

4731.0100 DEFINITIONS.

Subpart 1. **Scope.** For purposes of this chapter, the terms in this part have the meanings given them.

Subp. 2. **A₁.** "A₁" means the maximum activity of special form radioactive material permitted in a Type A package. These values are either listed in part 4731.0422 or may be derived according to the procedure in part 4731.0423.

Subp. 3. **A₂.** "A₂" means the maximum activity of radioactive material, other than special form radioactive material, low specific activity material, and surface contaminated object material permitted in a Type A package. These values are either listed in part 4731.0422 or may be derived according to the procedure in part 4731.0423.

Subp. 4. **Absorbed dose.** "Absorbed dose" means the energy imparted by ionizing radiation per unit mass of irradiated material. The units of absorbed dose are the rad and the gray.

Subp. 4a. **Accelerator-produced radioactive material.** "Accelerator-produced radioactive material" means any material made radioactive by a particle accelerator.

Subp. 5. **Active maintenance.** "Active maintenance" means any significant remedial activity needed during the period of institutional control to maintain a reasonable assurance that the performance objectives in Code of Federal Regulations, title 10, sections 61.41 and 61.42, are met. Active maintenance includes ongoing activities, such as the pumping and treatment of water from a disposal unit, or one time measures, such as replacement of a disposal unit cover. Active maintenance does not include custodial activities such as repair of fencing, repair or replacement of monitoring equipment, revegetation, minor additions to soil cover, minor repair of disposal unit covers, and general disposal site upkeep, such as mowing grass.

Subp. 6. **Activity.** "Activity" is the rate of disintegration (transformation) or decay of radioactive material. The units of activity are the curie and becquerel.

Subp. 7. **Acute.** "Acute" is a single radiation dose or chemical exposure event or multiple radiation doses or chemical exposure events occurring within a short time, 24 hours or less.

Subp. 8. **Address of use.** "Address of use" means the building or buildings that are identified on a license and where radioactive material may be received, prepared, used, or stored.

Subp. 9. **Adult.** "Adult" means an individual 18 or more years of age.

Subp. 10. **Agreement state.** "Agreement state" means a state with which the NRC or the federal Atomic Energy Commission has entered into an effective agreement under

subsection 274b of the Atomic Energy Act of 1954, United States Code, title 42, section 2021, paragraph (b), as amended.

Subp. 11. **Air-purifying respirator.** "Air-purifying respirator" means a respirator with an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element.

Subp. 12. **Airborne radioactive material.** "Airborne radioactive material" means radioactive material dispersed in the air in the form of dusts, fumes, particulates, mists, vapors, or gases.

Subp. 13. **Airborne radioactivity area.** "Airborne radioactivity area" means a room, enclosure, or area in which airborne radioactive materials, composed wholly or partly of licensed material, exist in concentrations:

A. in excess of the derived air concentrations (DACs) specified in part 4731.2750;
or

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

Subp. 14. **Alert.** "Alert" means a situation in which events may occur, are in progress, or have occurred that could lead to a release of radioactive material, but the release is not expected to require a response by off-site response organizations to protect persons off site.

Subp. 15. **Annual limit on intake or ALI.** "Annual limit on intake" or "ALI" means the derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide in a year by the reference man that would result in a committed effective dose equivalent of five rems (0.05 Sv) or a committed dose equivalent of 50 rems (0.5 Sv) to any individual organ or tissue. ALI values for intake by ingestion and by inhalation of selected radionuclides are given in part 4731.2750.

Subp. 16. **Annual refresher safety training or safety review.** "Annual refresher safety training" or "safety review" means a review conducted or provided by the licensee for its employees on radiation safety aspects of industrial radiography or well logging using radioactive materials.

Subp. 17. **Area of use.** "Area of use" means a portion of an address of use that has been set aside for the purpose of receiving, preparing, using, or storing radioactive material.

Subp. 18. **As low as reasonably achievable or ALARA.** "As low as reasonably achievable" or "ALARA" means making every reasonable effort to maintain exposures to radiation as far below the dose limits as is practical, consistent with the purpose for which the licensed or registered activity is undertaken, taking into account the state of technology,

the economics of improvement in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed materials in the public interest.

Subp. 19. **Assigned protection factor or APF.** "Assigned protection factor" or "APF" means the expected workplace level of respiratory protection that would be provided by a properly functioning respirator or a class of respirators to properly fitted and trained users. Operationally, the inhaled concentration can be estimated by dividing the ambient airborne concentration by the APF.

Subp. 20. **Associated equipment.** "Associated equipment" means equipment, which is used in conjunction with a radiographic exposure device to make radiographic exposures, that drives, guides, or comes in contact with the sealed source when it is used as an exposure head, for example a guide tube, control tube, control cable, removable source stop, "J" tube, or collimator.

Subp. 21. **Atmosphere-supplying respirator.** "Atmosphere-supplying respirator" means a respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere and includes supplied-air respirators and self-contained breathing apparatus units.

Subp. 22. **Authorized medical physicist.** "Authorized medical physicist" means an individual who:

- A. meets the requirements in parts 4731.4412 and 4731.4415; or
- B. is identified as an authorized medical physicist or teletherapy physicist on:
 - (1) a specific medical use license issued by the NRC or an agreement state;
 - (2) a medical use permit issued by an NRC master material licensee;
 - (3) a permit issued by an NRC or agreement state broad scope medical use licensee; or
 - (4) a permit issued by an NRC master material license broad scope medical use permittee.

Subp. 23. **Authorized nuclear pharmacist.** "Authorized nuclear pharmacist" means a pharmacist who:

- A. meets the requirements in parts 4731.4413 and 4731.4415;
- B. is identified as an authorized nuclear pharmacist on:
 - (1) a specific license issued by the NRC or an agreement state that authorizes medical use or the practice of nuclear pharmacy;

(2) a permit issued by an NRC master material licensee that authorizes medical use or the practice of nuclear pharmacy;

(3) a permit issued by an NRC or agreement state broad scope medical use licensee that authorizes medical use or the practice of nuclear pharmacy; or

(4) a permit issued by an NRC master material licensee broad scope medical use permitted that authorizes medical use or the practice of nuclear pharmacy;

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

D. is designated as an authorized nuclear pharmacist according to part 4731.3395, subpart 2, item C.

Subp. 24. **Authorized user.** "Authorized user" means a licensed practitioner of the healing arts who:

A. meets the requirements in part 4731.4415 and in parts 4731.4433, 4731.4436, 4731.4443 to 4731.4445, 4731.4458, 4731.4461, or 4731.4479; or

B. is identified as an authorized user on:

(1) an NRC or agreement state license that authorizes the medical use of radioactive material;

(2) a permit issued by an NRC master material licensee that is authorized to permit the medical use of radioactive material;

(3) a permit issued by an NRC or agreement state specific licensee of broad scope that is authorized to permit the medical use of radioactive material; or

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

Subp. 25. **Background radiation.** "Background radiation" means radiation from cosmic sources; naturally occurring radioactive material, including radon, except as a decay product of source or special nuclear material; and global fallout as it exists in the environment from the testing of nuclear explosive devices or from past nuclear accidents such as Chernobyl that are not under the control of the licensee. Background radiation does not include radiation from source, radioactive, or special nuclear materials regulated by the commissioner.

Subp. 26. **Becquerel or Bq.** One "becquerel" or "Bq" is equal to one disintegration per second. One curie is equal to 3.7×10^{10} becquerels. The conventional system equivalent is the curie.

Subp. 27. **Bioassay or radiobioassay.** "Bioassay" or "radiobioassay" means the determination of kinds, quantities, or concentrations, and, in some cases, the locations of

radioactive material in the human body, whether by direct measurement (in vivo counting) or by analysis and evaluation of materials excreted or removed from the human body.

Subp. 28. **Boring.** "Boring" has the meaning given in Minnesota Statutes, section 103I.005, subdivision 2.

Subp. 29. **Brachytherapy.** "Brachytherapy" means a method of radiation therapy in which sources are used to deliver a radiation dose at a distance of up to a few centimeters by surface, intracavitary, intraluminal, or interstitial application.

Subp. 30. **Brachytherapy source.** "Brachytherapy source" means a radioactive sealed source or a manufacturer-assembled source train or a combination of these sources that is designed to deliver a therapeutic dose within a distance of a few centimeters.

Subp. 31. **Broad scope license.** "Broad scope license" is one kind of a specific license that permits the licensee to use radionuclides, in any chemical or physical form, as long as the amount does not exceed the quantity indicated in the broad scope license.

Subp. 32. **Byproduct material.** "Byproduct material" means:

A. any radioactive material, except special nuclear material, yielded in, or made radioactive by, exposure to the radiation incident to the process of producing or using special nuclear material;

B. the tailings or wastes produced by the extraction or concentration of uranium or thorium from ore processed primarily for its source material content, including discrete surface wastes resulting from uranium solution extraction processes. Underground ore bodies depleted by these solution extraction operations do not constitute byproduct material within this definition;

C. any discrete source of radium-226 that is produced, extracted, or converted after extraction for commercial, medical, or research activity, or any material that:

(1) has been made radioactive by use of a particle accelerator; and

(2) is produced, extracted, or converted after extraction for commercial, medical, or research activity; and

D. any discrete source of naturally occurring radioactive material, other than source material, that:

(1) the United States Nuclear Regulatory Commission, in consultation with the Administrator of Environmental Protection Agency, the Secretary of Energy, the Secretary of Homeland Security, and the head of any other appropriate federal agency determines would pose a threat similar to the threat posed by a discrete source of radium-226 to the public health and safety or the common defense and security; and

(2) is extracted or converted after extraction for use in a commercial, medical, or research activity.

