

**MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES,  
AND ENERGY**

**MATERIALS MANAGEMENT DIVISION**

**IONIZING RADIATION RULES FOR RADIOACTIVE MATERIAL**

(By authority conferred on the director of the department of environment, great lakes, and energy by section 13521 of 1978 PA 368, MCL 333.13521, Executive Reorganization Order No. 1996-1, MCL 330.33101, and Executive Reorganization Order No. 2019-6, MCL 324.99923)

**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 AACCS.

**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 AACCS; 2016 MR 10, Eff. May 25, 2016.

**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 MR 10, Eff. May 25, 2016.

#### **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 MR 10, Eff. May 25, 2016.

#### **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 AACS; 2016 MR 10, Eff. May 25, 2016.

#### **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  $3.7 \times 10^{10}$  disintegrations per second (dps). Commonly used submultiples of the curie (Ci) are the millicurie (mCi), the microcurie ( $\mu$ Ci) and the nanocurie (nCi). One millicurie = 0.001 curie =  $3.7 \times 10^7$  dps. One microcurie = 0.000001 curie =  $3.7 \times 10^4$  dps. One nanocurie = 0.000000001 curie = 37 dps. Curie is the special unit of measurement of radioactivity.

History: 1979 AACS; 2016 MR 10, Eff. May 25, 2016.

#### **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 MR 10, Eff. May 25, 2016.

#### **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 MR 10, Eff. May 25, 2016.

**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 AACs; 2016 MR 10, Eff. May 25, 2016.

**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 AACs; 2016 MR 10, Eff. May 25, 2016.

**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 AACs; 2016 MR 10, Eff. May 25, 2016.

**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 AACs; 2016 MR 10, Eff. May 25, 2016.

### **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 AACs; 2016 MR 10, Eff. May 25, 2016.

### **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 AACS; 2016 MR 10, Eff. May 25, 2016.

**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 <sup>2</sup> )	Average flux to deliver 100 millirem in 40 hours (neutrons/cm <sup>2</sup> per second)
Thermal	970 x 10 <sup>6</sup>	670
0.0001	720 x 10 <sup>6</sup>	500
0.005	820 x 10 <sup>6</sup>	570
0.02	400 x 10 <sup>6</sup>	280
0.1	120 x 10 <sup>6</sup>	80
0.5	43 x 10 <sup>6</sup>	30
1.0	26 x 10 <sup>6</sup>	18
2.5	29 x 10 <sup>6</sup>	20
5.0	26 x 10 <sup>6</sup>	18
7.5	24 x 10 <sup>6</sup>	17
10	24 x 10 <sup>6</sup>	17
10 to 30	14 x 10 <sup>6</sup>	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  $2.58 \times 10^{-4}$  Coulombs/kilogram of air and is the special unit of exposure.

History: 1979 AACCS; 2016 MR 10, Eff. May 25, 2016.

### **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 MR 10, Eff. May 25, 2016.

### **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:

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

(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 AACS; 2016 MR 10, Eff. May 25, 2016.

### **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 MR 10, Eff. May 25, 2016.

### **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 MR 10, Eff. May 25, 2016.

### **R 325.5021. Rescinded.**

History: 1979 AACS; 2016 MR 10, Eff. May 25, 2016.



**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 <sup>-1</sup> )	da	deka	(=10)
c	centi	(=10 <sup>-2</sup> )	h	hecto	(=10 <sup>2</sup> )
m	milli	(=10 <sup>-3</sup> )	k	kilo	(=10 <sup>3</sup> )
μ	micro	(=10 <sup>-6</sup> )	M	mega	(=10 <sup>6</sup> )
n	nano	(=10 <sup>-9</sup> )	G	giga	(=10 <sup>9</sup> )
p	pico	(=10 <sup>-12</sup> )	T	tera	(=10 <sup>12</sup> )
f	femto	(=10 <sup>-15</sup> )			
a	atto	(=10 <sup>-18</sup> )			

History: 1979 AACCS.

**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 AACCS; 2016 MR 10, Eff. May 25, 2016.

**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 AACCS; 2016 MR 10, Eff. May 25, 2016.

**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 MR 10, Eff. May 25, 2016.

## **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 MR 10, Eff. May 25, 2016.

### **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 AACS; 2016 MR 10, Eff. May 25, 2016.

### **R 325.5043 Impounding.**

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

History: 1979 AACS; 2016 MR 10, Eff. May 25, 2016.

### **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 AACS; 2016 MR 10, Eff. May 25, 2016.

**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 AACS.

**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 MR 10, Eff. May 25, 2016.

**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 MR 10, Eff. May 25, 2016.

**R 325.5049. Rescinded.**

History: 1979 AACS; 2016 MR 10, Eff. May 25, 2016.