^{-4} |
| | | I | 5×10^{-8} | 3×10^{-3} | 2×10^{-9} | 9×10^{-5} |
| Co-60 | S | 3×10^{-7} | 1×10^{-3} | 1×10^{-8} | 5×10^{-5} | |
| | I | 9×10^{-9} | 1×10^{-3} | 3×10^{-10} | 3×10^{-5} | |
| Copper (29) | Cu-64 | S | 2×10^{-6} | 1×10^{-2} | 7×10^{-8} | 3×10^{-4} |
| | | I | 1×10^{-6} | 6×10^{-3} | 4×10^{-8} | 2×10^{-4} |
| Curium (96) | Cm-242 | S | 1×10^{-10} | 7×10^{-4} | 4×10^{-12} | 2×10^{-5} |
| | | I | 2×10^{-10} | 7×10^{-4} | 6×10^{-12} | 2×10^{-5} |
| | Cm-243 | S | 6×10^{-12} | 1×10^{-4} | 2×10^{-13} | 5×10^{-6} |

| | | | | | | |
|--|--------|---|---------------------|--------------------|---------------------|--------------------|
| | | I | 1×10^{-10} | 7×10^{-4} | 3×10^{-12} | 2×10^{-5} |
| | Cm-244 | S | 9×10^{-12} | 2×10^{-4} | 3×10^{-13} | 7×10^{-6} |
| | | I | 1×10^{-10} | 8×10^{-4} | 3×10^{-12} | 3×10^{-5} |
| | Cm-245 | S | 5×10^{-12} | 1×10^{-4} | 2×10^{-13} | 4×10^{-6} |
| | | I | 1×10^{-10} | 8×10^{-4} | 4×10^{-12} | 3×10^{-5} |
| | Cm-246 | S | 5×10^{-12} | 1×10^{-4} | 2×10^{-13} | 4×10^{-6} |
| | | I | 1×10^{-10} | 8×10^{-4} | 4×10^{-12} | 3×10^{-5} |
| | Cm-247 | S | 5×10^{-12} | 1×10^{-4} | 2×10^{-13} | 4×10^{-6} |
| | | I | 1×10^{-10} | 6×10^{-4} | 4×10^{-12} | 2×10^{-5} |
| | Cm-248 | S | 6×10^{-13} | 1×10^{-5} | 2×10^{-14} | 4×10^{-7} |
| | | I | 1×10^{-11} | 4×10^{-5} | 4×10^{-13} | 1×10^{-6} |
| | Cm-249 | S | 1×10^{-5} | 6×10^{-2} | 4×10^{-7} | 2×10^{-3} |
| | | I | 1×10^{-5} | 6×10^{-2} | 4×10^{-7} | 2×10^{-3} |

History: 1979 AC; 2016 AACS.

R 325.5263 Appendix A3. Concentrations in air and water above natural background. Elements D to H.

Rules 263. (See notes in Rule 270.)

| Element (atomic number) | Radionuclide* | TABLE I | | TABLE II | | |
|----------------------------|-----------------------------------|--|--|--|--|--------------------|
| | | Column 1 Air ($\mu\text{Ci/ml}$) | Column 2 Water ($\mu\text{Ci/ml}$) | Column 1 Air ($\mu\text{Ci/ml}$) | Column 2 Water ($\mu\text{Ci/ml}$) | |
| Dysprosium (66) | Dy-165 | S | 3×10^{-6} | 1×10^{-2} | 9×10^{-8} | 4×10^{-4} |
| | | I | 2×10^{-6} | 1×10^{-2} | 7×10^{-8} | 4×10^{-4} |
| | Dy-166 | S | 2×10^{-7} | 1×10^{-3} | 8×10^{-9} | 4×10^{-5} |
| | | I | 2×10^{-7} | 1×10^{-3} | 7×10^{-9} | 4×10^{-5} |
| Einsteinium (99) | Es-253 | S | 8×10^{-10} | 7×10^{-4} | 3×10^{-11} | 2×10^{-5} |
| | | I | 6×10^{-10} | 7×10^{-4} | 2×10^{-11} | 2×10^{-5} |
| | Es-254m | S | 5×10^{-9} | 5×10^{-4} | 2×10^{-10} | 2×10^{-5} |
| | | I | 6×10^{-9} | 5×10^{-4} | 2×10^{-10} | 2×10^{-5} |
| | Es-254 | S | 2×10^{-11} | 4×10^{-4} | 6×10^{-13} | 1×10^{-5} |
| | | I | 1×10^{-10} | 4×10^{-4} | 4×10^{-12} | 1×10^{-5} |
| | Es-255 | S | 5×10^{-10} | 8×10^{-4} | 2×10^{-11} | 3×10^{-5} |
| | | I | 4×10^{-10} | 8×10^{-4} | 1×10^{-11} | 3×10^{-5} |
| Erbium (68) | Er-169 | S | 6×10^{-7} | 3×10^{-3} | 2×10^{-8} | 9×10^{-5} |
| | | I | 4×10^{-7} | 3×10^{-3} | 1×10^{-8} | 9×10^{-5} |
| | Er-171 | S | 7×10^{-7} | 3×10^{-3} | 2×10^{-8} | 1×10^{-4} |
| | | I | 6×10^{-7} | 3×10^{-3} | 2×10^{-8} | 1×10^{-4} |
| Europium (63) | Eu-152 ($T_{1/2}=9.2$ hrs) | S | 4×10^{-7} | 2×10^{-3} | 1×10^{-8} | 6×10^{-5} |
| | | I | 3×10^{-7} | 2×10^{-3} | 1×10^{-8} | 6×10^{-5} |
| | Eu-152 ($T_{1/2}=13$ yrs) | S | 1×10^{-8} | 2×10^{-3} | 4×10^{-10} | 8×10^{-5} |
| | | I | 2×10^{-8} | 2×10^{-3} | 6×10^{-10} | 8×10^{-5} |

| | | | | | | | |
|-----------------|---------------|--------|--------------------|--------------------|---------------------|--------------------|--------------------|
| | Eu-154 | S | 4×10^{-9} | 6×10^{-4} | 1×10^{-10} | 2×10^{-5} | |
| | | I | 7×10^{-9} | 6×10^{-4} | 2×10^{-10} | 2×10^{-5} | |
| | Eu-155 | S | 9×10^{-8} | 6×10^{-3} | 3×10^{-9} | 2×10^{-4} | |
| | | I | 7×10^{-8} | 6×10^{-3} | 3×10^{-9} | 2×10^{-4} | |
| | Fermium (100) | Fm-254 | S | 6×10^{-8} | 4×10^{-3} | 2×10^{-9} | 1×10^{-4} |
| | | | I | 7×10^{-8} | 4×10^{-3} | 2×10^{-9} | 1×10^{-4} |
| Fm-255 | | S | 2×10^{-8} | 1×10^{-3} | 6×10^{-10} | 3×10^{-5} | |
| | | I | 1×10^{-8} | 1×10^{-3} | 4×10^{-10} | 3×10^{-5} | |
| Fm-256 | | S | 3×10^{-9} | 3×10^{-5} | 1×10^{-10} | 9×10^{-7} | |
| | | I | 2×10^{-9} | 3×10^{-5} | 6×10^{-11} | 9×10^{-7} | |
| Fluorine (9) | F-18 | S | 5×10^{-6} | 2×10^{-2} | 2×10^{-7} | 8×10^{-4} | |
| | | I | 3×10^{-6} | 1×10^{-2} | 9×10^{-8} | 5×10^{-4} | |
| Gadolinium (64) | Gd-153 | S | 2×10^{-7} | 6×10^{-3} | 8×10^{-9} | 2×10^{-4} | |
| | | I | 9×10^{-8} | 6×10^{-3} | 3×10^{-9} | 2×10^{-4} | |
| | Gd-159 | S | 5×10^{-7} | 2×10^{-3} | 2×10^{-8} | 8×10^{-5} | |
| | | I | 4×10^{-7} | 2×10^{-3} | 1×10^{-8} | 8×10^{-5} | |
| Gallium (31) | Ga-72 | S | 2×10^{-7} | 1×10^{-3} | 8×10^{-9} | 4×10^{-5} | |
| | | I | 2×10^{-7} | 1×10^{-3} | 6×10^{-9} | 4×10^{-5} | |
| Germanium (32) | Ge-71 | S | 1×10^{-5} | 5×10^{-2} | 4×10^{-7} | 2×10^{-3} | |
| | | I | 6×10^{-6} | 5×10^{-2} | 2×10^{-7} | 2×10^{-3} | |
| Gold (79) | Au-196 | S | 1×10^{-6} | 5×10^{-3} | 4×10^{-8} | 2×10^{-4} | |
| | | I | 6×10^{-7} | 4×10^{-3} | 2×10^{-8} | 1×10^{-4} | |
| | Au-198 | S | 3×10^{-7} | 2×10^{-3} | 1×10^{-8} | 5×10^{-5} | |
| | | I | 2×10^{-7} | 1×10^{-3} | 8×10^{-9} | 5×10^{-5} | |
| | Au-199 | S | 1×10^{-6} | 5×10^{-3} | 4×10^{-8} | 2×10^{-4} | |
| | | I | 8×10^{-7} | 4×10^{-3} | 3×10^{-8} | 2×10^{-4} | |
| Hafnium (72) | Hf-181 | S | 4×10^{-8} | 2×10^{-3} | 1×10^{-9} | 7×10^{-5} | |
| | | I | 7×10^{-8} | 2×10^{-3} | 3×10^{-9} | 7×10^{-5} | |
| Holmium (67) | Ho-166 | S | 2×10^{-7} | 9×10^{-4} | 7×10^{-9} | 3×10^{-5} | |
| | | I | 2×10^{-7} | 9×10^{-4} | 6×10^{-9} | 3×10^{-5} | |
| Hydrogen (1) | H-3 | S | 5×10^{-6} | 1×10^{-1} | 2×10^{-7} | 3×10^{-3} | |
| | | I | 5×10^{-6} | 1×10^{-1} | 2×10^{-7} | 3×10^{-3} | |
| | | Sub** | 2×10^{-3} | ----- | 4×10^{-5} | ----- | |

History: 1979 AC; 2016 AACS.

R 325.5264 Appendix A4. Concentrations in air and water above natural background. Elements I to L.

