**641—37.2(136C) Definitions.** Except as otherwise specifically provided within a chapter or rule, these definitions apply to 641—Chapters 37 through 42.

*"Absorbed dose rate"* means absorbed dose per unit time, for machines with timers, or dose monitor unit per unit time for linear accelerators.

*"Accelerator"* or *"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 1 MeV.

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

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

*"Adult"* means an individual 18 years of age or older.

*"Agreement state"* means any state with which the U.S. Nuclear Regulatory Commission or the U.S. Atomic Energy Commission has entered into an effective agreement under Subsection 274b of the Atomic Energy Act of 1954 as amended (73 Stat. 689). The state of Iowa is an agreement state as of January 1, 1986.

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

*"Airborne radioactivity area"* means a room, enclosure, or area in which airborne radioactive material (composed wholly or partly of licensed material) exists in concentrations (1) in excess of the derived air concentrations (DACs) specified in 10 CFR Part 20, Appendix A (as amended to August 1, 2025), or (2) 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.

*"Air kerma"* or *"K"* means the kinetic energy released in air by ionizing radiation. Kerma is determined as the quotient of dE by dM, where dE is the sum of the initial kinetic energies of all the charged ionizing particles liberated by uncharged ionizing particles in air of mass dM. The SI unit of air kerma is joule per kilogram, and the special name for the unit of kerma is the gray (Gy).

*"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.

*"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 person that would result in a committed effective dose equivalent of 5 rem (0.05 Sv) or a committed dose equivalent of 50 rem (0.5 Sv) to any individual organ or tissue. ALI values for intake by ingestion and by inhalation of selected radionuclides are given in Table I, Columns 1 and 2, of 10 CFR Part 20, Appendix B, as amended to August 1, 2025.

*"Annually"* means at least once every 365 days.

*"As low as is reasonably achievable"* or *"ALARA"* means making every reasonable effort to maintain exposures to radiation as far below the dose limits in these rules as is practical, consistent with the purpose for which the licensed or registered activity is undertaken, taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations and in relation to utilization of nuclear energy and licensed or registered sources of radiation in the public interest.

*"Assembler"* means any person engaged in the business of assembling, replacing, or installing one or more components into an X-ray system or subsystem. The term includes the owner of an X-ray system or the employee or agent who assembles components into an X-ray system that is subsequently used to provide professional or commercial services.

*"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.

*"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 (SARs) and self-contained breathing apparatus (SCBA) units.

*"Authorization"* means license, registration, certificate, permit, or any other document issued or received by the department that authorizes specific activities related to the possession and use of radioactive materials or radiation-producing machines in Iowa.

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

*"Beam axis"* means a line from the source through the centers of the X-ray fields.

*"Beam-limiting device"* means a field defining collimator, integral to the system, which provides a means to restrict the dimensions of the X-ray field or useful beam.

*"Beam monitoring system"* means a system designed and installed in the radiation head to detect and measure the radiation present in the useful beam.

*"Becquerel"* or *"Bq"* means the SI unit of activity. One becquerel is equal to 1 disintegration or transformation per second (dps or tps).

*"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.

*"Bone densitometry"* means the use of ionizing radiation for diagnostic purposes utilizing a dual energy X-ray absorptiometry (DEXA) system. A DEXA system employs low-dose X-rays at two distinct energy levels to measure bone mineral density, and may also be used to assess lean tissue mass, total or regional body fat, or to perform other examinations as permitted by the system's intended use and the department.

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

*"Brachytherapy source"* means a radioactive 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.

*"Byproduct material"* means:

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

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

3. Any discrete source of radium-226 that is produced, extracted, or converted after extraction before, on, or after August 8, 2005, for use for a commercial, medical, or research activity or any material that:

- Has been made radioactive by use of a particle accelerator; and
- Is produced, extracted, or converted after extraction before, on, or after August 8, 2005, for use for a commercial, medical, or research activity; and
- Any discrete source of naturally occurring radioactive material, other than source material, that:
  - The Nuclear Regulatory Commission, in consultation with the Administrator of the Environmental Protection Agency, the Secretary of Energy, the Secretary of Homeland Security, and the head of any other appropriate federal agency, determines would pose a threat to the public health and safety or the common defense and security similar to the threat posed by a discrete source of radium-226; and
  - Before, on, or after August 8, 2005, is extracted or converted after extraction for use in a commercial, medical, or research activity.

