# Full-Text Glossary

See also NUREG-0544, "Collection of Abbreviations" [/reading-rm/doc-collections/nuregs/staff/sr0544/index.html]

**Access hatch**

An airtight door system that preserves the pressure integrity of the containment structure [/reading-rm/basic-ref/glossary/containment-structure.html] of a nuclear reactor [/reading-rm/basic-ref/glossary/nuclear-reactor.html] , while allowing access to personnel and equipment.

**Activation**

The process of making a radioisotope [/reading-rm/basic-ref/glossary/radioisotope-radionuclide.html] by bombarding a stable element [/reading-rm/basic-ref/glossary/element.html] with neutrons [/reading-rm/basic-ref/glossary/neutron.html] or protons [/reading-rm/basic-ref/glossary/proton.html] .

**Active fuel length**

The end-to-end dimension of fuel [/reading-rm/basic-ref/glossary/nuclear-fuel.html] material within a fuel assembly [/reading-rm/basic-ref/glossary/fuel-assembly-fuel-bundle-fuel-element.html] (also known as a "fuel bundle" or "fuel element").

**Activity**

The rate of disintegration (transformation) or decay [/reading-rm/basic-ref/glossary/radioactive-decay.html] of radioactive material per unit time. The units of activity (also known as radioactivity [/reading-rm/basic-ref/glossary/radioactivity.html] ) are the curie (Ci) [/reading-rm/basic-ref/glossary/curie-ci.html] and the becquerel (Bq) [/reading-rm/basic-ref/glossary/becquerel-bq.html] . For related information, see Measuring Radiation [/about-nrc/radiation/health-effects/measuring-radiation.html] .

**Advanced reactors**

Reactors that differ from today's reactors primarily by their use of inert gases, molten salt mixtures, or liquid metals to cool the reactor core. Advanced reactors can also consider fuel materials and designs that differ radically from today's enriched-uranium-dioxide pellets within zirconium cladding.

**Agreement State**

A U.S. State that has signed an agreement with the U.S. Nuclear Regulatory Commission (NRC) authorizing the State to regulate certain uses of radioactive materials within the State.

**Air sampling**

The collection of samples of air to measure the radioactivity [/reading-rm/basic-ref/glossary/radioactivity.html] or to detect the presence of radioactive material, particulate matter, or chemical pollutants in the air. For related information, see Detecting Radiation [/about-nrc/radiation/health-effects/detection-radiation.html] and Regulatory Guide 8.25 [/docs/ML0037/ML003739616.pdf] , "Air Sampling in the Workplace."

**Airborne radioactivity area**

As defined in Title 10, Section 20.1003, of the *Code of Federal Regulations* (10 CFR 20.1003 [/reading-rm/doc-collections/cfr/part020/part020-1003.html] ), the airborne radioactivity area is a room, enclosure, or area in which airborne radioactive materials, composed wholly or partially of licensed material [/reading-rm/basic-ref/glossary/licensed-material.html] , exist in concentrations that (1) exceed the derived air concentration limits (DACs) [/reading-rm/basic-ref/glossary/derived-air-concentration-dac.html] , or (2) would result in an individual present in the area without respiratory protection exceeding, during those hours, 0.6 percent of the annual limit on intake (ALI) [/reading-rm/basic-ref/glossary/annual-limit-on-intake-ali.html] or 12 DAC-hours [/reading-rm/basic-ref/glossary/derived-air-concentration-hour-dac-hour.html] . For additional detail, see Appendix B [/reading-rm/doc-collections/cfr/part020/part020-appb.html] to 10 CFR Part 20 [/reading-rm/doc-collections/cfr/part020/] , "Standards for Protection Against Radiation," and Information for Radiation Workers [/about-nrc/radiation/health-effects/info.html] .

**ALARA**

As defined in Title 10, Section 20.1003, of the *Code of Federal Regulations* (10 CFR 20.1003 [/reading-rm/doc-collections/cfr/part020/part020-1003.html] ), ALARA is an acronym for "as low as (is) reasonably achievable," which means making every reasonable effort to maintain exposures [/reading-rm/basic-ref/glossary/exposure.html] to ionizing radiation [/reading-rm/basic-ref/glossary/radiation-ionizing-radiation.html] as far below the dose limits as practical, consistent with the purpose for which the licensed 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 [/reading-rm/basic-ref/glossary/atomic-energy.html]

and licensed materials [/reading-rm/basic-ref/glossary/licensed-material.html] in the public interest. For additional detail, see Dose Limits for Radiation Workers [/about-nrc/radiation/health-effects/info.html#dose] .