Rule 264. (See notes in Rule 270.)

| Element (atomic number) | Radionuclide* | TABLE I | | TABLE II | | |
|----------------------------|---------------|--|--|--|--|--------------------|
| | | Column 1 Air ($\mu\text{Ci/ml}$) | Column 2 Water ($\mu\text{Ci/ml}$) | Column 1 Air ($\mu\text{Ci/ml}$) | Column 2 Water ($\mu\text{Ci/ml}$) | |
| Indium (49) | In-113m | S | 8×10^{-6} | 4×10^{-2} | 3×10^{-7} | 1×10^{-3} |
| | | I | 7×10^{-6} | 4×10^{-2} | 2×10^{-7} | 1×10^{-3} |
| | In-114m | S | 1×10^{-7} | 5×10^{-4} | 4×10^{-9} | 2×10^{-5} |
| | | I | 2×10^{-8} | 5×10^{-4} | 7×10^{-10} | 2×10^{-5} |

| | | | | | | |
|----------------|---------|--------------------|---------------------|---------------------|---------------------|--------------------|
| | In-115m | S | 2×10^{-6} | 1×10^{-2} | 8×10^{-8} | 4×10^{-4} |
| | | I | 2×10^{-6} | 1×10^{-2} | 6×10^{-8} | 4×10^{-4} |
| | In-115 | S | 2×10^{-7} | 3×10^{-3} | 9×10^{-9} | 9×10^{-5} |
| | | I | 3×10^{-8} | 3×10^{-3} | 1×10^{-9} | 9×10^{-5} |
| Iodine (53) | I-125 | S | 5×10^{-9} | 4×10^{-5} | 8×10^{-11} | 2×10^{-7} |
| | | I | 2×10^{-7} | 6×10^{-3} | 6×10^{-9} | 2×10^{-4} |
| | I-126 | S | 8×10^{-9} | 5×10^{-5} | 9×10^{-11} | 3×10^{-7} |
| | | I | 3×10^{-7} | 3×10^{-3} | 1×10^{-8} | 9×10^{-5} |
| | I-129 | S | 2×10^{-9} | 1×10^{-5} | 2×10^{-11} | 6×10^{-8} |
| | | I | 7×10^{-8} | 6×10^{-3} | 2×10^{-9} | 2×10^{-4} |
| | I-131 | S | 9×10^{-9} | 6×10^{-5} | 1×10^{-10} | 3×10^{-7} |
| | | I | 3×10^{-7} | 2×10^{-3} | 1×10^{-8} | 6×10^{-5} |
| I-132 | S | 2×10^{-7} | 2×10^{-3} | 3×10^{-9} | 8×10^{-6} | |
| | I | 9×10^{-7} | 5×10^{-3} | 3×10^{-8} | 2×10^{-4} | |
| | I-133 | S | 3×10^{-8} | 2×10^{-4} | 4×10^{-10} | 1×10^{-6} |
| | | I | 2×10^{-7} | 1×10^{-3} | 7×10^{-9} | 4×10^{-5} |
| | I-134 | S | 5×10^{-7} | 4×10^{-3} | 6×10^{-9} | 2×10^{-5} |
| | | I | 3×10^{-6} | 2×10^{-2} | 1×10^{-7} | 6×10^{-4} |
| | I-135 | S | 1×10^{-7} | 7×10^{-4} | 1×10^{-9} | 4×10^{-6} |
| I | | 4×10^{-7} | 2×10^{-3} | 1×10^{-8} | 7×10^{-5} | |
| Iridium (77) | Ir-190 | S | 1×10^{-6} | 6×10^{-3} | 4×10^{-8} | 2×10^{-4} |
| | | I | 4×10^{-7} | 5×10^{-3} | 1×10^{-8} | 2×10^{-4} |
| | Ir-192 | S | 1×10^{-7} | 1×10^{-3} | 4×10^{-9} | 4×10^{-5} |
| | | I | 3×10^{-8} | 1×10^{-3} | 9×10^{-10} | 4×10^{-5} |
| | Ir-194 | S | 2×10^{-7} | 1×10^{-3} | 8×10^{-9} | 3×10^{-5} |
| I | | 2×10^{-7} | 9×10^{-4} | 5×10^{-9} | 3×10^{-5} | |
| Iron (26) | Fe-55 | S | 9×10^{-7} | 2×10^{-2} | 3×10^{-8} | 8×10^{-4} |
| | | I | 1×10^{-6} | 7×10^{-2} | 3×10^{-8} | 2×10^{-3} |
| | Fe-59 | S | 1×10^{-7} | 2×10^{-3} | 5×10^{-9} | 6×10^{-5} |
| | | I | 5×10^{-8} | 2×10^{-3} | 2×10^{-9} | 5×10^{-5} |
| Krypton (36) | Kr-85m | Sub** | 6×10^{-6} | ----- | 1×10^{-7} | ----- |
| | Kr-85 | Sub** | 1×10^{-5} | ----- | 3×10^{-7} | ----- |
| | Kr-87 | Sub** | 1×10^{-6} | ----- | 2×10^{-8} | ----- |
| | Kr-88 | Sub** | 1×10^{-6} | ----- | 2×10^{-8} | ----- |
| Lanthanum (57) | La-140 | S | 2×10^{-7} | 7×10^{-4} | 5×10^{-9} | 2×10^{-5} |
| | | I | 1×10^{-7} | 7×10^{-4} | 4×10^{-9} | 2×10^{-5} |
| Lead (82) | Pb-203 | S | 3×10^{-6} | 1×10^{-2} | 9×10^{-8} | 4×10^{-4} |
| | | I | 2×10^{-6} | 1×10^{-2} | 6×10^{-8} | 4×10^{-4} |
| | Pb-210 | S | 1×10^{-10} | 4×10^{-6} | 4×10^{-12} | 1×10^{-7} |
| | | I | 2×10^{-10} | 5×10^{-3} | 8×10^{-12} | 2×10^{-4} |
| | Pb-212 | S | 2×10^{-8} | 6×10^{-4} | 6×10^{-10} | 2×10^{-5} |
| I | | 2×10^{-8} | 5×10^{-4} | 7×10^{-10} | 2×10^{-5} | |
| Lutetium (71) | Lu-177 | S | 6×10^{-7} | 3×10^{-3} | 2×10^{-8} | 1×10^{-4} |
| | | I | 5×10^{-7} | 3×10^{-3} | 2×10^{-8} | 1×10^{-4} |

History: 1979 AC; 2016 AACS.

**R 325.5265 Appendix A5. Concentrations in air and water above natural background.
Elements M to O.**

Rule 265. (See notes in Rule 270.)

| Element (atomic number) | Radionuclide* | | TABLE I | | TABLE II | |
|----------------------------|---------------|---|--|--|--|--|
| | | | Column 1 Air ($\mu\text{Ci/ml}$) | Column 2 Water ($\mu\text{Ci/ml}$) | Column 1 Air ($\mu\text{Ci/ml}$) | Column 2 Water ($\mu\text{Ci/ml}$) |
| Manganese (25) | Mn-52 | S | 2×10^{-7} | 1×10^{-3} | 7×10^{-9} | 3×10^{-5} |
| | | I | 1×10^{-7} | 9×10^{-4} | 5×10^{-9} | 3×10^{-5} |
| | Mn-54 | S | 4×10^{-7} | 4×10^{-3} | 1×10^{-8} | 1×10^{-4} |
| | | I | 4×10^{-8} | 3×10^{-3} | 1×10^{-9} | 1×10^{-4} |
| | Mn-56 | S | 8×10^{-7} | 4×10^{-3} | 3×10^{-8} | 1×10^{-4} |
| | | I | 5×10^{-7} | 3×10^{-3} | 2×10^{-8} | 1×10^{-4} |
| Mercury (80) | Hg-197m | S | 7×10^{-7} | 6×10^{-3} | 3×10^{-8} | 2×10^{-4} |
| | | I | 8×10^{-7} | 5×10^{-3} | 3×10^{-8} | 2×10^{-4} |
| | Hg-197 | S | 1×10^{-6} | 9×10^{-3} | 4×10^{-8} | 3×10^{-4} |
| | | I | 3×10^{-6} | 1×10^{-2} | 9×10^{-8} | 5×10^{-4} |
| | Hg-203 | S | 7×10^{-8} | 5×10^{-4} | 2×10^{-9} | 2×10^{-5} |
| | | I | 1×10^{-7} | 3×10^{-3} | 4×10^{-9} | 1×10^{-4} |
| Molybdenum (42) | Mo-99 | S | 7×10^{-7} | 5×10^{-3} | 3×10^{-8} | 2×10^{-4} |
| | | I | 2×10^{-7} | 1×10^{-3} | 7×10^{-9} | 4×10^{-5} |
| Neodymium (60) | Nd-144 | S | 8×10^{-11} | 2×10^{-3} | 3×10^{-12} | 7×10^{-5} |
| | | I | 3×10^{-10} | 2×10^{-3} | 1×10^{-11} | 8×10^{-5} |
| | Nd-147 | S | 4×10^{-7} | 2×10^{-3} | 1×10^{-8} | 6×10^{-5} |
| | | I | 2×10^{-7} | 2×10^{-3} | 8×10^{-9} | 6×10^{-5} |
| | Nd-149 | S | 2×10^{-6} | 8×10^{-3} | 6×10^{-8} | 3×10^{-4} |
| | | I | 1×10^{-6} | 8×10^{-3} | 5×10^{-8} | 3×10^{-4} |
| Neptunium (93) | Np-237 | S | 4×10^{-12} | 9×10^{-5} | 1×10^{-13} | 3×10^{-6} |
| | | I | 1×10^{-10} | 9×10^{-4} | 4×10^{-12} | 3×10^{-5} |
| | Np-239 | S | 8×10^{-7} | 4×10^{-3} | 3×10^{-8} | 1×10^{-4} |
| | | I | 7×10^{-7} | 4×10^{-3} | 2×10^{-8} | 1×10^{-4} |
| Nickel (28) | Ni-59 | S | 5×10^{-7} | 6×10^{-3} | 2×10^{-8} | 2×10^{-4} |
| | | I | 8×10^{-7} | 6×10^{-2} | 3×10^{-8} | 2×10^{-3} |
| | Ni-63 | S | 6×10^{-8} | 8×10^{-4} | 2×10^{-9} | 3×10^{-5} |
| | | I | 3×10^{-7} | 2×10^{-2} | 1×10^{-8} | 7×10^{-4} |
| | Ni-65 | S | 9×10^{-7} | 4×10^{-3} | 3×10^{-8} | 1×10^{-4} |
| | | I | 5×10^{-7} | 3×10^{-3} | 2×10^{-8} | 1×10^{-4} |
| Niobium (41) | Nb-93m | S | 1×10^{-7} | 1×10^{-2} | 4×10^{-9} | 4×10^{-4} |
| | | I | 2×10^{-7} | 1×10^{-2} | 5×10^{-9} | 4×10^{-4} |
| | Nb-95 | S | 5×10^{-7} | 3×10^{-3} | 2×10^{-8} | 1×10^{-4} |
| | | I | 1×10^{-7} | 3×10^{-3} | 3×10^{-9} | 1×10^{-4} |
| | Nb-97 | S | 6×10^{-6} | 3×10^{-2} | 2×10^{-7} | 9×10^{-4} |
| | | I | 5×10^{-6} | 3×10^{-2} | 2×10^{-7} | 9×10^{-4} |
| Osmium (76) | Os-185 | S | 5×10^{-7} | 2×10^{-3} | 2×10^{-8} | 7×10^{-5} |
| | | I | 5×10^{-8} | 2×10^{-3} | 2×10^{-9} | 7×10^{-5} |
| | Os-191m | S | 2×10^{-5} | 7×10^{-2} | 6×10^{-7} | 3×10^{-3} |
| | | I | 9×10^{-6} | 7×10^{-2} | 3×10^{-7} | 2×10^{-3} |
| | Os-191 | S | 1×10^{-6} | 5×10^{-3} | 4×10^{-8} | 2×10^{-4} |
| | | I | 1×10^{-6} | 5×10^{-3} | 4×10^{-8} | 2×10^{-4} |