Subp. 33. **Carrier.** "Carrier" means a person engaged in the transportation of passengers or property by land or water as a common, contract, or private carrier, or by civil aircraft.

Subp. 33a. **Certificate holder.** "Certificate holder" means a person who has been issued a certificate of compliance or other package approval by the NRC.

Subp. 33b. **Certificate of compliance.** "Certificate of compliance" means the certificate issued by the NRC under Code of Federal Regulations, title 10, part 71, subpart D, which approves the design of a package for transportation of radioactive material.

Subp. 34. **Certifying entity or independent certifying organization.** "Certifying entity" or "independent certifying organization" means an independent certifying organization meeting the requirements in part 4731.4360 or an agreement state meeting the requirements in part 4731.4360, subparts 2 and 3, for certifying industrial radiographers.

Subp. 35. **Chelating agent.** "Chelating agent" means amine polycarboxylic acids, for example EDTA and DTPA; hydroxy-carboxylic acids; and polycarboxylic acids, for example citric acid, carbolic acid, and glucinic acid.

Subp. 36. **Class, inhalation class, or lung class.** "Class," "inhalation class," or "lung class" means a classification scheme for inhaled material according to its rate of clearance from the pulmonary region of the lung. Materials are classified as D, W, or Y, which applies to a range of clearance half-times of:

- A. less than ten days for class D (days);
- B. from ten to 100 days for class W (weeks); and
- C. greater than 100 days for class Y (years).

Subp. 37. **Client's address.** "Client's address" means the area of use or a temporary job site for the purpose of providing mobile medical service according to part 4731.4428.

Subp. 38. **Collective dose.** "Collective dose" is the sum of the individual doses received in a given period of time by a specified population from exposure to a specified source of radiation.

Subp. 39. **Collimator.** "Collimator" means a radiation shield that is placed on the end of the guide tube or directly onto a radiographic exposure device to restrict the size of the radiation beam when the sealed source is cranked into position to make a radiographic exposure.

Subp. 40. **Commencement of construction.** "Commencement of construction" means any clearing of land, excavation, or other substantial action that would adversely affect the natural environment of a site but does not include:

A. changes desirable for the temporary use of the land for public recreational uses; or

B. necessary borings to determine site characteristics or other preconstruction monitoring to establish background information related to the suitability of a site or to the protection of environmental values.

Subp. 41. **Commissioner.** "Commissioner" means the commissioner of the Minnesota Department of Health.

Subp. 42. **Committed dose equivalent or $H_{T,50}$.** "Committed dose equivalent" or " $H_{T,50}$ " means the dose equivalent to organs or tissues of reference (T) that will be received from an intake of radioactive material by an individual during the 50-year period following the intake.

Subp. 43. **Committed effective dose equivalent or $H_{E,50}$.** "Committed effective dose equivalent" or " $H_{E,50}$ " is the sum of the products of the weighting factors (W_T) applicable to each of the body organs or tissues that are irradiated and the committed dose equivalent to these organs or tissues ($H_{E,50} = \sum W_T H_{T,50}$).

Subp. 43a. **Consignment.** "Consignment" means each shipment of a package or groups of packages or load of radioactive material offered by a shipper for transport.

Subp. 43b. **Consortium.** "Consortium" means an association of medical use licensees and a PET radionuclide production facility in the same geographical area that jointly own or share in the operation and maintenance cost of the PET radionuclide production facility that produces PET radionuclides for use in producing radioactive drugs within the consortium for noncommercial distributions among its associated members for medical use. The PET radionuclide production facility within the consortium must be located at an educational institution or a federal facility or a medical facility.

Subp. 44. **Constraint or dose constraint.** "Constraint" or "dose constraint" means a value above which specified licensee or registrant actions are required.

Subp. 44a. **Containment system.** "Containment system" means the assembly of components of the packaging intended to retain the radioactive material during transport.

Subp. 45. **Contiguous sites.** "Contiguous sites" means licensee-controlled locations that are deemed by the commissioner to be in close enough proximity to each other so that the special nuclear material must be considered in the aggregate for the purpose of physical protection.

Subp. 46. **Control cable or drive cable.** "Control cable" or "drive cable" means the cable that is connected to the source assembly and used to drive the source to and from the exposure location.

Subp. 47. **Control drive mechanism.** "Control drive mechanism" means a device that enables the source assembly to be moved to and from the exposure device.

Subp. 48. **Control tube.** "Control tube" means a protective sheath for guiding the control cable. The control tube connects the control drive mechanism to the radiographic exposure device.

Subp. 49. **Controlled area.** "Controlled area" means an area outside of a restricted area but inside the site boundary, access to which can be limited by the licensee or registrant for any reason.

Subp. 49a. **Conveyance.** "Conveyance" means:

A. for transport by public highway or rail, any transport vehicle or large freight container;

B. for transport by water, any vessel or any hold, compartment, or defined deck area of a vessel, including any transport vehicle on board the vessel; and

C. for transport by air, any aircraft.

Subp. 50. **Critical group.** "Critical group" means the group of individuals reasonably expected to receive the greatest exposure to residual radioactivity for any applicable set of circumstances.

Subp. 50a. **Criticality safety index or CSI.** "Criticality safety index" or "CSI" means the dimensionless number, rounded up to the next tenth, assigned to and placed on the label of a fissile material package, to designate the degree of control of accumulation of packages containing fissile material during transportation. Determination of the criticality safety index is described in parts 4731.0410 and 4731.0411 and Code of Federal Regulations, title 10, section 71.59.

Subp. 51. **Curie or Ci.** One "curie" or "Ci" is the quantity of radioactive material that decays at the rate of 3.7×10^{10} disintegrations per second (dps). The SI equivalent is the becquerel.

Subp. 51a. **Cyclotron.** "Cyclotron" means a particle accelerator in which the charged particles travel in an outward spiral or circular path. A cyclotron accelerates charged particles at energies usually in excess of ten MeV and is commonly used for production of short half-life radionuclides for medical use.

Subp. 52. **Declared pregnant woman.** "Declared pregnant woman" means a woman who has voluntarily informed the licensee or registrant, in writing, of her pregnancy and the

estimated date of conception. The declaration remains in effect until the declared pregnant woman withdraws the declaration in writing or is no longer pregnant.

Subp. 53. **Decommission.** "Decommission" means to safely remove a facility or site from service and reduce residual radioactivity to a level that permits:

A. release of the property for unrestricted use and termination of the license or registration; or

B. release of the property under restricted conditions and termination of the license or registration.

Subp. 54. **Dedicated check source.** "Dedicated check source" means a radioactive source that is used to ensure the constant operation of a radiation detection or measurement device over several months or years.

Subp. 55. **Deep dose equivalent or H_d .** "Deep dose equivalent" or " H_d ," which applies to external whole-body exposure, is the dose equivalent at a tissue depth of one centimeter ($1,000 \text{ mg/cm}^2$).

Subp. 56. **Demand respirator.** "Demand respirator" means an atmosphere-supplying respirator that admits breathing air to the facepiece only when a negative pressure is created inside the facepiece by inhalation.

Subp. 57. **Depleted uranium.** "Depleted uranium" means the source material uranium in which the isotope uranium-235 is less than 0.711 weight percent of the total uranium present. Depleted uranium does not include special nuclear material.

Subp. 58. **Derived air concentration or DAC.** "Derived air concentration" or "DAC" means the concentration of a given radionuclide in air which, if breathed by the reference man for a working year of 2,000 hours under conditions of light work (inhalation rate 1.2 cubic meters of air per hour), results in an intake of one ALI. DAC values are given in part 4731.2750, subpart 7, Table 1, column 3.

Subp. 59. **Derived air concentration-hour or DAC-hour.** "Derived air concentration-hour" or "DAC-hour" is the product of the concentration of radioactive material in air, expressed as a fraction or multiple of the derived air concentration for each radionuclide, and the time of exposure to that radionuclide, in hours. A licensee or registrant may take 2,000 DAC-hours to represent one ALI, equivalent to a committed effective dose equivalent of five rems (0.05 Sv).

Subp. 59a. **Deuterium.** "Deuterium" means, for purposes of parts 4731.0403, subpart 4, and 4731.0410, deuterium and any deuterium compounds, including heavy water, in which the ratio of deuterium atoms to hydrogen atoms exceeds 1:5000.

Subp. 60. **Disposable respirator.** "Disposable respirator" means a respirator for which maintenance is not intended and that is designed to be discarded after excessive

breathing resistance, sorbent exhaustion, physical damage, or end-of-service-life renders it unsuitable for use. Examples of this type of respirator are a disposable half-mask respirator or a disposable escape-only self-contained breathing apparatus.

Subp. 60a. **Discrete source.** "Discrete source" means a radionuclide that has been processed so that its concentration within a material has been purposely increased for use for commercial, medical, or research activities.