**Aleatory**

A type of uncertainty that is irreducible.

**Alkali silica reaction (ASR)**

ASR is a chemical combining of reactive silica from the concrete aggregate with the alkali from the cement paste in the presence of moisture. The result of the reaction is a gel, which can expand and may cause micro-cracks in the concrete.

**Allegation**

A declaration, statement, or assertion of impropriety or inadequacy associated with NRC-regulated activities, the validity of which has not been established. For additional detail, see What is an Allegation [/about-nrc/regulatory/allegations/what-is-allegation.html] .

**Alpha particle**

A positively charged particle ejected spontaneously from the nuclei [/reading-rm/basic-ref/glossary/nucleus.html] of some radioactive elements [/reading-rm/basic-ref/glossary/element.html] . It is identical to a helium nucleus that has a mass number of 4 and an electrostatic charge of +2. It has low penetrating power and a short range (a few centimeters in air). The most energetic alpha particle will generally fail to penetrate the dead layers of cells covering the skin, and can be easily stopped by a sheet of paper. Alpha particles are hazardous when an alpha-emitting isotope [/reading-rm/basic-ref/glossary/isotope.html] is inside the body. For additional detail, see Radiation Basics [/about-nrc/radiation/health-effects/radiation-basics.html] .

**Anion**

A negatively charged ion [/reading-rm/basic-ref/glossary/ion.html] .

**Annual limit on intake (ALI)**

As defined in Title 10, Section 20.1003, of the *Code of Federal Regulations* (10 CFR 20.1003 [/reading-rm/doc-collections/cfr/part020/part020-1003.html] ), ALI is 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 [/reading-rm/basic-ref/glossary/radioisotope-radionuclide.html] in a year by the "reference man [/reading-rm/basic-ref/glossary/reference-man.html] " that would result in a committed effective dose equivalent (CEDE) [/reading-rm/basic-ref/glossary/committed-effective-dose-equivalent-cede.html] of 5 rems [/reading-rm/basic-ref/glossary/rem-roentgen-equivalent-man.html] (0.05 sievert [/reading-rm/basic-ref/glossary/sievert-sv.html] ) or a committed dose equivalent (CDE) [/reading-rm/basic-ref/glossary/committed-dose-equivalent-cde.html] of 50 rems (0.5 sievert) to any individual organ or tissue. ALI values for intake by ingestion and inhalation of selected radionuclides are given in Table 1, Columns 1 and 2, of Appendix B [/reading-rm/doc-collections/cfr/part020/part020-appb.html] to 10 CFR Part 20 [/reading-rm/doc-collections/cfr/part020/] , "Standards for Protection Against Radiation." For additional detail, see Information for Radiation Workers [/about-nrc/radiation/health-effects/info.html] .

**Anticipated transient without scram (ATWS)**

An ATWS is one of the "worst case" accidents, consideration of which frequently motivates the NRC to take regulatory action. Such an accident could happen if the scram [/reading-rm/basic-ref/glossary/scram.html] system (which provides a highly reliable means of shutting down the reactor) fails to work during a reactor event (anticipated transient [/reading-rm/basic-ref/glossary/transient.html] ). The types of events considered are those used for designing the plant.

**Assumptions (for IPEs, IPEEs, and PRAs)**

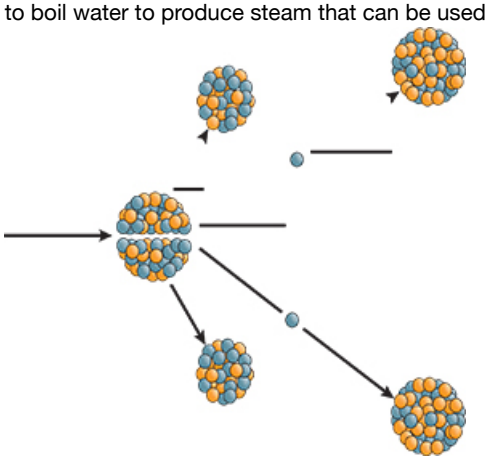
In the context of individual plant examinations (IPEs) [/reading-rm/basic-ref/glossary/individual-plant-examination-ipe.html] , individual plant examinations for external events (IPEEE) [/reading-rm/basic-ref/glossary/individual-plant-examination-for-external-events-ipeee.html] , and probabilistic risk assessments (PRAs) [/reading-rm/basic-ref/glossary/probabilistic-risk-assessment-pra.html] , assumptions are those parts of the mathematical models that the analyst expects will hold true for the range of solutions used for making decisions. Without assumptions, even the most powerful computers may not be able to provide useful solutions for the models.