| | | | | | | |
|--|--------|---|--------------------|--------------------|--------------------|--------------------|
| | | I | 4×10^{-7} | 5×10^{-3} | 1×10^{-8} | 2×10^{-4} |
| | Os-193 | S | 4×10^{-7} | 2×10^{-3} | 1×10^{-8} | 6×10^{-5} |
| | | I | 3×10^{-7} | 2×10^{-3} | 9×10^{-9} | 5×10^{-5} |

History: 1979 AC; 2016 AACS.

R 325.5266 Appendix A6. Concentrations in air and water above natural background. Elements P.

Rule 266. (See notes in Rule 270.)

| Element (atomic number) | Radionuclide* | TABLE I | | TABLE II | | |
|----------------------------|---------------|--|--|--|--|--------------------|
| | | Column 1 Air ($\mu\text{Ci/ml}$) | Column 2 Water ($\mu\text{Ci/ml}$) | Column 1 Air ($\mu\text{Ci/ml}$) | Column 2 Water ($\mu\text{Ci/ml}$) | |
| Palladium (46) | Pd-103 | S | 1×10^{-6} | 1×10^{-2} | 5×10^{-8} | 3×10^{-4} |
| | | I | 7×10^{-7} | 8×10^{-3} | 3×10^{-8} | 3×10^{-4} |
| | Pd-109 | S | 6×10^{-7} | 3×10^{-3} | 2×10^{-8} | 9×10^{-5} |
| | | I | 4×10^{-7} | 2×10^{-3} | 1×10^{-8} | 7×10^{-5} |
| Phosphorus (15) | P-32 | S | 7×10^{-8} | 5×10^{-4} | 2×10^{-9} | 2×10^{-5} |
| | | I | 8×10^{-8} | 7×10^{-4} | 3×10^{-9} | 2×10^{-5} |
| Platinum (78) | Pt-191 | S | 8×10^{-7} | 4×10^{-3} | 3×10^{-8} | 1×10^{-4} |
| | | I | 6×10^{-7} | 3×10^{-3} | 2×10^{-8} | 1×10^{-4} |
| | Pt-193m | S | 7×10^{-6} | 3×10^{-2} | 2×10^{-7} | 1×10^{-3} |
| | | I | 5×10^{-6} | 3×10^{-2} | 2×10^{-7} | 1×10^{-3} |
| | Pt-193 | S | 1×10^{-6} | 3×10^{-2} | 4×10^{-8} | 9×10^{-4} |
| | | I | 3×10^{-7} | 5×10^{-2} | 1×10^{-8} | 2×10^{-3} |
| | Pt-197m | S | 6×10^{-6} | 3×10^{-2} | 2×10^{-7} | 1×10^{-3} |
| | | I | 5×10^{-6} | 3×10^{-2} | 2×10^{-7} | 9×10^{-4} |
| | Pt-197 | S | 8×10^{-7} | 4×10^{-3} | 3×10^{-8} | 1×10^{-4} |
| | | I | 6×10^{-7} | 3×10^{-3} | 2×10^{-8} | 1×10^{-4} |
| Plutonium (94) | Pu-238 | S | 2×10^{-12} | 1×10^{-4} | 7×10^{-14} | 5×10^{-6} |
| | | I | 3×10^{-11} | 8×10^{-4} | 1×10^{-12} | 3×10^{-5} |
| | Pu-239 | S | 2×10^{-12} | 1×10^{-4} | 6×10^{-14} | 5×10^{-6} |
| | | I | 4×10^{-11} | 8×10^{-4} | 1×10^{-12} | 3×10^{-5} |
| | Pu-240 | S | 2×10^{-12} | 1×10^{-4} | 6×10^{-14} | 5×10^{-6} |
| | | I | 4×10^{-11} | 8×10^{-4} | 1×10^{-12} | 3×10^{-5} |
| | Pu-241 | S | 9×10^{-11} | 7×10^{-3} | 3×10^{-12} | 2×10^{-4} |
| | | I | 4×10^{-8} | 4×10^{-2} | 1×10^{-9} | 1×10^{-3} |
| | Pu-242 | S | 2×10^{-12} | 1×10^{-4} | 6×10^{-14} | 5×10^{-6} |
| | | I | 4×10^{-11} | 9×10^{-4} | 1×10^{-12} | 3×10^{-5} |
| | Pu-243 | S | 2×10^{-6} | 1×10^{-2} | 6×10^{-8} | 3×10^{-4} |
| | | I | 2×10^{-6} | 1×10^{-2} | 8×10^{-8} | 3×10^{-4} |
| | Pu-244 | S | 2×10^{-12} | 1×10^{-4} | 6×10^{-14} | 4×10^{-6} |
| | | I | 3×10^{-11} | 3×10^{-4} | 1×10^{-12} | 1×10^{-5} |
| Polonium (84) | Po-210 | S | 5×10^{-10} | 2×10^{-5} | 2×10^{-11} | 7×10^{-7} |
| | | I | 2×10^{-10} | 8×10^{-4} | 7×10^{-12} | 3×10^{-5} |
| Potassium (19) | K-42 | S | 2×10^{-6} | 9×10^{-3} | 7×10^{-8} | 3×10^{-4} |
| | | I | 1×10^{-7} | 6×10^{-4} | 4×10^{-9} | 2×10^{-5} |
| Praseodymium (59) | Pr-142 | S | 2×10^{-7} | 9×10^{-4} | 7×10^{-9} | 3×10^{-5} |

| | | | | | | |
|-------------------|--------|---|---------------------|--------------------|---------------------|--------------------|
| Promethium (61) | Pr-143 | I | 2×10^{-7} | 9×10^{-4} | 5×10^{-9} | 3×10^{-5} |
| | | S | 3×10^{-7} | 1×10^{-3} | 1×10^{-8} | 5×10^{-5} |
| | Pm-147 | I | 2×10^{-7} | 1×10^{-3} | 6×10^{-9} | 5×10^{-5} |
| | | S | 6×10^{-8} | 6×10^{-3} | 2×10^{-9} | 2×10^{-4} |
| | Pm-149 | S | 3×10^{-7} | 1×10^{-3} | 1×10^{-8} | 4×10^{-5} |
| | | I | 2×10^{-7} | 1×10^{-3} | 8×10^{-9} | 4×10^{-5} |
| Protactinium (91) | Pa-230 | S | 2×10^{-9} | 7×10^{-3} | 6×10^{-11} | 2×10^{-4} |
| | | I | 8×10^{-10} | 7×10^{-3} | 3×10^{-11} | 2×10^{-4} |
| | Pa-231 | S | 1×10^{-12} | 3×10^{-5} | 4×10^{-14} | 9×10^{-7} |
| | | I | 1×10^{-10} | 8×10^{-4} | 4×10^{-12} | 2×10^{-5} |
| | Pa-233 | S | 6×10^{-7} | 4×10^{-3} | 2×10^{-8} | 1×10^{-4} |
| | | I | 2×10^{-7} | 3×10^{-3} | 6×10^{-9} | 1×10^{-4} |

History: 1979 AC; 2016 AACS.

R 325.5267 Appendix A7. Concentrations in air and water above natural background.

Elements R and S.

Rule 267. (See notes in Rule 270.)

| Element (atomic number) | Radionuclide* | | TABLE I | | TABLE II | |
|----------------------------|---------------|---|--|--|--|--|
| | | | Column 1 Air ($\mu\text{Ci/ml}$) | Column 2 Water ($\mu\text{Ci/ml}$) | Column 1 Air ($\mu\text{Ci/ml}$) | Column 2 Water ($\mu\text{Ci/ml}$) |
| Radium (88) | Ra-223 | S | 2×10^{-9} | 2×10^{-5} | 6×10^{-11} | 7×10^{-7} |
| | | I | 2×10^{-10} | 1×10^{-4} | 8×10^{-12} | 4×10^{-6} |
| | Ra-224 | S | 5×10^{-9} | 7×10^{-5} | 2×10^{-10} | 2×10^{-6} |
| | | I | 7×10^{-10} | 2×10^{-4} | 2×10^{-11} | 5×10^{-6} |
| | Ra-226 | S | 3×10^{-11} | 4×10^{-7} | 3×10^{-12} | 3×10^{-8} |
| | | I | 5×10^{-11} | 9×10^{-4} | 2×10^{-12} | 3×10^{-5} |
| | Ra-228 | S | 7×10^{-11} | 8×10^{-7} | 2×10^{-12} | 3×10^{-8} |
| | | I | 4×10^{-11} | 7×10^{-4} | 1×10^{-12} | 3×10^{-5} |
| Radon (86) | Rn-220 | S | 3×10^{-7} | ----- | 1×10^{-8} | ----- |
| | | I | ----- | ----- | ----- | ----- |
| | Rn-222*** | S | 1×10^{-7} | ----- | 3×10^{-9} | ----- |
| Rhenium (75) | Re-183 | S | 3×10^{-6} | 2×10^{-2} | 9×10^{-8} | 6×10^{-4} |
| | | I | 2×10^{-7} | 8×10^{-3} | 5×10^{-9} | 3×10^{-4} |
| | Re-186 | S | 6×10^{-7} | 3×10^{-3} | 2×10^{-8} | 9×10^{-5} |
| | | I | 2×10^{-7} | 1×10^{-3} | 8×10^{-9} | 5×10^{-5} |
| | Re-187 | S | 9×10^{-6} | 7×10^{-2} | 3×10^{-7} | 3×10^{-3} |
| | | I | 5×10^{-7} | 4×10^{-2} | 2×10^{-8} | 2×10^{-3} |
| | Re-188 | S | 4×10^{-7} | 2×10^{-3} | 1×10^{-8} | 6×10^{-5} |
| | | I | 2×10^{-7} | 9×10^{-4} | 6×10^{-9} | 3×10^{-5} |
| Rhodium (45) | Rh-103m | S | 8×10^{-5} | 4×10^{-1} | 3×10^{-6} | 1×10^{-2} |
| | | I | 6×10^{-5} | 3×10^{-1} | 2×10^{-6} | 1×10^{-2} |
| | Rh-105 | S | 8×10^{-7} | 4×10^{-3} | 3×10^{-8} | 1×10^{-4} |
| | | I | 5×10^{-7} | 3×10^{-3} | 2×10^{-8} | 1×10^{-4} |
| Rubidium (37) | Rb-86 | S | 3×10^{-7} | 2×10^{-3} | 1×10^{-8} | 7×10^{-5} |