Subp. 61. **Distinguishable from background.** "Distinguishable from background" means that the detectable concentration of a radionuclide is statistically different from the background concentration of that radionuclide in the vicinity of the site or, in the case of structures, in similar materials using adequate measurement technology, survey, and statistical techniques.

Subp. 62. **Distribution.** "Distribution" means the act of distributing or the condition of being distributed.

Subp. 63. **Distributor.** "Distributor" means one who distributes, markets, or sells merchandise that includes a radiation source or radiation-producing equipment, especially a wholesaler.

Subp. 64. **Dose or radiation dose.** "Dose" or "radiation dose" means absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, or total effective dose equivalent.

Subp. 64a. **Dose commitment.** "Dose commitment" means the total radiation dose to a part of the body that will result from retention in the body of radioactive material. For purposes of estimating the dose commitment, it is assumed from the time of intake the period of exposure to retained material will not exceed 50 years.

Subp. 65. **Dose equivalent or H_T .** "Dose equivalent" or " H_T " means the product of the absorbed dose in tissue, quality factor, and all other necessary modifying factors at the location of interest. The units of dose equivalent are the rem and sievert.

Subp. 66. **Dose limits or limits.** "Dose limits" or "limits" means the permissible upper bounds of radiation doses.

Subp. 67. **DOT.** "DOT" means the United States Department of Transportation.

Subp. 68. **Doubly encapsulated sealed source.** "Doubly encapsulated sealed source" means a sealed source in which the radioactive material is sealed within a capsule and that capsule is sealed within another capsule.

Subp. 69. **Effective dose equivalent or H_E .** "Effective dose equivalent" or " H_E " means the sum of the products of the dose equivalent to the organ or tissue (H_T) and the weighting factors (W_T) applicable to each of the body organs or tissues that are irradiated. ($H_E = \sum \alpha \mu \rho \times W_T H_T$).

Subp. 70. **Effective kilogram.** "Effective kilogram" means:

A. for the source material uranium in which the uranium isotope uranium-235 is greater than 0.005 (0.5 weight percent) of the total uranium present, 10,000 kilograms; and

B. for any other source material, 20,000 kilograms.

Subp. 71. **Electron-beam generator.** "Electron-beam generator" means a type of electron accelerator in which the electron beam is brought out into the atmosphere for irradiation purposes.

Subp. 72. **Embryo/fetus.** "Embryo/fetus" means the developing human organism from conception until the time of birth.

Subp. 73. **Energy compensation source or ECS.** "Energy compensation source" or "ECS" means a small sealed source, with an activity not exceeding 100 microcuries (3.7 MBq), used within a logging tool, or other tool components, to provide a reference standard to maintain the tool's calibration when in use.

Subp. 74. **Enriched uranium.** "Enriched uranium" means uranium containing more uranium-235 than the naturally occurring distribution of uranium isotopes.

Subp. 75. **Entrance or access point.** "Entrance" or "access point" means any location through which an individual could gain access to radiation areas or to radioactive materials. Entrance or access point includes entry or exit portals of sufficient size to permit human entry, irrespective of their intended use.

Subp. 76. **Exclusive use.** "Exclusive use" means the sole use by a single consignor of a conveyance for which all initial, intermediate, and final loading and unloading are carried out according to the direction of the consignor or consignee. The consignor and the carrier must ensure that any loading or unloading is performed by personnel having radiological training and resources appropriate for safe handling of the consignment. The consignor must issue specific instructions, in writing, for maintenance of exclusive use shipment controls and include them with the shipping paper information provided to the carrier by the consignor.

Subp. 77. **Exposure.** "Exposure" means being exposed to ionizing radiation or to radioactive material.

Subp. 78. **Exposure head or source stop.** "Exposure head" or "source stop" means a device that locates the gamma radiography sealed source in the selected working position.

Subp. 79. **Exposure rate.** "Exposure rate" means the exposure per unit of time, such as roentgen per minute, milliroentgen per hour, sievert per minute, or millisievert per hour.

Subp. 80. **External dose.** "External dose" means that portion of the dose equivalent received from radiation sources outside the body.

Subp. 81. **Extremity.** "Extremity" means hand, elbow, arm below the elbow, foot, knee, or leg below the knee.

Subp. 82. **Field station.** "Field station" means a facility where licensed or registered material may be stored or used and from which equipment is dispatched to a temporary job site.

Subp. 83. **Filtering facepiece or dust mask.** "Filtering facepiece" or "dust mask" means a negative pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium, not equipped with elastomeric sealing surfaces and adjustable straps.

Subp. 84. **Fissile material.** "Fissile material" means the radionuclides plutonium-239, plutonium-241, uranium-233, uranium-235, or any combination of these radionuclides. Fissile material means the fissile nuclides themselves, not material containing fissile nuclides. Unirradiated natural uranium and depleted uranium and natural uranium or depleted uranium, that has been irradiated in thermal reactors only, are not included in this definition. Certain exclusions from fissile material controls are provided in parts 4731.0400 to 4731.0455.

Subp. 85. **Fit factor.** "Fit factor" means a quantitative estimate of the fit of a particular respirator to a specific individual and typically estimates the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn.

Subp. 86. **Fit test.** "Fit test" means the use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual.

Subp. 87. **Freshwater aquifer.** "Freshwater aquifer" means a geologic formation that is capable of yielding fresh water to a well or spring.

Subp. 88. **General license.** "General license" means a license that is provided by rule, grants authority to a person for certain activities involving radioactive material, and is effective without the filing of an application with the commissioner or the issuance of a licensing document to a particular person. The commissioner may require registration by the particular general licensee.

Subp. 89. **Geologic repository.** "Geologic repository" means a system that is intended to be used for, or may be used for, the disposal of radioactive wastes in excavated geologic media. Geologic repository includes:

- A. the geologic repository operations area; and
- B. the portion of the geologic setting that provides isolation of the radioactive waste.

Subp. 90. **Government agency.** "Government agency" means an executive department, commission, independent establishment, or corporation wholly or partly

owned by the United States or the state of Minnesota and which is an instrumentality of the United States or the state of Minnesota or a board, bureau, division, service, office, officer, authority, administration, or other establishment in the executive branch of federal government.

Subp. 90a. **Graphite.** "Graphite" means graphite with a boron equivalent content less than five parts per million and density greater than 1.5 grams per cubic centimeter.

Subp. 91. **Gray or Gy.** "Gray" or "Gy" is the SI unit of absorbed dose. One gray is equal to an absorbed dose of one joule/kilogram. One gray is also equal to 100 rads.

Subp. 92. **Guide tube or projection sheath.** "Guide tube" or "projection sheath" means a flexible or rigid tube, such as a "J" tube, for guiding the source assembly and the attached control cable from the exposure device to the exposure head. Guide tube or projection sheath includes the connections necessary for attachment to the exposure device and to the exposure head.

Subp. 93. **Hands-on experience.** "Hands-on experience" means experience in all of those areas considered to be directly involved in the industrial radiography process.

Subp. 94. **Hazardous waste.** "Hazardous waste" means those wastes designated as hazardous by the Environmental Protection Agency regulations in Code of Federal Regulations, title 40, part 261.

Subp. 95. **Helmet.** "Helmet" means a rigid respiratory inlet covering that also provides head protection against impact and penetration.

Subp. 96. **High dose-rate remote afterloader.** "High dose-rate remote afterloader" means a device that remotely delivers a dose rate in excess of 1,200 rads (12 Gy) per hour at the point or surface where the dose is prescribed.

Subp. 96a. **High integrity container or HIC.** "High integrity container" or "HIC" means a container commonly designed to meet the structural stability requirements of Code of Federal Regulations, title 10, section 61.56, and to meet the United States Department of Transportation requirements for a Type A package.

Subp. 97. **High radiation area.** "High radiation area" means an area, accessible to individuals, in which radiation levels from radiation sources external to the body could result in an individual receiving a dose equivalent in excess of 0.1 rem (1 mSv) in one hour at 30 centimeters from the radiation source or 30 centimeters from any surface that the radiation penetrates.

Subp. 98. **Hood.** "Hood" means a respiratory inlet covering that completely covers the head and neck and may also cover portions of the shoulders and torso.

Subp. 99. **Inadvertent intruder.** "Inadvertent intruder" means a person who might occupy a disposal site after closure and engage in normal activities, such as agriculture,

dwelling construction, or other pursuits in which the person might be unknowingly exposed to radiation from the waste.

Subp. 100. **Incident.** "Incident" means an occurrence or event that interrupts normal procedure or precipitates a crisis.

Subp. 101. **Individual.** "Individual" means a human being.

Subp. 102. **Individual monitoring.** "Individual monitoring" means:

A. the assessment of dose equivalent by the use of devices designed to be worn by an individual;

B. the assessment of committed effective dose equivalent by bioassay or by determination of the time-weighted air concentrations to which an individual has been exposed, such as derived air concentration-hours (DAC-hours); or

C. the assessment of dose equivalent by the use of survey data.

Subp. 103. **Individual monitoring devices.** "Individual monitoring devices" means devices designed to be worn by a single individual for the assessment of dose equivalent such as film badges, thermoluminescence dosimeters, pocket ionization chambers, or personal air sampling devices.