**Atom**

The smallest particle of an element [/reading-rm/basic-ref/glossary/element.html] that cannot be divided or broken up by chemical means. It consists of a central core (or nucleus [/reading-rm/basic-ref/glossary/nucleus.html] ), containing protons [/reading-rm/basic-ref/glossary/proton.html] and neutrons [/reading-rm/basic-ref/glossary/neutron.html] , with electrons [/reading-rm/basic-ref/glossary/electron.html] revolving in orbits in the region surrounding the nucleus.

**Atomic energy**

The energy that is released through a nuclear reaction or radioactive decay process. One kind of nuclear reaction is fission, which occurs in a nuclear reactor and releases energy, usually in the form of heat and radiation. In a nuclear power plant, this heat is used to boil water to produce steam that can be used to drive large turbines. The turbines drive generators to produce electrical power.



**Atomic Energy Commission**

The Federal agency (known as the AEC), which was created in 1946 to manage the development, use, and control of atomic (nuclear) energy [/reading-rm/basic-ref/glossary/atomic-energy.html] for military and civilian applications. The AEC was subsequently abolished by the Energy Reorganization Act of 1974 [/about-nrc/governing-laws.html#era-1974] and succeeded by the Energy Research and Development Administration (now part of the U.S. Department of Energy [/reading-rm/basic-ref/glossary/u.s.-department-of-energy-doe.html] ) and the U.S. Nuclear Regulatory Commission. For related information, see Our History [/about-nrc/history.html] .

**Atomic number**

The number of positively charged protons [/reading-rm/basic-ref/glossary/proton.html] in the nucleus [/reading-rm/basic-ref/glossary/nucleus.html] of an atom [/reading-rm/basic-ref/glossary/atom.html] .

**Attenuation**

The process by which the number of particles or photons [/reading-rm/basic-ref/glossary/photon.html] entering a body of matter is reduced by absorption and scattered radiation [/reading-rm/basic-ref/glossary/radiation-nuclear.html] .

**Auxiliary building**

A building at a nuclear power plant [/reading-rm/basic-ref/glossary/nuclear-power-plant.html] , which is frequently located adjacent to the reactor containment structure [/reading-rm/basic-ref/glossary/containment-structure.html] , and houses most of the auxiliary and safety systems associated with the reactor [/reading-rm/basic-ref/glossary/reactor-nuclear.html] , such as radioactive waste systems, chemical and volume control systems, and emergency cooling water systems.

**Auxiliary feedwater**

Backup water supply used during nuclear plant startup [/reading-rm/basic-ref/glossary/startup.html] and shutdown [/reading-rm/basic-ref/glossary/shutdown.html] to supply water to the steam generators during accident conditions for removing decay heat [/reading-rm/basic-ref/glossary/decay-heat.html] from the reactor [/reading-rm/basic-ref/glossary/reactor-nuclear.html] .

**Average planar linear heat generation rate (APLGHR)**

The average value of the linear heat generation rate [/reading-rm/basic-ref/glossary/linear-heat-generation-rate.html] of all the fuel rods [/reading-rm/basic-ref/glossary/fuel-rod.html] at any given horizontal plane along a fuel assembly [/reading-rm/basic-ref/glossary/fuel-assembly-fuel-bundle-fuel-element.html] (also known as a "fuel bundle" or "fuel element").

**Axial crack**

A crack that is oriented in a plane extending radially from the center of a pipe.

**Background radiation**

The natural radiation that is always present in the environment. It includes cosmic radiation [/about-nrc/radiation/around-us/sources/nat-bg-sources.html#cosmic] which comes from the sun and stars, terrestrial radiation [/about-nrc/radiation/around-us/sources/nat-bg-sources.html#terr] which comes from the Earth, and internal radiation [/about-nrc/radiation/around-us/sources/nat-bg-sources.html#internal] which exists in all living things. The typical average individual exposure in the United States from natural background sources is about 300 millirems [/about-nrc/radiation/health-effects/measuring-radiation.html] per year. For additional information, see Natural Background Sources [/about-nrc/radiation/around-us/sources/nat-bg-sources.html] and Doses in Our Daily Lives [/about-nrc/radiation/around-us/doses-daily-lives.html] .