| | | | | | | |
|----------------|---------|--------------------|---------------------|--------------------|---------------------|--------------------|
| | | I | 7×10^{-8} | 7×10^{-4} | 2×10^{-9} | 2×10^{-5} |
| | Rb-87 | S | 5×10^{-7} | 3×10^{-3} | 2×10^{-8} | 1×10^{-4} |
| | | I | 7×10^{-8} | 5×10^{-3} | 2×10^{-9} | 2×10^{-4} |
| Ruthenium (44) | Ru-97 | S | 2×10^{-6} | 1×10^{-2} | 8×10^{-8} | 4×10^{-4} |
| | | I | 2×10^{-6} | 1×10^{-2} | 6×10^{-8} | 3×10^{-4} |
| | Ru-103 | S | 5×10^{-7} | 2×10^{-3} | 2×10^{-8} | 8×10^{-5} |
| | | I | 8×10^{-8} | 2×10^{-3} | 3×10^{-9} | 8×10^{-5} |
| | Ru-105 | S | 7×10^{-7} | 3×10^{-3} | 2×10^{-8} | 1×10^{-4} |
| | | I | 5×10^{-7} | 3×10^{-3} | 2×10^{-8} | 1×10^{-4} |
| | Ru-106 | S | 8×10^{-8} | 4×10^{-4} | 3×10^{-9} | 1×10^{-5} |
| | | I | 6×10^{-9} | 3×10^{-4} | 2×10^{-10} | 1×10^{-5} |
| Samarium (62) | Sm-147 | S | 7×10^{-11} | 2×10^{-3} | 2×10^{-12} | 6×10^{-5} |
| | | I | 3×10^{-10} | 2×10^{-3} | 9×10^{-12} | 7×10^{-5} |
| | Sm-151 | S | 6×10^{-8} | 1×10^{-2} | 2×10^{-9} | 4×10^{-4} |
| | | I | 1×10^{-7} | 1×10^{-2} | 5×10^{-9} | 4×10^{-4} |
| Sm-153 | S | 5×10^{-7} | 2×10^{-3} | 2×10^{-8} | 8×10^{-5} | |
| | I | 4×10^{-7} | 2×10^{-3} | 1×10^{-8} | 8×10^{-5} | |
| Scandium (21) | Sc-46 | S | 2×10^{-7} | 1×10^{-3} | 8×10^{-9} | 4×10^{-5} |
| | | I | 2×10^{-8} | 1×10^{-3} | 8×10^{-10} | 4×10^{-5} |
| | Sc-47 | S | 6×10^{-7} | 3×10^{-3} | 2×10^{-8} | 9×10^{-5} |
| | | I | 5×10^{-7} | 3×10^{-3} | 2×10^{-8} | 9×10^{-5} |
| | Sc-48 | S | 2×10^{-7} | 8×10^{-4} | 6×10^{-9} | 3×10^{-5} |
| | | I | 1×10^{-7} | 8×10^{-4} | 5×10^{-9} | 3×10^{-5} |
| Selenium (34) | Se-75 | S | 1×10^{-6} | 9×10^{-3} | 4×10^{-8} | 3×10^{-4} |
| | | I | 1×10^{-7} | 8×10^{-3} | 4×10^{-9} | 3×10^{-4} |
| Silicon (14) | Si-31 | S | 6×10^{-6} | 3×10^{-2} | 2×10^{-7} | 9×10^{-4} |
| | | I | 1×10^{-6} | 6×10^{-3} | 3×10^{-8} | 2×10^{-4} |
| Silver (47) | Ag-105 | S | 6×10^{-7} | 3×10^{-3} | 2×10^{-8} | 1×10^{-4} |
| | | I | 8×10^{-8} | 3×10^{-3} | 3×10^{-9} | 1×10^{-4} |
| | Ag-110m | S | 2×10^{-7} | 9×10^{-4} | 7×10^{-9} | 3×10^{-5} |
| | | I | 1×10^{-8} | 9×10^{-4} | 3×10^{-10} | 3×10^{-5} |
| | Ag-111 | S | 3×10^{-7} | 1×10^{-3} | 1×10^{-8} | 4×10^{-5} |
| | | I | 2×10^{-7} | 1×10^{-3} | 8×10^{-9} | 4×10^{-5} |
| Sodium (11) | Na-22 | S | 2×10^{-7} | 1×10^{-3} | 6×10^{-9} | 4×10^{-5} |
| | | I | 9×10^{-9} | 9×10^{-4} | 3×10^{-10} | 3×10^{-5} |
| | Na-24 | S | 1×10^{-6} | 6×10^{-3} | 4×10^{-8} | 2×10^{-4} |
| | | I | 1×10^{-7} | 8×10^{-4} | 5×10^{-9} | 3×10^{-5} |
| Strontium (38) | Sr-85m | S | 4×10^{-5} | 2×10^{-1} | 1×10^{-6} | 7×10^{-3} |
| | | I | 3×10^{-5} | 2×10^{-1} | 1×10^{-6} | 7×10^{-3} |
| | Sr-85 | S | 2×10^{-7} | 3×10^{-3} | 8×10^{-9} | 1×10^{-4} |
| | | I | 1×10^{-7} | 5×10^{-3} | 4×10^{-9} | 2×10^{-4} |
| | Sr-89 | S | 3×10^{-8} | 3×10^{-4} | 3×10^{-10} | 3×10^{-6} |
| | | I | 4×10^{-8} | 8×10^{-4} | 1×10^{-9} | 3×10^{-5} |
| | Sr-90 | S | 1×10^{-9} | 1×10^{-5} | 3×10^{-11} | 3×10^{-7} |
| | | I | 5×10^{-9} | 1×10^{-3} | 2×10^{-10} | 4×10^{-5} |
| | Sr-91 | S | 4×10^{-7} | 2×10^{-3} | 2×10^{-8} | 7×10^{-5} |
| | | I | 3×10^{-7} | 1×10^{-3} | 9×10^{-9} | 5×10^{-5} |

| | | | | | | |
|-------------|-------|---|--------------------|--------------------|--------------------|--------------------|
| | Sr-92 | S | 4×10^{-7} | 2×10^{-3} | 2×10^{-8} | 7×10^{-5} |
| | | I | 3×10^{-7} | 2×10^{-3} | 1×10^{-8} | 6×10^{-5} |
| Sulfur (16) | S-35 | S | 3×10^{-7} | 2×10^{-3} | 9×10^{-9} | 6×10^{-5} |
| | | I | 3×10^{-7} | 8×10^{-3} | 9×10^{-9} | 3×10^{-4} |

History: 1979 AC; 2016 AACS.

R 325.5268 Appendix A8. Concentrations in air and water above natural background. Elements T.

Rule 268. (See notes in Rule 270.)

| Element (atomic number) | Radionuclide* | TABLE I | | TABLE II | | |
|----------------------------|---------------|--|--|--|--|--------------------|
| | | Column 1 Air ($\mu\text{Ci/ml}$) | Column 2 Water ($\mu\text{Ci/ml}$) | Column 1 Air ($\mu\text{Ci/ml}$) | Column 2 Water ($\mu\text{Ci/ml}$) | |
| Tantalum (73) | Ta-182 | S | 4×10^{-8} | 1×10^{-3} | 1×10^{-9} | 4×10^{-5} |
| | | I | 2×10^{-8} | 1×10^{-3} | 7×10^{-10} | 4×10^{-5} |
| Technetium (43) | Tc-96m | S | 8×10^{-5} | 4×10^{-1} | 3×10^{-6} | 1×10^{-2} |
| | | I | 3×10^{-5} | 3×10^{-1} | 1×10^{-6} | 1×10^{-2} |
| | Tc-96 | S | 6×10^{-7} | 3×10^{-3} | 2×10^{-8} | 1×10^{-4} |
| | | I | 2×10^{-7} | 1×10^{-3} | 8×10^{-9} | 5×10^{-5} |
| | Tc-97m | S | 2×10^{-6} | 1×10^{-2} | 8×10^{-8} | 4×10^{-4} |
| | | I | 2×10^{-7} | 5×10^{-3} | 5×10^{-9} | 2×10^{-4} |
| | Tc-97 | S | 1×10^{-5} | 5×10^{-2} | 4×10^{-7} | 2×10^{-3} |
| | | I | 3×10^{-7} | 2×10^{-2} | 1×10^{-8} | 8×10^{-4} |
| | Tc-99m | S | 4×10^{-5} | 2×10^{-1} | 1×10^{-6} | 6×10^{-3} |
| | | I | 1×10^{-5} | 8×10^{-2} | 5×10^{-7} | 3×10^{-3} |
| Tc-99 | S | 2×10^{-6} | 1×10^{-2} | 7×10^{-8} | 3×10^{-4} | |
| | I | 6×10^{-8} | 5×10^{-3} | 2×10^{-9} | 2×10^{-4} | |
| Tellurium (52) | Te-125m | S | 4×10^{-7} | 5×10^{-3} | 1×10^{-8} | 2×10^{-4} |
| | | I | 1×10^{-7} | 3×10^{-3} | 4×10^{-9} | 1×10^{-4} |
| | Te-127m | S | 1×10^{-7} | 2×10^{-3} | 5×10^{-9} | 6×10^{-5} |
| | | I | 4×10^{-8} | 2×10^{-3} | 1×10^{-9} | 5×10^{-5} |
| | Te-127 | S | 2×10^{-6} | 8×10^{-3} | 6×10^{-8} | 3×10^{-4} |
| | | I | 9×10^{-7} | 5×10^{-3} | 3×10^{-8} | 2×10^{-4} |
| | Te-129m | S | 8×10^{-8} | 1×10^{-3} | 3×10^{-9} | 3×10^{-5} |
| | | I | 3×10^{-8} | 6×10^{-4} | 1×10^{-9} | 2×10^{-5} |
| | Te-129 | S | 5×10^{-6} | 2×10^{-2} | 2×10^{-7} | 8×10^{-4} |
| | | I | 4×10^{-6} | 2×10^{-2} | 1×10^{-7} | 8×10^{-4} |
| | Te-131m | S | 4×10^{-7} | 2×10^{-3} | 1×10^{-8} | 6×10^{-5} |
| | | I | 2×10^{-7} | 1×10^{-3} | 6×10^{-9} | 4×10^{-5} |
| | Te-132 | S | 2×10^{-7} | 9×10^{-4} | 7×10^{-9} | 3×10^{-5} |
| | | I | 1×10^{-7} | 6×10^{-4} | 4×10^{-9} | 2×10^{-5} |
| Terbium (65) | Tb-160 | S | 1×10^{-7} | 1×10^{-3} | 3×10^{-9} | 4×10^{-5} |
| | | I | 3×10^{-8} | 1×10^{-3} | 1×10^{-9} | 4×10^{-5} |
| Thallium (81) | Tl-200 | S | 3×10^{-6} | 1×10^{-2} | 9×10^{-8} | 4×10^{-4} |
| | | I | 1×10^{-6} | 7×10^{-3} | 4×10^{-8} | 2×10^{-4} |
| | Tl-201 | S | 2×10^{-6} | 9×10^{-3} | 7×10^{-8} | 3×10^{-4} |