Subp. 104. **Industrial radiographer or radiographer.** "Industrial radiographer" or "radiographer" means an individual who performs or who, in attendance at the site where radiation exposure devices, sealed source, or sources are being used, personally supervises industrial radiographic operations and who is responsible to the licensee or registrant for ensuring compliance with the requirements of this chapter and the conditions of the license or registration.

Subp. 105. **Industrial radiographer certification or radiographer certification.** "Industrial radiographer certification" or "radiographer certification" means written approval received from a certifying entity stating that an individual has satisfactorily met certain established radiation safety, testing, and experience criteria.

Subp. 106. **Industrial radiographer's assistant or radiographer's assistant.** "Industrial radiographer's assistant" or "radiographer's assistant" means an individual who, under the direct supervision of a radiographer, uses radiographic exposure devices, sealed sources, or related handling tools or radiation survey instruments in industrial radiography.

Subp. 107. **Industrial radiography or radiography.** "Industrial radiography" or "radiography" means an examination of the structure of materials by nondestructive methods, utilizing ionizing radiation to make radiographic images.

Subp. 108. **Injection tool.** "Injection tool" means a device used for controlled subsurface injection of radioactive tracer material.

Subp. 109. **Internal dose.** "Internal dose" means that portion of the dose equivalent received from radioactive material taken into the body.

Subp. 110. **Intruder barrier.** "Intruder barrier" means a sufficient depth of cover over radioactive waste that inhibits contact with the waste and helps to ensure that radiation exposure to an inadvertent intruder meets the performance objectives in this chapter or an engineered structure that provides equivalent protection to an inadvertent intruder.

Subp. 111. **Irradiation.** "Irradiation" means the exposure of matter to ionizing radiation.

Subp. 112. **Irradiator.** "Irradiator" means a facility that uses radioactive sealed sources for the irradiation of objects or materials and in which radiation dose rates exceeding 500 rads (5 Gy) per hour exist at one meter from the sealed radioactive sources in air or water, as applicable for the irradiator type. Irradiator does not include facilities in which both the sealed source and the area subject to irradiation are contained within a device and are not accessible to personnel.

Subp. 113. **Irradiator operator.** "Irradiator operator" means an individual who has successfully completed the training and testing described in part 4731.6160 and is authorized by the terms of the license to operate the irradiator without a supervisor present.

Subp. 114. **Irretrievable well logging source.** "Irretrievable well logging source" means any sealed source containing licensed material that is pulled off or not connected to the wireline that suspends the source in the well and for which all reasonable effort at recovery has been expended.

Subp. 115. **Land disposal facility.** "Land disposal facility" means the land, buildings and structures, and equipment that are intended to be used for the disposal of radioactive wastes. A geologic repository is not a land disposal facility.

Subp. 116. **Lay-barge radiography.** "Lay-barge radiography" means industrial radiography performed on any water vessel used for laying pipe.

Subp. 117. **Lens dose equivalent or eye dose equivalent.** "Lens dose equivalent" or "eye dose equivalent" applies to the external exposure of the lens of the eye and is taken as the dose equivalent at a tissue depth of 0.3 centimeter (300 mg/cm^2).

Subp. 118. **License.** "License" means a license issued under this chapter.

Subp. 119. **Licensee.** "Licensee" means a person issued a license under this chapter.

Subp. 120. **Licensed material.** "Licensed material" means source material, special nuclear material, or radioactive material received, possessed, used, transferred, or disposed of under a general or specific license issued by the commissioner.

Subp. 121. **Licensed practitioner of the healing arts.** "Licensed practitioner of the healing arts" means a health professional for diagnostic or healing treatment of human and animal maladies who is licensed under Minnesota Statutes, chapter 147, 153, or 156, Minnesota Statutes, section 148.01 or 150A.05, subdivision 1, clause (4), or Minnesota Statutes 1961, sections 148.11 to 148.16, for the lawful practice of medicine, podiatry, veterinary medicine, chiropractic, dentistry, or osteopathy, respectively.

Subp. 121a. **Licensing state.** "Licensing state" means any state that has been finally designated as a licensing state by the Conference of Radiation Control Program Directors, Inc., which reviews state regulations to establish equivalency with the suggested state regulations and ascertains whether a state has an effective program for control of natural occurring or accelerator produced radioactive material (NARM). The conference will designate as licensing states those states with regulations for control of radiation relating to, and an effective program for, the regulatory control of NARM.

Subp. 122. **Logging assistant.** "Logging assistant" means an individual who, under the personal supervision of a logging supervisor, handles sealed sources or tracers that are not in logging tools or shipping containers or who performs surveys required under part 4731.7230.

Subp. 123. **Logging supervisor.** "Logging supervisor" means an individual who uses licensed material or provides personal supervision in the use of licensed material at a temporary job site and who is responsible to the licensee for ensuring compliance with this chapter and the conditions of the license.

Subp. 124. **Logging tool.** "Logging tool" means a device used subsurface to perform well logging.

Subp. 125. **Loose-fitting facepiece.** "Loose-fitting facepiece" means a respiratory inlet covering that is designed to form a partial seal with the face.

Subp. 126. **Lost or missing licensed material.** "Lost or missing licensed material" means licensed material, the location of which is unknown. Lost or missing licensed material includes material that has been shipped but has not reached its destination and for which the location cannot be readily traced in the transportation system.

Subp. 127. **Lot tolerance percent defective.** "Lot tolerance percent defective" means, expressed in percent defective, the poorest quality in an individual inspection lot that should be accepted.

Subp. 128. **Low dose-rate remote afterloader.** "Low dose-rate remote afterloader" means a brachytherapy device that remotely delivers a dose rate of less than or equal to 200 rads (2 Gy) per hour at the point or surface where the dose is prescribed.

Subp. 129. **Low specific activity material or LSA.** "Low specific activity material" or "LSA" means radioactive material with limited specific activity which is nonfissile or is

excepted under part 4731.0403, subpart 3, and that satisfies the descriptions and limits in subpart 130, 131, or 132. Shielding materials surrounding the LSA material may not be considered in determining the estimated average specific activity of the package contents. LSA material must be in group I, group II, or group III.

Subp. 130. **Low specific activity material group I.** "Low specific activity material group I" means:

A. uranium and thorium ores, concentrates of uranium and thorium ores, and other ores containing naturally occurring radioactive radionuclides which are not intended to be processed for the use of these radionuclides;

B. solid unirradiated natural uranium or depleted uranium or natural thorium or their solid or liquid compounds or mixtures;

C. radioactive material for which the A_2 value is unlimited; or

D. other radioactive material in which the activity is distributed throughout and the estimated average specific activity does not exceed 30 times the value for exempt material activity concentration determined according to part 4731.0423.

Subp. 131. **Low specific activity material group II.** "Low specific activity material group II" means:

A. water with tritium concentration up to 20.0 Ci/liter (0.8 TBq/liter); or

B. other material in which the activity is distributed throughout and the average specific activity does not exceed $10^{-4} A_2/\text{g}$ for solids and gases or $10^{-5} A_2/\text{g}$ for liquids.

Subp. 132. **Low specific activity material group III.** "Low specific activity material group III" means solids, such as consolidated wastes and activated materials, excluding powders, that satisfy the requirements in Code of Federal Regulations, title 10, section 71.77, in which:

A. the radioactive material is distributed throughout a solid or a collection of solid objects or is essentially uniformly distributed in a solid compact binding agent such as concrete, bitumen, or ceramic;

B. the radioactive material is relatively insoluble or it is intrinsically contained in a relatively insoluble material, so that even under loss of packaging, the loss of radioactive material per package by leaching, when placed in water for seven days, would not exceed $0.1 A_2$; and

C. the estimated average specific activity of the solid does not exceed $2 \times 10^{-3} A_2/\text{g}$.

Subp. 133. **Low toxicity alpha emitters.** "Low toxicity alpha emitters" means:

A. natural uranium, depleted uranium, natural thorium;

B. uranium-235, uranium-238, thorium-232, thorium-228, or thorium-230 when contained in ores or physical or chemical concentrates or tailings; or

C. alpha emitters with a half-life of less than ten days.

Subp. 134. **Management.** "Management" means the chief executive officer or other individual having the authority to manage, direct, or administer a licensee's activities or the delegate of a chief executive officer or other individual having the authority to manage, direct, or administer a licensee's activities.

Subp. 135. **Manual brachytherapy.** "Manual brachytherapy" means a type of brachytherapy in which the brachytherapy sources are manually placed topically on or inserted either into the body cavities that are in close proximity to a treatment site or directly into the tissue volume.

Subp. 136. **Maximum normal operating pressure.** "Maximum normal operating pressure" means the maximum gauge pressure that would develop in a containment system in a period of one year under the heat condition specified in Code of Federal Regulations, title 10, section 71.71, paragraph (c), clause (1), in the absence of venting, external cooling by an ancillary system, or operational controls during transport.

Subp. 137. **Medical event.** "Medical event" means an event that requires a report under part 4731.4525.

Subp. 138. **Medical institution.** "Medical institution" means an organization in which more than one medical discipline is practiced.