*"Cabinet radiography"* means industrial radiography conducted in an enclosure or cabinet shielded so that radiation levels at every location on the exterior meet the limitations specified in rule 641—37.11(11).

*"Calendar quarter"* means not less than 12 consecutive weeks nor more than 14 consecutive weeks. The first calendar quarter of each year begins in January, and subsequent calendar quarters shall be so arranged such that no day is included in more than one calendar quarter and no day in any one year is omitted from inclusion within a calendar quarter. No licensee or registrant shall change the method of determining calendar quarters for purposes of these rules, except at the beginning of a year.

*"Calibration"* means the determination of:

1. The response or reading of an instrument relative to a series of known radiation values over the range of the instrument, or
2. The strength of a source of radiation relative to a standard.

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

*"Class," "lung class,"* or *"inhalation 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: for Class D, Days, of less than 10 days, for Class W, Weeks, from 10 to 100 days, and for Class Y, Years, of greater than 100 days.

*"Code of Federal Regulations"* or *"CFR"* means the codification of the general and permanent regulations promulgated by the executive departments and agencies of the federal government of the United States as amended to August 1, 2025, and all references to the CFR herein are amended as to August 1, 2025. It is the official legal print publication containing the rules published in the Federal Register.

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

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

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

*"Computed tomography"* or *"CT"* means the production of a tomogram by the acquisition and computer processing of X-ray transmission data.

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

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

*"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.

*"Curie"* means a unit of quantity of radioactivity. One curie (Ci) is that quantity of radioactive material that decays at the rate of 3.7E+10 transformations per second (tps).

*"Declared pregnant woman"* means a woman who has voluntarily informed her licensee or registrant, in writing, of her pregnancy and the estimated date of conception. The declaration remains in effect until the declared pregnant woman withdraws the declaration in writing or is no longer pregnant.

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

1. Release of the property for unrestricted use and termination of the license; or
2. Release of the property under restricted conditions and termination of the license.

*"Deep dose equivalent"* or *"Hd,"* which applies to external whole body exposure, means the dose equivalent at a tissue depth of 1 centimeter (1000 $mg/cm^2$ ).

*"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.

*"Derived air concentration"* or *"DAC"* means the concentration of a given radionuclide in air that if breathed by the reference person 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 Table I, Column 3, of 10 CFR Part 20, Appendix B.

*"Derived air concentration-hour"* or *"DAC-hour"* means 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 dose equivalent of 5 rem (0.05 Sv).

*"Direct supervision"* means guidance and instruction by a qualified individual who is physically present and watching the performance of the radiological operation or procedure and in such proximity that contact can be maintained and immediate assistance can be given as required.

*"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.

*"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 (SCBA).

*"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.

*"Dose"* or *"radiation dose"* is a generic term that means absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, total organ dose equivalent, or total effective dose equivalent.

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

*"Dose limits"* or *"limits"* means the permissible upper bounds of radiation doses established in accordance with these rules.

*"Effective dose equivalent"* or *"HE"* means the sum of the products of the dose equivalent to each organ or tissue (HT) and the weighting factor (wT) applicable to each of the body organs or tissues that is irradiated ($H_E = \Sigma w_T H_T$).

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

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

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

*"Exposure"* means the quotient of dQ by dm where "dQ" is the absolute value of the total charge of the ions of one sign produced in air when all the electrons (negatrons and positrons) liberated by photons in a volume element of air having mass "dm" are completely stopped in air. (The special unit of exposure is the roentgen (R) for SI equivalent coulomb per kilogram.) When not underlined as above or when indicated as "exposure" or (X), the term "exposure" has a more general meaning in these rules.

*"Exposure rate"* means the exposure per unit of time, such as roentgen per minute and milliroentgen per hour.

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

*"Extremity"* means hand, elbow, arm below the elbow, foot, knee, and leg below the knee. For purposes of certification standards, "lower extremities" and "upper extremities" mean the same as defined in rule 641—38.7(136C).

*"Facility"* means the location, building, vehicle, or complex under one administrative control at which radioactive material is stored or used or at which one or more radiation machines are installed, located, or used.