| | | | | | | |
|---------------|------------|---|---------------------|--------------------|---------------------|--------------------|
| | | I | 9×10^{-7} | 5×10^{-3} | 3×10^{-8} | 2×10^{-4} |
| | Tl-202 | S | 8×10^{-7} | 4×10^{-3} | 3×10^{-8} | 1×10^{-4} |
| | | I | 2×10^{-7} | 2×10^{-3} | 8×10^{-9} | 7×10^{-5} |
| | Tl-204 | S | 6×10^{-7} | 3×10^{-3} | 2×10^{-8} | 1×10^{-4} |
| | | I | 3×10^{-8} | 2×10^{-3} | 9×10^{-10} | 6×10^{-5} |
| Thorium (90) | Th-227 | S | 3×10^{-10} | 5×10^{-4} | 1×10^{-11} | 2×10^{-5} |
| | | I | 2×10^{-10} | 5×10^{-4} | 6×10^{-12} | 2×10^{-5} |
| | Th-228 | S | 9×10^{-12} | 2×10^{-4} | 3×10^{-13} | 7×10^{-6} |
| | | I | 6×10^{-12} | 4×10^{-4} | 2×10^{-13} | 1×10^{-5} |
| | Th-230 | S | 2×10^{-12} | 5×10^{-5} | 8×10^{-14} | 2×10^{-6} |
| | | I | 1×10^{-11} | 9×10^{-4} | 3×10^{-13} | 3×10^{-5} |
| | Th-231 | S | 1×10^{-6} | 7×10^{-3} | 5×10^{-8} | 2×10^{-4} |
| | | I | 1×10^{-6} | 7×10^{-3} | 4×10^{-8} | 2×10^{-4} |
| | Th-232 | S | 3×10^{-11} | 5×10^{-5} | 1×10^{-12} | 2×10^{-6} |
| | | I | 3×10^{-11} | 1×10^{-3} | 1×10^{-12} | 4×10^{-5} |
| | Th-natural | S | 6×10^{-11} | 6×10^{-5} | 2×10^{-12} | 2×10^{-6} |
| | | I | 6×10^{-11} | 6×10^{-4} | 2×10^{-12} | 2×10^{-5} |
| | Th-234 | S | 6×10^{-8} | 5×10^{-4} | 2×10^{-9} | 2×10^{-5} |
| | | I | 3×10^{-8} | 5×10^{-4} | 1×10^{-9} | 2×10^{-5} |
| Thulium (69) | Tm-170 | S | 4×10^{-8} | 1×10^{-3} | 1×10^{-9} | 5×10^{-5} |
| | | I | 3×10^{-8} | 1×10^{-3} | 1×10^{-9} | 5×10^{-5} |
| | Tm-171 | S | 1×10^{-7} | 1×10^{-2} | 4×10^{-9} | 5×10^{-4} |
| | | I | 2×10^{-7} | 1×10^{-2} | 8×10^{-9} | 5×10^{-4} |
| Tin (50) | Sn-113 | S | 4×10^{-7} | 2×10^{-3} | 1×10^{-8} | 9×10^{-5} |
| | | I | 5×10^{-8} | 2×10^{-3} | 2×10^{-9} | 8×10^{-5} |
| | Sn-125 | S | 1×10^{-7} | 5×10^{-4} | 4×10^{-9} | 2×10^{-5} |
| | | I | 8×10^{-8} | 5×10^{-4} | 3×10^{-9} | 2×10^{-5} |
| Tungsten (74) | W-181 | S | 2×10^{-6} | 1×10^{-2} | 8×10^{-8} | 4×10^{-4} |
| | | I | 1×10^{-7} | 1×10^{-2} | 4×10^{-9} | 3×10^{-4} |
| | W-185 | S | 8×10^{-7} | 4×10^{-3} | 3×10^{-8} | 1×10^{-4} |
| | | I | 1×10^{-7} | 3×10^{-3} | 4×10^{-9} | 1×10^{-4} |
| | W-187 | S | 4×10^{-7} | 2×10^{-3} | 2×10^{-8} | 7×10^{-5} |
| | | I | 3×10^{-7} | 2×10^{-3} | 1×10^{-8} | 6×10^{-5} |

History: 1979 AC; 2016 AACS.

R 325.5269 Appendix A9. Concentrations in air and water above natural background. Elements U to Z and certain unlisted radionuclides.

Rule 269. (See notes in Rule 270.)

| Element (atomic number) | Radionuclide* | TABLE I | | TABLE II | | |
|----------------------------|---------------|--|--|--|--|--------------------|
| | | Column 1 Air ($\mu\text{Ci/ml}$) | Column 2 Water ($\mu\text{Ci/ml}$) | Column 1 Air ($\mu\text{Ci/ml}$) | Column 2 Water ($\mu\text{Ci/ml}$) | |
| Uranium (92) | U-230 | S | 3×10^{-10} | 1×10^{-4} | 1×10^{-11} | 5×10^{-6} |
| | | I | 1×10^{-10} | 1×10^{-4} | 4×10^{-12} | 5×10^{-6} |
| | U-232 | S | 1×10^{-10} | 8×10^{-4} | 3×10^{-12} | 3×10^{-5} |
| | | I | 3×10^{-11} | 8×10^{-4} | 9×10^{-13} | 3×10^{-5} |
| | U-233 | S | 5×10^{-10} | 9×10^{-4} | 2×10^{-11} | 3×10^{-5} |

| | | | | | | |
|--|---------------|-------|---------------------|--------------------|---------------------|--------------------|
| | | I | 1×10^{-10} | 9×10^{-4} | 4×10^{-12} | 3×10^{-5} |
| | U-234**** | S | 6×10^{-10} | 9×10^{-4} | 2×10^{-11} | 3×10^{-5} |
| | | I | 1×10^{-10} | 9×10^{-4} | 4×10^{-12} | 3×10^{-5} |
| | U-235**** | S | 5×10^{-10} | 8×10^{-4} | 2×10^{-11} | 3×10^{-5} |
| | | I | 1×10^{-10} | 8×10^{-4} | 4×10^{-12} | 3×10^{-5} |
| | U-236 | S | 6×10^{-10} | 1×10^{-3} | 2×10^{-11} | 3×10^{-5} |
| | | I | 1×10^{-10} | 1×10^{-3} | 4×10^{-12} | 3×10^{-5} |
| | U-238**** | S | 7×10^{-11} | 1×10^{-3} | 3×10^{-12} | 4×10^{-5} |
| | | I | 1×10^{-10} | 1×10^{-3} | 5×10^{-12} | 4×10^{-5} |
| | U-240 | S | 2×10^{-7} | 1×10^{-3} | 8×10^{-9} | 3×10^{-5} |
| | | I | 2×10^{-7} | 1×10^{-3} | 6×10^{-9} | 3×10^{-5} |
| | U-natural**** | S | 1×10^{-10} | 1×10^{-3} | 5×10^{-12} | 3×10^{-5} |
| | | I | 1×10^{-10} | 1×10^{-3} | 5×10^{-12} | 3×10^{-5} |
| Vanadium (23) | V-48 | S | 2×10^{-7} | 9×10^{-4} | 6×10^{-9} | 3×10^{-5} |
| | | I | 6×10^{-8} | 8×10^{-4} | 2×10^{-9} | 3×10^{-5} |
| Xenon (54) | Xe-131m | Sub** | 2×10^{-5} | ----- | 4×10^{-7} | ----- |
| | Xe-133m | Sub | 1×10^{-5} | ----- | 3×10^{-7} | ----- |
| | Xe-133 | Sub | 1×10^{-5} | ----- | 3×10^{-7} | ----- |
| | Xe-135 | Sub | 4×10^{-6} | ----- | 1×10^{-7} | ----- |
| Ytterbium (70) | Yb-175 | S | 7×10^{-7} | 3×10^{-3} | 2×10^{-8} | 1×10^{-4} |
| | | I | 6×10^{-7} | 3×10^{-3} | 2×10^{-8} | 1×10^{-4} |
| Yttrium (39) | Y-90 | S | 1×10^{-7} | 6×10^{-4} | 4×10^{-9} | 2×10^{-5} |
| | | I | 1×10^{-7} | 6×10^{-4} | 3×10^{-9} | 2×10^{-5} |
| | Y-91m | S | 2×10^{-5} | 1×10^{-1} | 8×10^{-7} | 3×10^{-3} |
| | | I | 2×10^{-5} | 1×10^{-1} | 6×10^{-7} | 3×10^{-3} |
| | Y-91 | S | 4×10^{-8} | 8×10^{-4} | 1×10^{-9} | 3×10^{-5} |
| | | I | 3×10^{-8} | 8×10^{-4} | 1×10^{-9} | 3×10^{-5} |
| | Y-92 | S | 4×10^{-7} | 2×10^{-3} | 1×10^{-8} | 6×10^{-5} |
| | | I | 3×10^{-7} | 2×10^{-3} | 1×10^{-8} | 6×10^{-5} |
| | Y-93 | S | 2×10^{-7} | 8×10^{-4} | 6×10^{-9} | 3×10^{-5} |
| | | I | 1×10^{-7} | 8×10^{-4} | 5×10^{-9} | 3×10^{-5} |
| Zinc (30) | Zn-65 | S | 1×10^{-7} | 3×10^{-3} | 4×10^{-9} | 1×10^{-4} |
| | | I | 6×10^{-8} | 5×10^{-3} | 2×10^{-9} | 2×10^{-4} |
| | Zn-69m | S | 4×10^{-7} | 2×10^{-3} | 1×10^{-8} | 7×10^{-5} |
| | | I | 3×10^{-7} | 2×10^{-3} | 1×10^{-8} | 6×10^{-5} |
| | Zn-69 | S | 7×10^{-6} | 5×10^{-2} | 2×10^{-7} | 2×10^{-3} |
| | | I | 9×10^{-6} | 5×10^{-2} | 3×10^{-7} | 2×10^{-3} |
| Zirconium (40) | Zr-93 | S | 1×10^{-7} | 2×10^{-2} | 4×10^{-9} | 8×10^{-4} |
| | | I | 3×10^{-7} | 2×10^{-2} | 1×10^{-8} | 8×10^{-4} |
| | Zr-95 | S | 1×10^{-7} | 2×10^{-3} | 4×10^{-9} | 6×10^{-5} |
| | | I | 3×10^{-8} | 2×10^{-3} | 1×10^{-9} | 6×10^{-5} |
| | Zr-97 | S | 1×10^{-7} | 5×10^{-4} | 4×10^{-9} | 2×10^{-5} |
| | | I | 9×10^{-8} | 5×10^{-4} | 3×10^{-9} | 2×10^{-5} |
| Any single radionuclide not listed in Appendix A1 to A9 with decay mode other than alpha emission or spontaneous fission and with radioactive half-life less than 2 hours. Sub | | | 1×10^{-6} | ----- | 3×10^{-8} | ----- |