Subp. 139. **Medical use.** "Medical use" means the intentional internal or external administration of radioactive material or the radiation from radioactive material to patients or human research subjects under the supervision of an authorized user.

Subp. 140. **Medium dose-rate remote afterloader.** "Medium dose-rate remote afterloader" means a brachytherapy device that remotely delivers a dose rate of greater than 200 rads (2 Gy), but less than or equal to 1,200 rads (12 Gy) per hour at the point or surface where the dose is prescribed.

Subp. 141. **Member of the public.** "Member of the public" means an individual other than an individual receiving an occupational dose.

Subp. 142. **Microcurie or μCi .** "Microcurie" or " μCi " means the amount of radioactive material that disintegrates at the rate of 37,000 atoms per second.

Subp. 143. **Millicurie or mCi.** "Millicurie" or "mCi" means the amount of radioactive material that disintegrates at the rate of 37,000,000 atoms per second.

Subp. 144. **Minor.** "Minor" means an individual less than 18 years of age.

Subp. 145. **Mobile medical service.** "Mobile medical service" means the transportation of radioactive materials and its medical use by the same licensee or registrant at a client's address.

Subp. 146. **Monitoring.** "Monitoring" means:

A. the measurement of radiation levels, concentrations, surface area concentrations, or quantities of radioactive material; and

B. the use of the results of the measurements to evaluate potential exposures and doses.

Subp. 147. **National Voluntary Laboratory Accreditation Program or NVLAP.** "National Voluntary Laboratory Accreditation Program" or "NVLAP" is the laboratory accreditation program of the National Institute of Standards and Technology.

Subp. 147a. **Nationally tracked source.** "Nationally tracked source" means a sealed source containing a quantity equal to or greater than Category 1 or Category 2 levels of any radioactive material listed in part 4731.2820. In this context, a sealed source is defined as radioactive material that is sealed in a capsule or closely bonded, in a solid form, and which is not exempt from regulatory control. It does not mean material encapsulated solely for disposal, or nuclear material contained in any fuel assembly, subassembly, fuel rod, or fuel pellet. Category 1 nationally tracked sources are those containing radioactive material at a quantity equal to or greater than the Category 1 threshold. Category 2 nationally tracked sources are those containing radioactive material at a quantity equal to or greater than the Category 2 threshold but less than the Category 1 threshold.

Subp. 148. **Natural thorium.** "Natural thorium" means thorium with the naturally occurring distribution of thorium isotopes, essentially 100 weight percent thorium-232.

Subp. 149. **Natural uranium.** "Natural uranium" means uranium with the naturally occurring distribution of uranium isotopes, approximately 0.711 weight percent uranium-235, and the remainder by weight essentially uranium-238.

Subp. 150. **Naturally occurring or accelerator-produced radioactive material or NARM.** "Naturally occurring or accelerator-produced radioactive material" or "NARM" does not include by-product, source, or special nuclear material.

Subp. 151. **Negative pressure respirator (tight fitting).** "Negative pressure respirator (tight fitting)" means a respirator in which the air pressure inside the facepiece is negative during inhalation with respect to the ambient air pressure outside the respirator.

Subp. 152. **Neutron generator.** "Neutron generator" means a type of accelerator in which the ion beam is used mainly for the production of neutrons. Neutron generation is also possible for high energy photon-producing equipment.

Subp. 153. **Nonstochastic effect or deterministic effect.** "Nonstochastic effect" or "deterministic effect" means a health effect, the severity of which varies with the dose and for which a threshold is believed to exist. Radiation-induced cataract formation is an example of a nonstochastic effect.

Subp. 154. **Normal form radioactive material.** "Normal form radioactive material" means radioactive material that has not been demonstrated to qualify as special form radioactive material.

Subp. 154a. **NRC.** "NRC" means the United States Nuclear Regulatory Commission.

Subp. 155. **Occupational dose.** "Occupational dose" means the dose received by an individual in the course of employment in which the individual's assigned duties involve exposure to radiation or to radioactive material from registered, licensed, or unlicensed sources of radiation, whether in the possession of a licensee, registrant, or other person. Occupational dose does not include doses received:

- A. from background radiation;
- B. from any medical administration the individual has received;
- C. from exposure to individuals administered radioactive materials and released according to part 4731.4427;
- D. from voluntary participation in medical research programs; or
- E. as a member of the public.

Subp. 156. **Offshore platform radiography.** "Offshore platform radiography" means industrial radiography conducted from a platform over a body of water.

Subp. 157. **Offshore waters.** "Offshore waters" means that area of land and water on or above the United States outer continental shelf and beyond the jurisdiction of an agreement state according to the Submerged Lands Act, United States Code, title 43, sections 1301 to 1314.

Subp. 158. **Output.** "Output" means the exposure rate, dose rate, or a quantity related in a known manner to these rates from a brachytherapy source, teletherapy remote afterloader, or gamma stereotactic radiosurgery unit for a specified set of exposure conditions.

Subp. 159. **Package.** "Package" means the packaging together with its radioactive contents as presented for transport.

A. "Fissile material package" or "Type AF package, Type BF package, Type B(U)F package, or Type B(M)F package" means a fissile material packaging together with its fissile material contents.

B. "Type A package" means a Type A packaging together with its radioactive contents. A Type A package is defined and must comply with DOT regulations in Code of Federal Regulations, title 49, part 173.

C. "Type B package" means a Type B packaging together with its radioactive contents. On approval, a Type B package design is designated by the NRC as B(U) unless the package has a maximum normal operating pressure of more than 100 lb/in² (700 kPascal) gauge or a pressure relief device that would allow the release of radioactive material to the environment under the tests specified in Code of Federal Regulations, title 10, section 71.73, for hypothetical accident conditions, in which case it will receive a designation B(M). B(U) refers to the need for unilateral approval of international shipments. B(M) refers to the need for multilateral approval of international shipments. There is no distinction made in how packages with these designations may be used in domestic transportation. To determine their distinction for international transportation, see DOT regulations in Code of Federal Regulations, title 49, part 173. A Type B package approved before September 6, 1983, was designated only as Type B. Limitations on its use are specified in Code of Federal Regulations, title 10, section 71.19.

Subp. 160. **Packaging.** "Packaging" means the assembly of components necessary to ensure compliance with the packaging requirements in this chapter. Packaging may consist of one or more receptacles, absorbent materials, spacing structures, thermal insulation, radiation shielding, and devices for cooling or absorbing mechanical shocks. The vehicle, tie-down system, and auxiliary equipment may be designated as part of the packaging.

Subp. 161. **Panoramic dry-source-storage irradiator.** "Panoramic dry-source-storage irradiator" means an irradiator in which the irradiations occur in air in areas potentially accessible to personnel and in which the sources are stored in shields made of solid material. Panoramic dry-source-storage irradiator includes beam-type dry-source-storage irradiators in which only a narrow beam of radiation is produced for performing irradiations.

Subp. 162. **Panoramic irradiator.** "Panoramic irradiator" means an irradiator in which the irradiations occur in air in areas potentially accessible to personnel. Panoramic irradiator includes beam-type irradiators.

Subp. 163. **Panoramic wet-source-storage irradiator.** "Panoramic wet-source-storage irradiator" means an irradiator in which the irradiations occur in air in areas potentially accessible to personnel and in which the sources are stored under water in a storage pool.

Subp. 163a. **Particle accelerator.** "Particle accelerator" means any machine capable of accelerating electrons, protons, deuterons, or other charged particles in a vacuum and of discharging the resultant particulate or other radiation into a medium at energies usually in

excess of one megaelectron volt (MeV). For purposes of this definition, "accelerator" is an equivalent term.

Subp. 164. **Patient intervention.** "Patient intervention" means actions by the patient or human research subject, whether intentional or unintentional, such as dislodging or removing treatment devices or prematurely terminating the administration.

Subp. 165. **Permanent radiographic installation.** "Permanent radiographic installation" means a shielded, enclosed room, cell, vault, or structure that is not moved, is not located at a temporary job site, and is designed or intended for radiography where radiography is regularly performed.

Subp. 166. **Person.** "Person" means an individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, agency, state or political subdivision of a state, or a legal successor, representative, agent, or agency of the foregoing. Person does not include federal government agencies.

Subp. 167. **Personal supervision.** "Personal supervision" means guidance and instruction by an industrial radiographer or logging supervisor who:

- A. is physically present at a temporary job site;
- B. is in personal contact with an industrial radiographer's assistant or logging assistant; and
- C. can give immediate assistance.

Subp. 168. **Pharmacist.** "Pharmacist" means an individual licensed by a state or territory of the United States, the District of Columbia, or the Commonwealth of Puerto Rico to practice pharmacy.

Subp. 169. **Planned special exposure.** "Planned special exposure" means an infrequent exposure to radiation, separate from and in addition to the annual dose limits.

Subp. 170. **Pool irradiator.** "Pool irradiator" means an irradiator at which the sources are stored or used in a pool of water, including panoramic wet-source-storage irradiators and underwater irradiators.

Subp. 171. **Positive pressure respirator.** "Positive pressure respirator" means a respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.

Subp. 171a. **Positron emission tomography (PET) radionuclide production facility.** "Positron emission tomography (PET) radionuclide production facility" is defined as a facility operating a cyclotron or accelerator for the purpose of producing PET radionuclides.