*"FDA"* means the United States Food and Drug Administration.

*"Filtering facepiece (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, that is not equipped with elastomeric sealing surfaces and adjustable straps.

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

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

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

*"Generally applicable environmental radiation standards"* means standards issued by the U.S. Environmental Protection Agency (EPA) under the authority of the Atomic Energy Act of 1954 as amended to August 1, 2025, that impose limits on radiation exposures or levels, or concentrations or quantities of radioactive material, in the general environment outside the boundaries of locations under the control of persons possessing or using radioactive material.

*"Gray"* or *"Gy"* means the SI unit of absorbed dose. One gray is equal to an absorbed dose of 1 joule per kilogram (1 Gy = 100 rad).

*"Half-value layer"* or *"HVL"* means the thickness of a specified material that attenuates X-radiation or gamma radiation to an extent such that the air kerma rate, exposure rate or absorbed dose rate is reduced to one-half of the value measured without the material at the same point. The contribution of all scattered radiation, other than any that might be present initially in the beam concerned, is excluded.

*"Hazardous waste"* means those wastes designated as hazardous by U.S. Environmental Protection Agency regulations in 40 CFR Part 261 as amended to August 1, 2025.

*"Healing arts"* means the occupational fields of diagnosing or treating disease, providing health care and improving health by the practice of medicine, osteopathy, chiropractic, podiatry, dentistry, nursing, veterinary medicine, and supporting professions, such as physician associates, nurse practitioners, radiologic technologists, and dental hygienists.

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

*"High dose-rate remote afterloader"* means a brachytherapy device that remotely delivers a dose rate in excess of 1200 rads (12 gray) per hour at the point or surface where the dose is prescribed.

*"High-level radioactive waste"* or *"HLW"* means (1) irradiated reactor fuel; (2) liquid wastes resulting from the operation of the first cycle solvent extraction system, or equivalent, and the concentrated wastes from subsequent extraction cycles, or equivalent, in a facility for reprocessing irradiated reactor fuel; and (3) solids into which such liquid wastes have been converted.

*"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's receiving a dose equivalent in excess of 0.1 rem (1 mSv) in one hour at 30 centimeters from any source of radiation or 30 centimeters from any surface that the radiation penetrates.

*"Highway route controlled quantity"* means a quantity within a single package that exceeds:

1. 3,000 times the A1 value of the radionuclides as specified in 49 CFR 173.435 for special form Class 7 (radioactive) material;
2. 3,000 times the A2 value of the radionuclides as specified in 49 CFR 173.435 for normal form Class 7 (radioactive) material; or
3. 1,000 TBq (27,000 Ci), whichever is least.

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

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

*"Individual"* means any human being.

*"Individual monitoring"* means the assessment of:

1. Dose equivalent by the use of devices designed to be worn by an individual or by the use of survey data; or

2. Committed effective dose equivalent by bioassay or by determination of the time-weighted air concentrations to which an individual has been exposed, that is, DAC-hours.

*"Individual monitoring devices," "personnel dosimeter"* or *"dosimeter"* means devices designed to be worn by a single individual for the assessment of dose equivalent. Examples of individual monitoring devices are film badges, thermoluminescent dosimeters (TLDs), pocket ionization chambers, optically stimulated luminescent (OSL) devices, and personal air sampling devices.

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

*"Inspection"* means an official examination or observation including but not limited to tests, surveys, and monitoring to determine compliance with rules, regulations, orders, requirements, and conditions of the department.

*"Instrument traceability," "source traceability"* or *"traceable to a national standard"* means, for ionizing radiation measurements, the ability to show that an instrument has been calibrated at specified time intervals using a national standard or a transfer standard. If a transfer standard is used, the calibration must be from a laboratory accredited by a program that required continuing participation in measurement quality assurance with the National Institute of Standards and Technology or other equivalent national or international program.

*"Interlock"* means a device preventing the start or continued operation of equipment unless certain predetermined conditions prevail.

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

*"Ionizing radiation producing machine"* or *"radiation machine"* means any device capable of producing radiation when the associated control devices are operated, excluding devices that produce radiation only by the use of radioactive material.