| | | | | |
|---|---------------------|--------------------|---------------------|--------------------|
| Any single radionuclide not listed in Appendix A1 to A9 with decay mode other than alpha emission or spontaneous fission and with radioactive half-life greater than 2 hours. | 3×10^{-9} | 9×10^{-5} | 1×10^{-10} | 3×10^{-6} |
| Any single radionuclide not listed in Appendix A1 to A9 which decays by alpha emission or spontaneous fission. | 6×10^{-13} | 4×10^{-7} | 2×10^{-14} | 3×10^{-8} |

History: 1979 AC; 2016 AACs.

R 325.5270 Notes to Appendices A1 to A9.

Rule 270.

*Soluble (S): Insoluble (I).

**"Sub" means that values given are for submersion in a semi-spherical infinite cloud of airborne material.

***For purposes of these rules, it may be assumed that the daughter activity concentrations in the following table are equivalent to an air concentration of 10^{-7} microcuries of radon-222 per milliliter of air in equilibrium with the daughters polonium-218, lead-214, bismuth-214, and polonium-214:

| Maximum Time Between Collection and Measurement (hours)*† | Alpha-Emitting Daughter Activity Collected per Milliliter of Air | |
|---|--|---|
| | Microcuries per milliliter | Total Alpha Disintegrations per minute per milliliter |
| 0.5 | 7.2×10^{-8} | 0.16 |
| 1.0 | 4.5×10^{-8} | 0.10 |
| 2.0 | 1.3×10^{-8} | 0.028 |
| 3.0 | 0.3×10^{-8} | 0.0072 |

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

****For soluble mixtures of U-238, U-234, and U-235 in air, chemical toxicity may be the limiting factor. If the percent by weight (enrichment) of U-235 is less than 5, the concentration value for a 40-hour workweek, table I, is 0.2 milligrams uranium per cubic meter of air average. For any enrichment, the product of the average concentration and time of exposure during a 40-hour workweek shall not exceed 8×10^{-3} SA $\mu\text{Ci-hr/ml}$, where SA is the specific activity of the uranium inhaled. The concentration value for table II is 0.007 milligrams uranium per cubic meter of air. The specific activity for natural uranium is 6.77×10^{-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 = 3.6×10^{-7} curies/gram U U-depleted

SA = $(0.4 + 0.38 E + 0.0034 E^2) 10^{-6} E \geq 0.72$ where E is the percentage by weight of U-235, expressed as percent.

NOTE: In any case where there is a mixture in air or water of more than 1 radionuclide, the limiting values for purposes of this appendix should be determined as follows:

1. If the identity and concentration of each radionuclide in the mixture are known, the limiting values should be derived as follows: Determine, for each radionuclide in the mixture, the ratio between the quantity present in the mixture and the limit otherwise established in Appendix "A" for the specific radionuclide when not in a mixture. The sum of such ratios for all 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 Maximum Permissible Concentrations (MPC's) are MPC_a , MPC_b , and MPC_c respectively, then the concentrations shall be limited so that the following relationship exists:

$$\frac{C_a}{MPC_a} + \frac{C_b}{MPC_b} + \frac{C_c}{MPC_c} \leq 1$$

2. If either the identity or the concentration of any radionuclide in the mixture is not known, the limiting values for purposes of Appendix "A" shall be:

- a. For purposes of Table I, Column 1 6×10^{-13}
- b. For purposes of Table I, Column 2 4×10^{-7}
- c. For purposes of Table II, Column 1 2×10^{-14}
- d. For purposes of Table II, Column 2 3×10^{-8}

3. If any of the conditions specified hereinafter are met, the corresponding values specified there may be used in lieu of those specified in Paragraph 2 above.

a. If the identity of each radionuclide in the mixture is known but the concentration of one or more of the radionuclides in the mixture is not known, the concentration limit for the mixture is the limit specified in Appendix "A" for the radionuclide in the mixture having the lowest concentration limit; or,

b. If the identity of each radionuclide in the mixture is not known, but it is known that certain radionuclides specified in Appendix "A" are not present in the mixture, the concentration limit for the mixture is the lowest concentration limit specified in Appendix "A" for any radionuclide that is not known to be absent from the mixture; or

| c. Element (atomic number) and radionuclide | TABLE I | | TABLE II | |
|---|--|--|--|--|
| | Column 1 Air ($\mu\text{Ci/ml}$) | Column 2 Water ($\mu\text{Ci/ml}$) | Column 1 Air ($\mu\text{Ci/ml}$) | Column 2 Water ($\mu\text{Ci/ml}$) |
| If it is known that Sr-90, I-125, I-126, I-129, I-131, (I-133, Table II only), Pb-210, Po-210, At-211, Ra-223, Ra-224, Ra-226, Ac-227, Ra-228, Th-230, Pa-231, Th-232, Th-nat, Cm-248, Cf-254, and Fm-256 are not present | ----- | 9×10^{-5} | ----- | 3×10^{-6} |
| If it is known that Sr-90, I-125, I-126, I-129, I-131, (I-133, Table II only), Pb-210, Po-210, Ra-223, Ra-226, Ra-228, Pa-231, Th-nat, Cm-248, Cf-254, and Fm-256 are not present | ----- | 6×10^{-5} | ----- | 2×10^{-6} |
| If it is known that Sr-90, I-129, (I-125, I-126, I-131, Table II only), Pb-210, Ra-226, Ra-228, Cm-248, and Cf-254 are not present | ----- | 2×10^{-5} | ----- | 6×10^{-7} |
| If it is known that (I-129, Table II only), Ra-226, and Ra-228 are not present | ----- | 3×10^{-6} | ----- | 1×10^{-7} |
| If it is known that alpha-emitters and Sr-90, I-129, Pb-210, Ac-227, Ra-228, Pa-230, Pu-241, and Bk-249 are not present | 3×10^{-9} | ----- | 1×10^{-10} | ----- |
| If it is known that alpha-emitters and Pb-210, Ac-227, Ra-228, and Pu-241 are not present | 3×10^{-10} | ----- | 1×10^{-11} | ----- |
| If it is known that alpha-emitters and Ac-227 are not present | 3×10^{-11} | ----- | 1×10^{-12} | ----- |
| If it is known that Ac-227, Th-230, Pa-231, Pu-238, Pu-239, Pu-240, Pu-242, Pu-244, Cm-248, Cf-249 and Cf-251 are not present | 3×10^{-12} | ----- | 1×10^{-13} | ----- |

4. If the mixture of radionuclides consists of uranium and its daughter products in ore dust before chemical processing of the uranium ore, the values specified below may be used in lieu of those determined in accordance with Paragraph 1 above or those specified in Paragraphs 2 and 3.

a. For purposes of Table I, Column 1, 1×10^{-10} $\mu\text{Ci/ml}$ gross alpha activity; or 5×10^{-11} $\mu\text{Ci/ml}$ natural uranium; or 75 micrograms per cubic meter of air natural uranium.

b. For purposes of Table II, Column 1, 3×10^{-12} $\mu\text{Ci/ml}$ gross alpha activity; or 2×10^{-12} $\mu\text{Ci/ml}$ natural uranium; or 3 micrograms per cubic meter of air natural uranium.

5. For purposes of this note, a radionuclide may be considered as not present in a mixture if (a) the ratio of the concentration of that radionuclide in the mixture (C_a) to the concentration limit for that radionuclide specified in table II of Appendix “A” (MPC_a) does not exceed 1/10,

$$\left(\text{i.e., } \frac{C_a}{MPC_a} \leq \frac{1}{10} \right)$$

and (b) the sum of such ratios for all radionuclides considered as not present in the mixture does not exceed 1/4, i.e.,

$$\left(\text{i.e., } \frac{C_a}{MPC_a} + \frac{C_b}{MPC_b} + \dots \leq \frac{1}{4} \right)$$

History: 1979 AC; 2016 AACS.