Subp. 172. **Powered air-purifying respirator.** "Powered air-purifying respirator" means an air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.

Subp. 173. **Practical examination.** "Practical examination" means a demonstration through practical application of the safety rules and principles in industrial radiography, including use of all appropriate equipment and procedures.

Subp. 174. **Preceptor.** "Preceptor" means an individual who provides, directs, or verifies the training and experience required for an individual to become an authorized user, an authorized medical physicist, an authorized nuclear pharmacist, or a radiation safety officer.

Subp. 175. **Prescribed dosage.** "Prescribed dosage" means the specified activity or range of activity of unsealed radioactive material as documented:

- A. in a written directive; or
- B. according to the directions of the authorized user for procedures performed according to parts 4731.4432 and 4731.4434.

Subp. 176. **Prescribed dose.** "Prescribed dose" means:

- A. for gamma stereotactic radiosurgery, the total dose as documented in a written directive;
- B. for teletherapy, the total dose and dose per fraction as documented in a written directive;
- C. for manual brachytherapy, either the total source strength and exposure time or the total dose, as documented in a written directive; and
- D. for remote brachytherapy afterloaders, the total dose and dose per fraction as documented in a written directive.

Subp. 177. **Pressure demand respirator.** "Pressure demand respirator" means a positive pressure atmosphere-supplying respirator that admits breathing air to the facepiece when the positive pressure is reduced inside the facepiece by inhalation.

Subp. 178. **Principal activities.** "Principal activities" means activities authorized by the license that are essential to achieving the purpose for which the license was issued or amended. Principal activities does not include storage during which no licensed material is accessed for use or disposal or activities incidental to decontamination or decommissioning.

Subp. 179. **Product conveyor system.** "Product conveyor system" means a system for moving the product to be irradiated to, from, and within the area where irradiation takes place. Product conveyor system does not include a hand fed system.

Subp. 180. **Public dose.** "Public dose" means the dose received by a member of the public from exposure to radiation or radioactive material released by a licensee or registrant or to any other source of radiation under the control of a licensee or registrant. Public dose does not include occupational dose or doses received from background radiation, from any medical administration the individual has received, from exposure to individuals administered radioactive material and released according to part 4731.4427, or from voluntary participation in medical research programs.

Subp. 181. **Pulsed dose-rate remote afterloader.** "Pulsed dose-rate remote afterloader" means a special type of remote afterloading brachytherapy device that uses a single source capable of delivering dose rates in the high dose-rate range, but:

A. is approximately one-tenth of the activity of typical high dose-rate remote afterloader sources; and

B. is used to simulate the radiobiology of a low dose-rate treatment by inserting the source for a given fraction of each hour.

Subp. 182. **Qualitative fit test.** "Qualitative fit test" means a pass or fail fit test to assess the adequacy of respirator fit that relies on the individual's response to the test agent.

Subp. 183. **Quality factor.**

A. "Quality factor" means the modifying factor that is used to derive dose equivalent from absorbed dose, as follows:

Type of radiation	Quality factor	Absorbed dose equal to a unit dose equivalent ^a
	(Q)	
X-, gamma, or beta radiation	1	1
Alpha particles, multiple-charged particles, fission fragments, and heavy particles of unknown charge	20	0.05
Neutrons of unknown energy	10	0.1
High-energy protons	10	0.1

^aAbsorbed dose in rad equal to one rem or the absorbed dose in gray equal to one sievert.

B. If it is more convenient to measure the neutron fluence rate than to determine the neutron dose equivalent rate in rems per hour or sieverts per hour, one rem (0.01 Sv) of neutron radiation of unknown energies may, for purposes of this subpart, be assumed to result from a total fluence of 25 million neutrons per square centimeter incident upon the body. If sufficient information exists to estimate the approximate energy distribution of the

neutrons, a licensee may use the fluence rate per unit dose equivalent or the appropriate Q value as follows to convert a measured tissue dose in rads to dose equivalent in rems.

Neutron energy (MeV)	Quality factor ^a (Q)	Fluence per unit dose equivalent ^b (neutrons cm ⁻² rem ⁻¹)
2.5×10^{-8}	2	980×10^6
1×10^{-7}	2	980×10^6
1×10^{-6}	2	810×10^6
1×10^{-5}	2	810×10^6
1×10^{-4}	2	840×10^6
1×10^{-3}	2	980×10^6
1×10^{-2}	2.5	1010×10^6
1×10^{-1}	7.5	170×10^6
5×10^{-1}	11	39×10^6
1	11	27×10^6
2.5	9	29×10^6
5	8	23×10^6
7	7	24×10^6
10	6.5	24×10^6
14	7.5	17×10^6
20	8	16×10^6
40	7	14×10^6
60	5.5	16×10^6
1×10^2	4	20×10^6
2×10^2	3.5	19×10^6
3×10^2	3.5	16×10^6
4×10^2	3.5	14×10^6

^aValue of quality factor (Q) at the point where the dose equivalent is maximum in a 30-cm diameter cylinder tissue-equivalent phantom.

^bMonoenergetic neutrons incident normally on a 30-cm diameter cylinder tissue-equivalent phantom.

Subp. 184. **Quantitative fit test.** "Quantitative fit test" means an assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.

Subp. 185. **Quarter.** "Quarter" means a period of time equal to one-fourth of the year observed by the licensee or registrant, approximately 13 consecutive weeks, provided that the first quarter in a year coincides with the starting date of the year and that no day is omitted or duplicated in consecutive quarters.

Subp. 186. **Rad.** "Rad" is the special unit of absorbed dose. One rad is equal to an absorbed dose of 100 ergs/gram or 0.01 joule/kilogram (0.01 Gy).

Subp. 187. **Radiation.** "Radiation" means the emission and propagation of waves or alpha particles, beta particles, gamma rays, x-rays, neutrons, high-speed electrons, high-speed protons, and other particles capable of producing ions. Radiation does not include nonionizing radiation such as radio or microwaves or visible, infrared, or ultraviolet light.

Subp. 188. **Radiation area.** "Radiation area" means an area accessible to individuals in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.005 rem (0.05 mSv) in one hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.

Subp. 189. **Radiation detector or detector.** "Radiation detector" or "detector" means a device that in the presence of radiation provides a signal or other indication suitable for use in measuring one or more quantities of incident radiation.

Subp. 190. **Radiation hazard.** "Radiation hazard" means a condition under which individuals might receive radiation in excess of the dose limits.

Subp. 191. **Radiation protection.** "Radiation protection" means the use of shielding, protective clothing, protective equipment, and other means to eliminate or reduce exposure to ionizing radiation.

Subp. 192. **Radiation room.** "Radiation room" means a shielded room in which irradiations take place.

Subp. 193. **Radiation safety officer or RSO.** "Radiation safety officer" or "RSO" is an individual who:

A. has the training, knowledge, authority, and responsibility to apply appropriate radiation protection regulations according to part 4731.4130 on behalf of the licensee; or

B. meets the requirements in part 4731.4411, subpart 1, item A, or parts 4731.4411, subpart 1, item C, and 4731.4415 or is identified as a radiation safety officer on:

(1) a specific medical use license issued by the commissioner, the NRC, or an agreement state; or

(2) a medical use permit issued by an NRC master material licensee.

Subp. 194. **Radioactive marker.** "Radioactive marker" means licensed material used for depth determination or direction orientation. Radioactive marker includes radioactive collar markers and radioactive iron nails.

Subp. 195. **Radioactive material.** "Radioactive material" means a solid, liquid, or gaseous substance that emits radiation spontaneously.

Subp. 196. **Radioactive waste or waste.** "Radioactive waste" or "waste" means those low-level radioactive wastes containing source, special nuclear, or byproduct material that are acceptable for disposal in a land disposal facility. For the purposes of this definition, low-level radioactive waste means radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or byproduct material as defined in subpart 32, items B, C, and D.

Subp. 197. **Radiographic exposure device.** "Radiographic exposure device" means an instrument containing a sealed source, fastened or contained therein, in which the sealed source or shielding thereof may be moved, or otherwise changed, from a shielded to an unshielded position for purposes of making a radiographic exposure.

Subp. 198. **Radiographic operations.** "Radiographic operations" means all activities associated with the presence of radiation sources in a radiographic exposure device, including x-ray radiographic devices, during use of the device or transport, except when being transported by a common or contract transport. Radiographic operations include surveys to confirm the adequacy of boundaries, setting up equipment, and any activity inside restricted area boundaries.

Subp. 199. **Reference man.** "Reference man" means a hypothetical aggregation of human physical and physiological characteristics arrived at by international consensus. The characteristics may be used by researchers and public health workers to standardize results of experiments and to relate biological insult to a common base.

Subp. 200. **Registrant.** "Registrant" means a person or facility registered with the commissioner or legally obligated to register with the commissioner according to this chapter.

Subp. 201. **Rem.** "Rem" is the special unit of any of the quantities expressed as dose equivalent. The dose equivalent in rems is equal to the absorbed dose in rads multiplied by the quality factor (1 rem = 0.01 sievert).