*"Iowa approved"* means recognized or accepted by the department as meeting the training and experience requirements established by MQSA, CFR, or any additional criteria set forth by the department. This may include but is not limited to formal approval by the department based on documentation of education, training, certification, and clinical experience.

*"Irradiation"* means the exposure of a living being or matter to ionizing radiation.

*"Leakage radiation"* means radiation emanating from the diagnostic or therapeutic source assembly, except for:

1. The useful beam, and

2. Radiation produced when the exposure switch or timer is not activated.

*"Lens dose equivalent"* or *"LDE"* 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$^2$).

*"License"* means a license issued by the department in accordance with the rules adopted by the department.

*"Licensed (or registered) material"* means radioactive material received, possessed, used, transferred or disposed of under a general or specific license (or registration) issued by the department.

*"Licensed practitioner"* means a person licensed or otherwise authorized by law to practice medicine, osteopathy, chiropractic, podiatry, or dentistry in Iowa, or certified as a physician associate, and authorized to prescribe X-ray tests for the purpose of diagnosis or treatment.

*"Licensee"* means any person who is licensed by the department in accordance with these rules and Iowa Code chapter 136C.

*"Licensing state"* means any state with regulations equivalent to the suggested state regulations for control of radiation relating to, and an effective program for, the regulatory control of NARM and that has been granted final designation by the Conference of Radiation Control Program Directors, Inc.

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

*"Lost or missing licensed (or registered) source of radiation"* means licensed (or registered) source of radiation whose location is unknown. This definition includes licensed (or registered) material that has been shipped but has not reached its planned destination and whose location cannot be readily traced in the transportation system.

*"Mammography"* means the radiography of the breast.

*"Mammography unit"* means an assemblage of components for the production of X-rays for use during mammography, including, at a minimum, an X-ray generator, an X-ray control, a tube housing assembly, a beam-limiting device, and the supporting structures for these components.

*"Medical event"* means the medical event:

1. In which, except for an event that results from patient intervention:

- The administration of byproduct material or radiation from byproduct material, except permanent implant brachytherapy, results in:
  - A dose that differs from the prescribed dose or dose that would have resulted from the prescribed dosage by more than 5 rem (0.05 Sv) effective dose equivalent, 50 rem (0.5 Sv) to an organ or tissue, or 50 rem (0.5 Sv) shallow dose equivalent to the skin; and
    - The total dose delivered differs from the prescribed dose by 20 percent or more;
    - The total dosage delivered differs from the prescribed dosage by 20 percent or more or falls outside the prescribed dosage range; or
    - The fractionated dose delivered differs from the prescribed dose, for a single fraction, by 50 percent or more.
  - A dose that exceeds 5 rem (0.05 Sv) effective dose equivalent, 50 rem (0.5 Sv) to an organ or tissue, or 50 rem (0.5 Sv) shallow dose equivalent to the skin from any of the following:
    - An administration of the wrong radioactive drug containing byproduct material or the wrong radionuclide for a brachytherapy procedure;
    - An administration of a radioactive drug containing byproduct material by the wrong route of administration;
    - An administration of a dose or dosage to the wrong individual or human research subject;
    - An administration of a dose or dosage delivered by the wrong mode of treatment; or
    - A leaking sealed source.
  - A dose to the skin or an organ or tissue other than the treatment site that exceeds by:
    - 50 rem (0.5 Sv) or more the expected dose to that site from the procedure if the administration had been given in accordance with the written directive prepared or revised before administration; and
    - 50 percent or more the expected dose from the procedure if the administration had been given in accordance with the written directive prepared or revised before administration;
- For permanent implant brachytherapy, the administration of byproduct material or radiation from byproduct material (excluding sources that were implanted in the correct site but migrated outside the treatment site) that results in:
  - The total source strength administered differing by 20 percent or more from the total source strength documented in the postimplantation portion of the written directive;
  - The total source strength administered outside of the treatment site exceeding 20 percent of the total source strength documented in the postimplantation portion of the written directive; or
  - An administration that includes any of the following:
    - The wrong radionuclide;
    - The wrong individual or human research subject;
    - Sealed source(s) implanted directly into a location discontiguous from the treatment site, as documented in the postimplantation portion of the written directive; or
    - A leaking sealed source resulting in a dose that exceeds 50 rem (0.5 Sv) to an organ or tissue.