R 325.5271 Appendix B. Reference quantities for posting and disposal
Rule 271.

| Radionuclide | Microcuries |
|---------------|-------------|
| Americium 241 | .01 |
| Antimony 122 | 100 |
| Antimony 124 | 10 |
| Antimony 125 | 10 |
| Arsenic 73 | 100 |
| Arsenic 74 | 10 |
| Arsenic 76 | 10 |
| Arsenic 77 | 100 |
| Barium 131 | 10 |
| Barium 133 | 10 |
| Barium 140 | 10 |
| Bismuth 210 | 1 |
| Bromine 82 | 10 |
| Cadmium 109 | 10 |
| Cadmium 115m | 10 |
| Cadmium 115 | 100 |
| Calcium 45 | 10 |
| Calcium 47 | 10 |
| Carbon 14 | 100 |
| Cerium 141 | 100 |
| Cerium 143 | 100 |
| Cerium 144 | 1 |
| Cesium 131 | 1,000 |
| Cesium 134m | 100 |
| Cesium 134 | 1 |

| | |
|---------------------|-------|
| Cesium 135 | 10 |
| Cesium 136 | 10 |
| Cesium 137 | 10 |
| Chlorine 36 | 10 |
| Chlorine 38 | 10 |
| Chromium 51 | 1,000 |
| Cobalt 58m | 10 |
| Cobalt 58 | 10 |
| Cobalt 60 | 1 |
| Copper 64 | 100 |
| Dysprosium 165 | 10 |
| Dysprosium 166 | 100 |
| Erbium 169 | 100 |
| Erbium 171 | 100 |
| Europium 152 (9.2h) | 100 |
| Europium 152 (13yr) | 1 |
| Europium 154 | 1 |
| Europium 155 | 10 |
| Fluorine 18 | 1,000 |
| Gadolinium 153 | 10 |
| Gadolinium 159 | 100 |
| Gallium 72 | 10 |
| Germanium 71 | 100 |
| Gold 198 | 100 |
| Gold 199 | 100 |
| Hafnium 181 | 10 |
| Holmium 166 | 100 |
| Hydrogen 3 | 1,000 |
| Indium 113m | 100 |
| Indium 114m | 10 |
| Indium 115m | 100 |
| Indium 115 | 10 |
| Iodine 125 | 1 |
| Iodine 126 | 1 |
| Iodine 129 | 0.1 |
| Iodine 131 | 1 |
| Iodine 132 | 10 |
| Iodine 133 | 1 |
| Iodine 134 | 10 |
| Iodine 135 | 10 |
| Iridium 192 | 10 |
| Iridium 194 | 100 |
| Iron 55 | 100 |

| | |
|------------------|-----|
| Iron 59 | 10 |
| Krypton 85 | 100 |
| Krypton 87 | 10 |
| Lanthanum 140 | 10 |
| Lutetium 177 | 100 |
| Manganese 52 | 10 |
| Manganese 54 | 10 |
| Manganese 56 | 10 |
| Mercury 197m | 100 |
| Mercury 197 | 100 |
| Mercury 203 | 10 |
| Molybdenum 99 | 100 |
| Neodymium 147 | 100 |
| Neodymium 149 | 100 |
| Nickel 59 | 100 |
| Nickel 63 | 10 |
| Nickel 65 | 100 |
| Niobium 93m | 10 |
| Niobium 95 | 10 |
| Niobium 97 | 10 |
| Osmium 185 | 10 |
| Osmium 191m | 100 |
| Osmium 191 | 100 |
| Osmium 193 | 100 |
| Palladium 103 | 100 |
| Palladium 109 | 100 |
| Phosphorus 32 | 10 |
| Platinum 191 | 100 |
| Platinum 193m | 100 |
| Platinum 193 | 100 |
| Platinum 197m | 100 |
| Platinum 197 | 100 |
| Plutonium 239 | .01 |
| Polonium 210 | 0.1 |
| Potassium 42 | 10 |
| Praseodymium 142 | 100 |
| Praseodymium 143 | 100 |
| Promethium 147 | 10 |
| Promethium 149 | 10 |
| Radium 226 | .01 |
| Radon 222 | .01 |
| Rhenium 186 | 100 |
| Rhenium 188 | 100 |

| | |
|----------------|-----|
| Rhodium 103m | 100 |
| Rhodium 105 | 100 |
| Rubidium 86 | 10 |
| Rubidium 87 | 10 |
| Ruthenium 97 | 100 |
| Ruthenium 103 | 10 |
| Ruthenium 105 | 10 |
| Ruthenium 106 | 1 |
| Samarium 151 | 10 |
| Samarium 153 | 100 |
| Scandium 46 | 10 |
| Scandium 47 | 100 |
| Scandium 48 | 10 |
| Selenium 75 | 10 |
| Silicon 31 | 100 |
| Silver 105 | 10 |
| Silver 110m | 1 |
| Silver 111 | 100 |
| 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 | .01 |
| Uranium 234 - 235 | .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 |

*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: For purposes of Rules 224 to 231, where there is involved a combination of nuclides in known amounts, the limit for the combination should be derived as follows: Determine, for each nuclide in the combination, the ratio between the quantity present in the combination and

the limit otherwise established for the specific nuclide when not in combination. The sum of such ratios for all the nuclides in the combination may not exceed “1” (i.e., “unity”).

History: 1979 AC; 2016 AACS.

R 325.5272 Appendix C. Radioactive surface contamination guides.

Rule 272.

| Application | Alpha(dpm/100 cm ²) | | Beta/Gamma* | |
|-----------------------------------|---------------------------------|-----------|---------------|--------------------------------------|
| | Total | Removable | Total (mR/hr) | Removable (dpm/100 cm ²) |
| Restricted Area | | | | |
| Basic Guide | 25,000 (max) | 500 | 1.0 | 5,000 |
| | 5,000 (avg) | | | |
| Clean Area | 1,000 | 100 | 0.5 | 1,000 |
| Non-Restricted Area | | | | |
| Skin, Personal Clothing | 500 | N.D.** | 0.1 | N.D.** |
| Release of Material or Facilities | 2,500 (max) | 100 | 0.2 | 1,000 |
| | 500 (avg) | | | |

*Measured at 1 cm from the surface

**N.D. - non-detectable

NOTES TO APPENDIX C

It should be emphasized that because of the wide range of physical factors, no one value (of the few which can be incorporated in a standard) can relate health effects to contamination levels in all the diverse situations in which contamination is measured. Accordingly, standards for contamination levels must be used as guides (or decision levels). The above levels shall therefore be applied with the following guidance:

1. The levels are to be used as guides, and in practice professional judgment should be used by the health physicist to determine the acceptability of the actual contamination.
2. Although it is felt that the recommended values should not result in a health hazard, good radiation protection practice dictates that a reasonable effort be made to keep actual contamination levels below these values.
3. Compliance with contamination guides shall not be used as evidence that exposing persons to internal or external sources of radiation is within the prescribed standards. Biological sampling or whole body counting should be used to ascertain internal doses.
4. For release of material to the general public:
 - a. A reasonable effort shall be made to minimize the contamination (i.e. the application of additional decontamination procedures have little effect on the contamination levels).

b. Surfaces of premises or equipment likely to be contaminated that are inaccessible for measurement shall be presumed to be contaminated in excess of the above limits and not released.

5. The levels adopted are for generally used isotopes of high toxicity, therefore lower levels may be appropriate for extremely toxic radionuclides and relaxations allowed for less toxic radionuclides.

History: 1979 AC.

R 325.5273 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5274 Rescinded.

History: 1979 AC; 2016 AACS.

PART 6. INDUSTRIAL RADIOGRAPHIC OPERATIONS AND INSTALLATIONS

R 325.5281 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5282 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5285 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5286 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5287 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5288 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5289 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5290 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5291 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5293 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5294 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5296 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5297 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5298 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5299 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5301 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5302 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5303 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5305 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5306 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5307 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5309 Rescinded.

History: 1979 AC; 2016 AACS.

PART 7. MEDICAL X-RAY INSTALLATIONS

R 325.5311 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5312 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5315 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5317 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5321 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5322 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5323 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5325 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5331 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5333 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5337 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5347 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5348 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5351 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5352 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5353 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5355 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5357 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5358 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5359 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5361 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5362 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5365 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5366 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5368 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5371 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5372 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5373 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5375 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5376 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5378 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5379 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5380 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5381 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5383 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5384 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5385 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5386 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5388 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5389 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5390 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5391 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5395 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5396 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5397 Rescinded.

History: 1979 AC; 2016 AACS.

PART 10. VETERINARY X-RAY INSTALLATIONS

R 325.5401 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5402 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5403 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5404 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5405 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5407 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5409 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5411 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5417 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5418 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5421 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5422 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5423 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5425 Rescinded.

History: 1979 AC; 2016 AACS.

PART 11. PARTICLE ACCELERATOR INSTALLATIONS

R 325.5431 Purpose and scope.

Rule 431. (1) This part establishes procedures for the licensing or registration of particle accelerators, a classification system for particle accelerator installations and use, and radiation safety requirements for persons utilizing all types of particle accelerators except those specifically exempted from this part.

(2) This part applies to all licensees and registrants who use particle accelerators for any purpose other than those exempted under Rule 432.

(3) In addition to the requirements of this part, all licensees and registrants are subject to the applicable provisions of the other parts.

History: 1979 AC; 2016 AACS.

R 325.5432 Definitions.

Rule 432. (1) "Particle accelerator" or "accelerator", as used in this part, means a radiation machine designed for or capable of accelerating electrically charged particles, such as electrons, protons, or deuterons, with an electrical potential in excess of 1 MeV. Radiation machines designed and used exclusively for the production of electron beams or x- radiation for any of the following purposes, except those capable of producing radioactive material in excess of exempt quantities listed in schedule B of Rule 147, are excluded from this definition:

- (a) The diagnosis or treatment of patients.
- (b) Industrial radiography.
- (c) Examination of the microscopic structure of materials.
- (d) Manufacturing process control.
- (e) Research and development.
- (f) Demonstration of scientific principles for educational purposes.

(2) "Radiation protection supervisor" means 1 specific individual appointed by the licensee or registrant who has been delegated the responsibility and authority to govern the operation of the accelerator in such a manner as to comply with the provisions of this part and part 5 and to enforce any written procedures approved by the department.

History: 1979 AC; 2016 AACS.

LICENSE OR REGISTRATION

R 325.5435 General provisions.

Rule 435. Except as otherwise provided in these rules, a person shall not manufacture, produce, own, receive, acquire, possess, use, transport, transfer, or dispose of a research, production, processing, or treatment particle accelerator capable of producing radioactive material in excess of exempt quantities listed in schedule B of Rule 147 unless authorized in a specific license issued pursuant to part 2.

History: 1979 AC; 2016 AACS.

R 325.5437 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5438 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5439 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5440 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5441 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5442 Rescinded.

History: 1979 AC; 2016 AACS.

**SAFETY REQUIREMENTS FOR THE USE
OF PARTICLE ACCELERATORS**

R 325.5445. General provisions.

Rule 445. (1) Rules 445 to 455 establish radiation safety requirements for the use of particle accelerators. The provisions of such rules are in addition to, and not in substitution for, other applicable provisions of these rules.

(2) A licensee or registrant shall be responsible for assuring that all requirements of this part are met.

History: 1979 AC.

R 325.5446 Limitations.

Rule 446. The radiation safety committee or the radiation protection supervisor may terminate the operations at an accelerator facility or of a class D operation if this action is deemed necessary to protect health and minimize danger to public health and safety or property.

History: 1979 AC; 2016 AACS.

R 325.5447 Shielding.