Subp. 202. **Research and development.** "Research and development" means:

- A. theoretical analysis, exploration, or experimentation; or
- B. the extension of investigative findings and theories of a scientific or technical nature into practical application for experimental and demonstration purposes, including the experimental production and testing of models, devices, equipment, materials, and processes.

Research and development does not include the internal or external administration of radioactive material, or the radiation therefrom, to human beings, unless the research using human subjects is conducted according to part 4731.4401.

Subp. 203. **Residual radioactivity.** "Residual radioactivity" means radioactivity in structures, materials, soils, groundwater, and other media at a site resulting from activities under a licensee's or registrant's control. Residual radioactivity includes radioactivity from all licensed and unlicensed sources used by the licensee or registrant, but excludes background radiation. Residual radioactivity includes radioactive materials remaining at a site as a result of routine or accidental releases of radioactive material at the site and previous burials at the site, even if those burials were made according to this chapter.

Subp. 204. **Respiratory protective device.** "Respiratory protective device" means an apparatus, such as a respirator, used to reduce an individual's intake of airborne radioactive materials.

Subp. 205. **Restricted area.** "Restricted area" means an area, access to which is limited by a licensee or registrant to protect individuals against undue risks from exposure to radiation and radioactive materials. Restricted area does not include areas used as residential quarters, but includes separate rooms in a residential building that are set apart as a restricted area.

Subp. 206. **Roentgen or R.** "Roentgen" or "R" is a special unit of exposure equal to 2.58×10^{-4} coulomb per kilogram of air. One milliroentgen (mR) equals 0.001 roentgen.

Subp. 207. **S-tube.** "S-tube" means a tube through which the radioactive source travels when inside a radiographic exposure device.

Subp. 208. **Sanitary sewerage.** "Sanitary sewerage" means a system of public sewers for carrying off waste water and refuse, but excluding sewage treatment facilities, septic tanks, and leach fields owned or operated by a licensee.

Subp. 209. **Sealed source.** "Sealed source" means radioactive material that is encased in a capsule designed to prevent leakage or escape of the radioactive material.

Subp. 210. **Sealed source and device registry.** "Sealed source and device registry" means the national registry that contains all the registration certificates, generated by both

the NRC and agreement states, that summarize the radiation safety information for sealed sources and devices and describe the licensing and use conditions approved for the product.

Subp. 211. **Self-contained breathing apparatus.** "Self-contained breathing apparatus" means an atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user.

Subp. 212. **Shallow dose equivalent or H_s .** "Shallow dose equivalent" or " H_s " means the dose equivalent at a tissue depth of 0.007 centimeter (7 mg/cm^2) averaged over an area of one square centimeter. Shallow dose equivalent applies to the external exposure of the skin or an extremity.

Subp. 213. **Shielded position.** "Shielded position" means the location within the radiographic exposure device or source changer where the sealed source is secured and restricted from movement.

Subp. 214. **SI.** "SI" means the international system of units.

Subp. 215. **Sievert or Sv.** "Sievert" or "Sv" is the SI unit of any of the quantities expressed as dose equivalent. The dose equivalent in sieverts is equal to the absorbed dose in grays multiplied by the quality factor identified in subpart 183 ($1 \text{ Sv} = 100 \text{ rems}$).

Subp. 216. **Site area emergency.** "Site area emergency" means a situation in which events may occur, are in progress, or have occurred that could lead to a significant release of radioactive material and that could require a response by off-site response organizations to protect persons off-site.

Subp. 217. **Site boundary.** "Site boundary" means the line beyond which the land or property is not owned, leased, or otherwise controlled by the licensee.

Subp. 218. **Source.** "Source" means a discrete amount of radioactive material.

Subp. 219. **Source assembly.** "Source assembly" means an assembly that consists of the sealed source and a connector that attaches the source to the control cable. The source assembly may also include a stop ball used to secure the source in the shielded position.

Subp. 220. **Source changer.** "Source changer" means a device designed and used for replacement of sealed sources in radiographic exposure devices, including those also used for transporting and storage of sealed sources.

Subp. 221. **Source holder.** "Source holder" means a housing or assembly into which a sealed source is placed to facilitate the handling and use of the source in well logging.

Subp. 222. **Source material.** "Source material" means:

A. uranium, thorium, or any combination thereof, in any physical or chemical form; or

B. ores that contain by weight 1/20 of one percent (0.05 percent) or more of:

- (1) uranium;
- (2) thorium; or
- (3) any combination thereof.

Source material does not include special nuclear material.

Subp. 223. **Source of radiation.** "Source of radiation" means radioactive material, a device, or equipment that emits, or is capable of producing, radiation.

Subp. 224. **Special form radioactive material.** "Special form radioactive material" means radioactive material that satisfies the following conditions:

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

B. the piece or capsule has at least one dimension not less than 0.2 inches (5 mm); and

C. it satisfies the requirements of Code of Federal Regulations, title 10, section 71.75. A special form encapsulation designed according to Code of Federal Regulations, title 10, section 71.4, in effect on June 30, 1983, and constructed before July 1, 1985, and a special form encapsulation designed according to Code of Federal Regulations, title 10, section 71.4, in effect on March 31, 1996, and constructed before April 1, 1998, may continue to be used. Any other special form encapsulation must meet the specifications of this subpart.

Subp. 225. **Special nuclear material.** "Special nuclear material" means:

A. plutonium, uranium-233, uranium enriched in the isotope 233 or in the isotope 235, and any other material the NRC, under the Atomic Energy Act of 1954, as amended, United States Code, title 42, section 2071, determines to be special nuclear material; or

B. any material artificially enriched by a material listed in item A.

Special nuclear material does not include source material.

Subp. 226. **Specific activity.** "Specific activity" means the radioactivity of the radionuclide per unit mass of that nuclide. The specific activity of a material in which the radionuclide is essentially uniformly distributed is the radioactivity per unit mass of the material.

Subp. 227. **Stereotactic radiosurgery.** "Stereotactic radiosurgery" means the use of external radiation in conjunction with a stereotactic guidance device to very precisely deliver a dose to a tissue volume. Use of a gamma knife is stereotactic radiosurgery.

Subp. 228. **Stochastic effect.** "Stochastic effect" means a health effect that occurs randomly and for which the probability of the effect occurring, rather than its severity, is assumed to be a linear function of dose without threshold, such as hereditary effects and cancer incidence.

Subp. 229. **Storage area.** "Storage area" means a location, facility, or vehicle that is used to store or secure a radiographic exposure device, a storage container, or a sealed source when it is not in use and that is locked or has a physical barrier to prevent accidental exposure to, tampering with, or unauthorized removal of the device, container, or source.

Subp. 230. **Storage container.** "Storage container" means a container in which sealed sources are secured and stored.

Subp. 231. **Structured educational program.** "Structured educational program" means an educational program designed to impart particular knowledge and practical education through interrelated studies and supervised training.

Subp. 232. **Subsurface tracer study.** "Subsurface tracer study" means the release of unsealed licensed material or a substance labeled with licensed material in a single well or boring to trace the movement or position of the material or substance in the well, boring, or adjacent formation.

Subp. 233. **Supplied-air respirator or airline respirator.** "Supplied-air respirator" or "airline respirator" means an atmosphere-supplying respirator for which the source of breathing air is not designed to be carried by the user.

Subp. 234. **Surface casing for protecting freshwater aquifers.** "Surface casing for protecting freshwater aquifers" means a pipe or tube used as a lining in a well or boring to isolate freshwater aquifers from the well or boring.

Subp. 235. **Surface contaminated object or SCO.** "Surface contaminated object" or "SCO" means a solid object that is not itself classed as radioactive material, but that has radioactive material distributed on any of its surfaces. SCO must be in one of two groups, with surface activity not exceeding the following limits:

A. SCO-I is a solid object on which:

(1) the nonfixed contamination on the accessible surface averaged over 300 cm², or the area of the surface if less than 300 cm², does not exceed:

(a) 10^{-4} μCi/cm² (4 Bq/cm²) for beta and gamma and low toxicity alpha emitters; or

(b) 10^{-5} μCi/cm² (0.4 Bq/cm²) for all other alpha emitters;

(2) the fixed contamination on the accessible surface averaged over 300 cm^2 , or the area of the surface if less than 300 cm^2 , does not exceed:

(a) $1.0\text{ }\mu\text{Ci/cm}^2$ ($4 \times 10^4\text{ Bq/cm}^2$) for beta and gamma and low toxicity alpha emitters; or

(b) $0.1\text{ }\mu\text{Ci/cm}^2$ ($4 \times 10^3\text{ Bq/cm}^2$) for all other alpha emitters; and

(3) the nonfixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm^2 , or the area of the surface if less than 300 cm^2 , does not exceed:

(a) $1.0\text{ }\mu\text{Ci/cm}^2$ ($4 \times 10^4\text{ Bq/cm}^2$) for beta and gamma and low toxicity alpha emitters; or

(b) $0.1\text{ }\mu\text{Ci/cm}^2$ ($4 \times 10^3\text{ Bq/cm}^2$) for all other alpha emitters; and

B. SCO-II is a solid object on which the limits for SCO-I are exceeded and on which:

(1) the nonfixed contamination on the accessible surface averaged over 300 cm^2 , or the area of the surface if less than 300 cm^2 , does not exceed:

(a) $10^{-2}\text{ }\mu\text{Ci/cm}^2$ (400 Bq/cm^2) for beta and gamma and low toxicity alpha emitters; or

(b) $10^{-3}\text{ }\mu\text{Ci/cm}^2$ (40 Bq/cm^2) for all other alpha emitters;

(2) the fixed contamination on the accessible surface averaged over 300 cm^2 , or the area of the surface if less than 300 cm^2 , does not exceed:

(a) $20\text{ }\mu\text{Ci/cm}^2$ ($8 \times 10^5\text{ Bq/cm}^2$) for beta and gamma and low toxicity alpha emitters; or

(b) $2\text{ }\mu\text{Ci/cm}^2$ ($8 \times 10^4\text{ Bq/cm}^2$) for all other alpha emitters; and

(3) the nonfixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm^2 , or the area of the surface if less than 300 cm^2 , does not exceed:

(a) $20\text{ }\mu\text{Ci/cm}^2$ ($8 \times 10^5\text{ Bq/cm}^2$) for beta and gamma and low toxicity alpha emitters; or

(b) $2\text{ }\mu\text{Ci/cm}^2$ ($8 \times 10^4\text{ Bq/cm}^2$) for all other alpha emitters.