2. Resulting from intervention of a patient or human research subject in whom administration of byproduct material or radiation from byproduct material results or will result in unintended permanent functional damage to an organ or a physiological system as determined by a physician.

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

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

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

*"Monitoring, radiation monitoring"* or *"radiation protection monitoring"* means the measurement of radiation levels, radioactive material concentrations, surface area concentrations or quantities of radioactive material and the use of the results of these measurements to evaluate potential exposures and doses.

*"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.

*"Nonstochastic effect"* or *"deterministic event"* 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.

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

*"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 licensed or unlicensed and registered or unregistered sources of radiation, whether in the possession of the licensee, registrant, or other person. Occupational dose does not include a dose received from background radiation, from any medical administration the individual has received, from exposure to individuals administered sources of radiation or radioactive material from voluntary participation in medical research programs, or as a member of the public.

*"Online licensing portal"* means the electronic system designated by the department through which applicants and credential holders shall submit applications, renewals, supporting documentation, and other required information for licensure, certification, credentialing, or registration.

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

*"Patient"* means an individual or animal subjected to healing arts examination, diagnosis or treatment.

*"Person"* means any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, department, political subdivision of this state, any other state or political subdivision or agency thereof, and any legal successor, representative, agent, or department of the foregoing, but cannot include federal government agencies.

*"PET/CT"* means an imaging modality that uses positron emission tomography and computed tomography in one device to combine the structural anatomic information with functional data collected during the examination.

*"Phantom"* means a volume of material behaving in a manner similar to tissue with respect to the attenuation and scattering of radiation. This requires that both the atomic number (Z) and the density of the material be similar to that of tissue.

*"Physician"* means a person who is currently licensed in Iowa to practice medicine and surgery, osteopathic medicine and surgery, or osteopathy.

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

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

*"Positron emission tomography (PET) radionuclide production facility"* means a facility operating a cyclotron or accelerator for the purpose of producing PET radionuclides.

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

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

*"Primary protective barrier"* or *"barrier"* means the material, excluding filters, placed in the useful beam to reduce the radiation exposure (beyond the patient and cassette holder) for protection purposes.

*"Public dose"* means the dose received by a member of the public from exposure to radiation or to radioactive material released by a licensee, registrant, or other person or to any other source of radiation under the control of a licensee, registrant, or other person. It does not include occupational dose or doses

received from background radiation, from any medical administration the individual has received, or from exposure to individuals administered sources of radiation or radioactive material and released from voluntary participation in medical research programs.

*"Qualified expert"* means an individual registered with the department as a radiation machines service provider, whether as an individual, as part of a corporation, or any other entity included in the definition of "person" under this chapter, having the knowledge and training to measure ionizing radiation, evaluate safety techniques, and provide guidance on radiation protection.

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

*"Quality assurance"* means the overall program of testing and maintaining the highest possible standards of quality in the acquisition and interpretation of radiographic images.

*"Quality control"* means the actual process of testing and maintaining the highest possible standards of quality in equipment performance and the acquisition and interpretation of radiographic images.

*"Quality factor"* or *"Q"* means the modifying factor, listed in Tables I and II of subrule 37.5(1), that is used to derive dose equivalent from absorbed dose.

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

*"Quarter"* means a period of time equal to one-fourth of the year observed by the licensee, approximately 13 consecutive weeks, providing that the beginning of 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.

*"Rad"* means the special unit of absorbed dose. One rad is equal to an absorbed dose of 100 erg per gram or 0.01 joule per kilogram (0.01 gray).

*"Radiation"* or *"ionizing radiation"* means alpha particles, beta particles, gamma rays, X-rays, neutrons, high-speed electrons, high-speed protons, and other particles capable of producing ions. Radiation, as used in these rules, does not include nonionizing radiation, such as radiowaves or microwaves, visible, infrared, or ultraviolet light.

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

*"Radiation detector"* or *"detector"* means a device that in the presence of radiation, by either direct or indirect means, provides a signal or other indication suitable for use in measuring one or more quantities of incident radiation.

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

*"Radiation safety officer"* or *"RSO"* means an individual who has the knowledge and responsibility to apply appropriate radiation protection regulations and has been assigned such responsibility by the licensee or registrant.