Rule 447. (1) The design and shielding specifications for an accelerator shall be submitted and approved before issuance of a license by the department. After construction and installation, the radiation safety of the installation shall be established by a protection survey conducted in accord with Rule 221. A written report of the initial survey shall be submitted to the department and approved in writing before continued operation of the accelerator.

(2) Each accelerator installation shall be provided with such primary or secondary barriers as are necessary to assure compliance with Rules 203, 205, and 211.

History: 1979 AC; 2016 AACS.

R 325.5448 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5449 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5450 Equipment control and operations.

Rule 450. (1) A building housing a fixed particle accelerator shall not be left unattended without locking the building or portions thereof in some manner that will prevent unauthorized entry into the control room or target room, or any access to areas that may contain induced radioactivity resulting from accelerator operation.

(2) A mobile or portable particle accelerator shall not be left unattended without locking the room or building in which it is housed in some manner that will prevent its removal by unauthorized persons.

(3) Access to or possession of keys or combinations used to comply with the requirements of this rule shall be limited to specific authorized persons approved by the radiation protection supervisor.

History: 1979 AC; 2016 AACCS.

R 325.5452 Radiation surveys.

Rule 452. (1) A licensee or registrant shall maintain at each accelerator installation appropriate calibrated and operable portable radiation monitoring instruments to make physical radiation surveys as required by this part and part 5.

(2) Portable radiation monitoring instruments shall be capable by design, calibration, and operation of measuring the intensity of the various types and energies of radiation produced by the accelerator. These instruments shall be tested for proper operation at the beginning of each day they are to be used and calibrated at intervals not to exceed 3 months.

(3) During repair or calibration of a radiation monitoring instrument, a spare calibrated and operable instrument shall be provided or accelerator operations which require the instrument shall be terminated until required instrumentation is available.

(4) A radiation protection survey shall be performed and documented in accord with Rule 221 when changes have been made in shielding, operation, equipment, or occupancy of adjacent areas, and periodically to check for unknown changes and malfunctioning equipment.

(5) Whenever applicable, periodic surveys shall be made to determine the amount of airborne radioactivity present in areas of airborne hazards.

(6) Whenever applicable, periodic smear surveys shall be made to determine the degree of contamination in target and other pertinent areas.

(7) All area surveys shall be made in accordance with the written procedures established by a health physics consultant or the radiation protection supervisor of the accelerator facility and approved by the department.

(8) Records of all radiation protection surveys, calibration results, instrumentation tests, and smear results shall be kept current and on file at each accelerator facility.

History: 1979 AC; 2016 AACCS.

R 325.5454 Ventilation systems.

Rule 454. (1) An accessible airborne radioactivity area shall be provided with ventilation adequate to reduce airborne radioactivity to concentrations that do not exceed the limits specified in column 1, table I of Rules 261 to 269.

(2) A licensee or registrant shall not vent, release, or otherwise discharge concentrations of radioactive material from an airborne radioactivity area to an uncontrolled area that exceed the limits specified in table II of Rules 261 to 269 except as authorized pursuant to subrule (2) of Rule 238(2) of part 5. For purposes of this subrule, concentrations may be averaged over a period not greater than 1 year.

History: 1979 AC; 2016 AACS.

R 325.5455 Special precautions.

Rule 455. A licensee or registrant shall not permit dismantling, repair, or servicing of any portion of the accelerator or changing of target materials by any persons unless such persons have been approved for such activity by the radiation protection supervisor. The radiation protection supervisor shall determine that such persons are the following:

(a) Qualified by training or experience to conduct such activities safely with respect to potential radiation hazards.

(b) Knowledgeable regarding the potential hazards of induced radioactivity.

(c) Provided with appropriate monitoring instruments and dosimeters.

(d) Informed of any special procedures or precautions necessary to protect themselves and others from radiation exposure or spread of contamination.

History: 1979 AC; 2016 AACS.

PART 12. SEALED RADIOACTIVE SOURCES IN THE HEALING ARTS

R 325.5461 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5462 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5464 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5465 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5466 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5468 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5471 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5474 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5475 Rescinded

History: 1979 AC; 2016 AACS.

PART 13. MISCELLANEOUS SOURCES

R 325.5481 Purpose and scope.

Rule 481. (1) This part establishes radiation safety requirements for miscellaneous radiation sources and for persons utilizing such sources not exempted under Rules 31 to 33 and not specifically covered elsewhere by these rules.

(2) This part applies to all persons who use sources of radiation not specifically covered by the other parts.

(3) In addition to the requirements of this part all persons and activities covered by this part are subject to the applicable provisions of parts 1, 2, and 5.

History: 1979 AC; 2016 AACS.

R 325.5482 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5484 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5485 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5486 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5487 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5491 Rescinded

History: 1979 AC; 2016 AACS.

R 325.5492 Rescinded

History: 1979 AC; 2016 AACS.

R 325.5493 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5494 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5495 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5501 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5505 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5506 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5507 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5508 Rescinded.

History: 1979 AC; 2016 AACS.

OTHER MISCELLANEOUS SOURCES

R 325.5511 License or registration conditions.

Rule 511. Types of radiation sources and uses not specifically covered by these rules shall be subject to specific requirements designated by the department in the form of license or registration conditions for the protection of public health, safety, and property until such time that these rules are amended to specifically cover such sources and uses.

History: 1979 AC; 2016 AACS.

R 325.5601 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5601a Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5602 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5603 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5605 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5606 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5607 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5608 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5609 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5610 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5611 Rescinded.

History: 1979 AC; 2016 AACCS.

R 325.5612 Rescinded.

History: 1979 AC; 2016 AACS.

R 325.5613 Rescinded.

History: 1979 AC; 2016 AACS.

MAMMOGRAPHY SUPERVISOR

R 325.5617 Rescinded.

History: 1993 AACS; 2013 AACS.

R 325.5618 Rescinded.

History: 1993 AACS; 2013 AACS.

R 325.5619 Rescinded.

History: 1993 AACS; 2013 AACS.

OPERATORS OF MAMMOGRAPHY EQUIPMENT

R 325.5621 Rescinded.

History: 1993 AACS; 2013 AACS.

R 325.5622 Rescinded.

History: 1993 AACS; 2013 AACS.

R 325.5623 Rescinded.

History: 1993 AACS; 2013 AACS.

R 325.5624 Rescinded.

History: 1993 AACS; 2013 AACS.

R 325.5625 Rescinded.

History: 1993 AACS; 2013 AACS.

R 325.5626 Rescinded.

History: 2013 AACS; 2016 AACS.

R 325.5627 Rescinded.

History: 2013 AACS; 2016 AACS.

R 325.5628 Rescinded.

History: 2013 AACS; 2016 AACS.

R 325.5629 Rescinded.

History: 2013 AACS; 2016 AACS.

R 325.5630 Rescinded.

History: 2013 AACS; 2016 AACS.

R 325.5631 Rescinded.

History: 1993 AACS; 2013 AACS.

R 325.5632 Rescinded.

History: 1993 AACS; 2013 AACS.

R 325.5633 Rescinded.

History: 1993 AACS; 2013 AACS.

R 325.5634 Rescinded.

History: 2013 AACS; 2016 AACS.

R 325.5635 Rescinded.

History: 2013 AACS; 2016 AACS.

R 325.5637 Rescinded.

History: 1993 AACS; 2013 AACS; 2016 AACS.

R 325.5638 Rescinded.

History: 1993 AACS; 2013 AACS.

R 325.5639 Rescinded.

History: 1993 AACS; 2013 AACS.

R 325.5640 Rescinded.

History: 1993 AACS; 2013 AACS.

R 325.5641 Rescinded.

History: 1993 AACS; 2013 AACS.

R 325.5642 Rescinded.

History: 1993 AACS; 2013 AACS.

R 325.5643 Rescinded.

History: 1993 AACCS; 2013 AACCS.

R 325.5644 Rescinded.

History: 1993 AACCS; 2013 AACCS.

R 325.5645 Rescinded.

History: 1993 AACCS; 2013 AACCS.

R 325.5646 Rescinded.

History: 1993 AACCS; 2013 AACCS.

R 325.5647 Rescinded.

History: 1993 AACCS; 2013 AACCS.

R 325.5648 Rescinded.

History: 1993 AACCS; 2013 AACCS.

R 325.5649 Rescinded.

History: 1993 AACCS; 2013 AACCS.

R 325.5650 Rescinded.

History: 1993 AACCS; 2013 AACCS.

R 325.5651 Rescinded.

History: 1993 AACCS; 2013 AACCS.

R 325.5652 Rescinded.

History: 1993 AACCS; 2013 AACCS.

R 325.5655 Rescinded.

History: 1993 AACCS; 2013 AACCS; 2016 AACCS.

R 325.5656 Rescinded.

History: 1993 AACCS; 2013 AACCS; 2016 AACCS.

R 325.5657 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5658 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5659 Rescinded.

History: 1993 AACCS; 2013 AACCS.

R 325.5660 Rescinded.

History: 1993 AACCS; 2013 AACCS.

R 325.5661 Rescinded.

History: 1993 AACCS; 2013 AACCS.

R 325.5662 Rescinded.

History: 1993 AACCS; 2013 AACCS.

R 325.5663 Rescinded.

History: 1993 AACCS; 2013 AACCS.

R 325.5664 Rescinded.

History: 1993 AACCS; 2013 AACCS.

R 325.5665 Rescinded.

History: 1993 AACCS; 2013 AACCS.

R 325.5667 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5668 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5669 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5674 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5675 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5676 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5677 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5678 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5679 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5681 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5682 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5683 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5684 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5685 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5686 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5687 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5688 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5689 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5690 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5691 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5692 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5693 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5694 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5695 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5696 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5697 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5698 Rescinded.

History: 2013 AACCS; 2016 AACCS.

R 325.5701 Rescinded.

History: 2011 AACCS; 2016 AACCS.

R 325.5703 Rescinded.

History: 2011 AACCS; 2016 AACCS.

R 325.5705 Rescinded.

History: 2011 AACCS; 2016 AACCS.

R 325.5707 Rescinded.

History: 2011 AACCS; 2016 AACCS.

R 325.5709 Rescinded.

History: 2011 AACCS; 2016 AACCS.

R 325.5711 Rescinded.

History: 2011 AACCS; 2016 AACCS.

R 325.5713 Rescinded.

History: 2011 AACCS; 2016 AACCS.

R 325.5715 Rescinded.

History: 2011 AACS; 2016 AACS.

R 325.5717 Rescinded.

History: 2011 AACS; 2016 AACS.

R 325.5719 Rescinded.

History: 2011 AACS; 2016 AACS.

R 325.5721 Rescinded.

History: 2011 AACS; 2016 AACS.