Subp. 236. **Survey or radiation safety survey.** "Survey" or "radiation safety survey" means an evaluation of the radiological conditions and potential hazards incident to the production, use, transfer, release, disposal, or presence of radioactive material or other sources of radiation. When appropriate, such an evaluation includes a physical survey of the

location of radioactive material or other radiation sources and measurements or calculations of levels of radiation or concentrations or quantities of radioactive material present.

Subp. 237. **Target.** "Target" means the part of a radiation-producing system that by design intercepts a beam of accelerated particles with subsequent emission of other radiation.

Subp. 238. **Teletherapy.** "Teletherapy" means a method of radiation therapy in which collimated gamma rays are delivered at a distance from the patient or human research subject.

Subp. 239. **Temporary job site.** "Temporary job site" means a location where licensed operations are conducted and where licensed or registered material may be stored, other than those locations of use authorized on the license or registration.

Subp. 240. **Therapeutic dosage.** "Therapeutic dosage" means a dosage of unsealed radioactive material that is intended to deliver a radiation dose to a patient or human research subject for palliative or curative treatment.

Subp. 241. **Therapeutic dose.** "Therapeutic dose" means a radiation dose delivered from a source containing radioactive material to a patient or human research subject for palliative or curative treatment.

Subp. 242. **Tight-fitting facepiece.** "Tight-fitting facepiece" means a respiratory inlet covering that forms a complete seal with the face.

Subp. 243. **Total effective dose equivalent or TEDE.** "Total effective dose equivalent" or "TEDE" means the sum of the effective dose equivalent for external exposures and the committed effective dose equivalent for internal exposures.

Subp. 244. **Traceable to a standard.** "Traceable to a standard" means a comparison directly to a standard maintained by the National Institute of Standards and Technology, provided that all comparisons are documented.

Subp. 245. **Transient shipment.** "Transient shipment" means a shipment of nuclear material originating and terminating in foreign countries on a vessel or aircraft that stops at a United States port.

Subp. 246. **Transport index.** "Transport index" means the dimensionless number, rounded up to the next tenth, placed on the label of a package to designate the degree of control to be exercised by the carrier during transportation. The transport index is the number determined by multiplying the maximum radiation level in millisievert (mSv) per hour at 3.3 feet (one meter) from the external surface of the package by 100 (equivalent to the maximum radiation level in millirem per hour at 3.3 feet (one meter)).

Subp. 247. **Treatment site.** "Treatment site" means the anatomical description of the tissue intended to receive a radiation dose, as described in a written directive.

Subp. 248. **Tritium neutron generator target source.** "Tritium neutron generator target source" means a tritium source used within a neutron generator tube to produce neutrons for use in well logging applications.

Subp. 249. **Type A quantity.** "Type A quantity" means a quantity of radioactive material, the aggregate radioactivity of which does not exceed A_1 for special form radioactive material or A_2 for normal form radioactive material where A_1 and A_2 are given in part 4731.0422 or determined by procedures described in part 4731.0423.

Subp. 250. **Type B quantity.** "Type B quantity" means a quantity of radioactive material greater than a Type A quantity.

Subp. 251. **Type of use.** "Type of use" means use of radioactive material under part 4731.4404, 4731.4432, 4731.4434, 4731.4440, 4731.4450, 4731.4460, or 4731.4463.

Subp. 252. **Underwater irradiator.** "Underwater irradiator" means an irradiator in which the sources always remain shielded under water and humans do not have access to the sealed sources or the space subject to irradiation without entering the pool.

Subp. 253. **Underwater radiography.** "Underwater radiography" means industrial radiography performed when the radiographic exposure device or related equipment are beneath the surface of the water.

Subp. 253a. **Unirradiated uranium.** "Unirradiated uranium" means uranium containing not more than 2×10^3 Bq of plutonium per gram of uranium-235, not more than 9×10^6 Bq of fission products per gram of uranium-235, and not more than 5×10^{-3} gram of uranium-236 per gram of uranium-235.

Subp. 254. **Unit dosage.** "Unit dosage" means a dosage prepared for medical use in a single patient or human research subject without any further manipulations of the dosage after it is initially prepared.

Subp. 255. **Unrefined and unprocessed ore.** "Unrefined and unprocessed ore" means ore in its natural form prior to any processing, such as grinding, roasting, or beneficiating, or refining.

Subp. 256. **Unrestricted area.** "Unrestricted area" means an area, the access to which is neither limited nor controlled by the licensee or registrant.

Subp. 257. **Uranium sinker bar.** "Uranium sinker bar" means a weight containing depleted uranium used to pull a logging tool toward the bottom of a well.

Subp. 258. **User seal check or fit check.** "User seal check" or "fit check" means an action by the respirator user to determine if the respirator is properly seated to the face, including a negative pressure check, positive pressure check, irritant smoke check, or isoamyl acetate check.

Subp. 259. **Very high radiation area.** "Very high radiation area" means an area accessible to individuals in which radiation levels from radiation sources external to the body could result in an individual receiving an absorbed dose in excess of 500 rads (5 Gy) in one hour at one meter from a radiation source or one meter from any surface that the radiation penetrates. At very high doses received at high dose rates, units of absorbed dose (rads and grays) are appropriate, rather than units of dose equivalent (rems and sieverts).

Subp. 260. **Week.** "Week" means seven consecutive days.

Subp. 261. **Weighting factor or W_T .** "Weighting factor" or W_T for an organ or tissue (T) is the proportion of the risk of stochastic effects resulting from irradiation of that organ or tissue to the total risk of stochastic effects when the whole body is irradiated uniformly. For calculating the effective dose equivalent, the values of W_T are:

Organ Dose Weighting Factors

Organ or tissue	W_T
Gonads	0.25
Breast	0.15
Red bone marrow	0.12
Lung	0.12
Thyroid	0.03
Bone surface	0.03
Remainder	0.30 ¹
Whole Body	1.00 ²

¹0.30 results from 0.06 for each of five remainder organs (excluding the skin and the lens of the eye) that receive the highest doses.

²For the purpose of weighting the external whole body dose (for adding it to the internal dose), a single weighting factor, $W_T=1.0$, has been specified. The use of other weighting factors for external exposure may be approved on a case-by-case basis until such time as specific guidance is issued.

Subp. 262. **Well.** "Well" has the meaning given in Minnesota Statutes, section 103I.005, subdivision 21.

Subp. 263. **Well logging or logging.** "Well logging" or "logging" means all operations involving the lowering and raising of measuring devices or tools that contain licensed material or are used to detect licensed materials in wells or borings to obtain information about the well, boring, or adjacent formations, which may be used in oil, gas, mineral, groundwater, or geological exploration.

Subp. 264. **Whole body.** "Whole body" means, for purposes of external exposure, head, trunk including male gonads, arms above the elbow, or legs above the knee.

Subp. 265. **Worker.** "Worker" means an individual who engages in activities that are licensed or registered by the commissioner and that are controlled by a licensee. Worker does not include a licensee or registrant.

Subp. 266. **Working level.** "Working level" is any combination of short-lived radon daughters in one liter of air that results in the ultimate emission of 1.3×10^5 MeV of potential alpha particle energy. Radon daughters include:

- A. for radon-220: polonium-216, lead-212, bismuth-212, and polonium-212; and
- B. for radon-222: polonium-218, lead-214, bismuth-214, and polonium-214.

Subp. 267. **Working level month.** "Working level month" means an exposure to one working level for 170 hours (2,000 working hours per year/12 months per year=approximately 170 hours per month).

Subp. 268. **Written directive.** "Written directive" means an authorized user's written order for the administration of radioactive material or radiation from radioactive material to a specific patient or human research subject, as specified under part 4731.4408.

Subp. 269. **Year.** "Year" means the 12-month period of time used to determine compliance with this chapter, beginning in January unless the licensee changes the starting date of the 12-month period used to determine compliance by the licensee, provided that the change is made at the beginning of the year and that no day is omitted or duplicated in consecutive years.

Statutory Authority: *MS s 144.1202; 144.1203*

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