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

*"Radioactivity"* means the transformation of unstable atomic nuclei by the emission of radiation.

*"Radionuclide"* means a radioactive element or a radioactive isotope.

*"Reference person"* means a hypothetical aggregation of human physical and physiological characteristics determined by international consensus. These characteristics may be used by researchers and public health workers to standardize results of experiments and to relate biological insult to a common base. A description of the reference person is contained in the International Commission on Radiological Protection report, ICRP Publication 23, "Report of the Task Group on Reference Man" as amended to August 1, 2025.

*"Registrant"* means any person who is registered with the department or is legally obligated to register with the department pursuant to these rules and Iowa Code chapter 136C.

*"Registration"* means registration with the department in accordance with the rules adopted by the department.

*"Regulations of the U.S. Department of Transportation"* means the regulations in 49 CFR Parts 100 through 180.

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

*"Reportable radiation incident"* means an occurrence involving the use of a radiation-producing machine that meets one or more of the criteria established in the Council of Radiation Control Program Director's (CRCPD) Suggested State Regulations, Part F.2 as amended to August 1, 2025, for medical events. This includes but is not limited to any of the following:

1. Unintended skin dose to the same area in a single procedure greater than 2 Gy (200 rad);
2. Unintended dose other than skin dose in a single procedure greater than:

- 5 times the facility's established protocol, and > 0.5 Gy (50 rad) to any organ, or
- 5 times the facility's established protocol, and > 0.05 Sv (5 rem) effective dose;

3. Wrong patient or wrong site for entire procedure when the resultant dose is:

- Dose > 0.5 Gy (50 rad) to any organ, or
- Effective dose ≥ 0.05 Sv (5 rem).

4. This definition includes radiation incidents occurring during medical diagnostic and interventional X-ray procedures, as well as any other radiation machine-related incident that meets established reporting criteria. It also encompasses any additional incident deemed reportable by the department based on potential or actual deviation from intended use, dose, or safety standards.

*"Research and development"* means:

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

*"Residual radioactivity"* means radioactivity in structures, materials, soils, groundwater, and other media at a site resulting from activities under the licensee's control. This includes radioactivity from all licensed and unlicensed sources used by the licensee but excludes background radiation. It also includes radioactive materials remaining at the 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 in accordance with any previous state or federal licenses, rules, or regulations.

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

*"Restricted area"* means an area, access to which is limited by the licensee or registrant for the purpose of protecting individuals against undue risks from exposure to sources of radiation. A restricted area cannot include any areas used for residential quarters, although a separate room or rooms in a residential building may be set apart as a restricted area.

*"Roentgen"* means the special unit of exposure. One roentgen (R) equals 2.58 × 10-4 coulombs/ kilogram of air.

*"Sanitary sewerage"* means a system of public sewers for carrying off wastewater and refuse, excluding sewage treatment facilities, septic tanks, and leach fields owned or operated by the licensee or registrant.

*"Scattered radiation"* means ionizing radiation emitted by interaction of ionizing radiation with matter, the interaction being accompanied by a change in direction of the radiation. Scattered primary radiation means the scattered radiation that has been deviated in direction only by materials irradiated by the useful beam.

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

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

*"Service provider"* means an individual or company engaged in equipment services included in this chapter.

*"Shallow dose equivalent"* or *"Hs,"* which applies to the external exposure of the skin of the whole body or the skin of an extremity, means the dose equivalent at a tissue depth of 0.007 centimeter (7 $mg/cm^2$).

*"Shutter"* means a device attached to the tube housing assembly that can intercept the entire cross-sectional area of the useful beam and that has a lead equivalency not less than that of the tube housing assembly.

*"SI"* means the abbreviation for the International System of Units.

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

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

*"Source"* means the focal spot of the X-ray tube.

*"Source material"* means:

a. Uranium or thorium, or any combination thereof, in any physical or chemical form; or

b. Ores that contain by weight one-twentieth of 1 percent (0.05 percent) or more of uranium, thorium or any combination of uranium and thorium. Source material does not include special nuclear material.

*"Source material milling"* means any activity that results in the production of byproduct material described in numbered paragraph "2" of the definition of "byproduct material."

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

*"Source traceability"* means the ability to show that a radioactive source has been calibrated either by the national standards laboratory of the National Institute of Standards and Technology or by a laboratory that participates in continuing measurement quality assurance programs with the National Institute of Standards and Technology or other equivalent national or international program.

*"SPECT/CT"* means an imaging modality that uses single photon emission computed tomography and computed tomography in one device to combine the structural anatomic information with functional data collected during the examination.

*"SSD"* means the distance between the source and the skin entrance plane of the patient.

*"Stochastic effect"* or *"probabilistic 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. Hereditary effects and cancer incidence are examples of stochastic effects.

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

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

*"Survey"* means an evaluation of the radiological conditions and potential hazards incident to the production, use, transfer, release, disposal, or presence of sources of radiation. When appropriate, such evaluation includes a physical survey of the location of radioactive material and measurements or calculations of levels of radiation or concentrations or quantities of radioactive material present.

*"Target-to-skin distance"* or *"TSD"* means the distance measured along the beam axis from the center of the front surface of the X-ray target or electron virtual source scattering foil to the surface of the irradiated object or patient.

*"Termination of irradiation"* means the stopping of irradiation in a fashion that will not permit continuance of irradiation without the resetting of operating conditions at the control panel.

*"Test"* means the process of verifying compliance with an applicable regulation.

*"These rules"* means the rules contained within 641—Chapters 37 through 44.

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

*"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).

*"Total organ dose equivalent"* or *"TODE"* means the sum of the deep dose equivalent and the committed dose equivalent to the organ receiving the highest dose as described in rule 641—37.4(136C).

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

*"Tube housing assembly"* means the tube housing with tube installed. It includes high-voltage or filament transformers, or both, and other appropriate elements when such are contained within the tube housing.

*"Type A quantity"* means a quantity of radioactive material, the aggregate radioactivity of which does not exceed A1 for special form radioactive material or A2 for normal form radioactive material as defined in 10 CFR 71.4 as amended to August 1, 2025.

*"Type B quantity"* means a quantity of radioactive material greater than a Type A quantity as defined in 10 CFR 71.4 as amended to August 1, 2025.

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

*"U.S. Department of Energy"* means the Department of Energy established by Public Law 95-91, August 4, 1977, 91 Stat. 565, 42 U.S.C. 7101 et seq., to the extent that the department exercises functions formerly vested in the U.S. Atomic Energy Commission, its chairman, members, officers and components and transferred to the U.S. Energy Research and Development Administration and to the administrator thereof pursuant to Sections 104(b), (c) and (d) of the Energy Reorganization Act of 1974 (Public Law 93-438, October 11, 1974, 88 Stat. 1233 at 1237, effective January 19, 1975) and retransferred to the Secretary of Energy pursuant to Section 301(a) of the Department of Energy Organization Act (Public Law 95-91, August 4, 1977, 91 Stat. 565 at 577-578, 42 U.S.C. 7151, effective October 1, 1977), all as amended to August 1, 2025.

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

*"Very high radiation area"* means an area accessible to individuals in which radiation levels from radiation sources external to the body could result in an individual's receiving an absorbed dose in excess of 500 rad (5 Gy) in one hour at 1 meter from a source of radiation or 1 meter from any surface that the radiation penetrates.

*"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 described in paragraphs "2," "3" and "4" of the definition of "byproduct material."

*"Week"* means seven consecutive days starting on Sunday.

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

| ORGAN DOSE WEIGHTING FACTORS | |
|---|---|
| Gonads | 0.25 |
| Breast | 0.15 |
| Red bone marrow | 0.12 |
| Lung | 0.12 |
| Thyroid | 0.03 |
| Bone surfaces | 0.03 |
| Remainder | 0.30[a] |
| Whole Body | 1.00[b] |

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

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

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

*"Worker"* means an individual engaged in work under a license or registration issued by the department and controlled by a licensee or registrant but does not include the licensee or registrant.

*"X-radiation"* means penetrating electromagnetic radiation with energy greater than 0.1 kV produced by bombarding a metallic target with fast electrons in a high vacuum.

*"X-ray tube"* or *"tube"* means any electron tube that is designed to be used primarily for the production of X-rays.

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

[**ARC 0387D**, IAB 6/24/26, effective 7/29/26]