**Base metal**

Materials located adjacent to a weld joining two sections of pipe.

**Baseline Inspection Program**

The normal inspection program performed at all nuclear power plants. The program focuses on plant activities that are not adequately measured by performance indicators, on the corrective action program, and on verifying the accuracy of the performance indicators.

**Bayesian estimation**

A mathematical formulation, using Bayes' theorem, by which the likelihood of an event can be estimated taking explicit consideration of certain contextual features (such as amount of data, nature of decision, etc.).

**Bayesian prior**

A way to express the context of a Bayesian estimation [/reading-rm/basic-ref/glossary/bayesian-estimation.html] in which initial data are updated as new data become available.

**Becquerel (Bq)**

One of three units used to measure radioactivity [/reading-rm/basic-ref/glossary/radioactivity.html] , which refers to the amount of ionizing radiation [/reading-rm/basic-ref/glossary/radiation-ionizing-radiation.html] released when an element [/reading-rm/basic-ref/glossary/element.html] (such as uranium [/reading-rm/basic-ref/glossary/uranium.html] ) spontaneously emits energy as a result of the radioactive decay [/reading-rm/basic-ref/glossary/radioactive-decay.html] (or disintegration) of an unstable atom [/reading-rm/basic-ref/glossary/atom.html] . Radioactivity is also the term used to describe the rate at which radioactive material emits radiation, or how many atoms in the material decay (or disintegrate) in a given time period. As such, 1 Bq represents a rate of radioactive decay equal to 1 disintegration per second, and 37 billion (3.7 x 1010) Bq equals 1 curie (Ci) [/reading-rm/basic-ref/glossary/curie-ci.html] .

**Beta particle**

A charged particle (with a mass equal to 1/1837 that of a proton [/reading-rm/basic-ref/glossary/proton.html] ) that is emitted from the nucleus [/reading-rm/basic-ref/glossary/nucleus.html] of a radioactive element [/reading-rm/basic-ref/glossary/element.html] during radioactive decay [/reading-rm/basic-ref/glossary/radioactive-decay.html] (or disintegration) of an unstable atom [/reading-rm/basic-ref/glossary/atom.html] . A negatively charged beta particle is identical to an electron [/reading-rm/basic-ref/glossary/electron.html] , while a positively charged beta particle is called a positron [/reading-rm/basic-ref/glossary/positron.html] . Large amounts of beta radiation may cause skin burns, and beta emitters are harmful if they enter the body. Beta particles may be stopped by thin sheets of metal or plastic. For additional detail, see Radiation Basics [/about-nrc/radiation/health-effects/radiation-basics.html] .

**Beyond design-basis accidents**

This term is used as a technical way to discuss accident sequences that are possible but were not fully considered in the design process because they were judged to be too unlikely. (In that sense, they are considered beyond the scope of design-basis accidents [/reading-rm/basic-ref/glossary/design-basis-accident.html] that a nuclear facility must be designed and built to withstand.) As the regulatory process strives to be as thorough as possible, "beyond design-basis" accident sequences are analyzed to fully understand the capability of a design.

**Binding energy**

The minimum energy required to separate the nucleus [/reading-rm/basic-ref/glossary/nucleus.html] of an atom [/reading-rm/basic-ref/glossary/atom.html] into its component neutrons [/reading-rm/basic-ref/glossary/neutron.html] and protons [/reading-rm/basic-ref/glossary/proton.html] .

**Bioassay**

The determination of kinds, quantities, or concentrations and, in some cases, 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 (in vitro) from the human body.

**Biological half-life**

The time required for a biological system, such as that of a human, to eliminate, by natural processes, half of the amount of a substance (such as a radioactive material) that has entered it.

**Biological shield**

A mass of absorbing material placed around a reactor [/reading-rm/basic-ref/glossary/reactor-nuclear.html] or radioactive source [/reading-rm/basic-ref/glossary/radiation-source.html] to reduce the radiation [/reading-rm/basic-ref/glossary/radiation-nuclear.html] to a level safe for humans.

**Boiling-water reactor (BWR)**

A nuclear reactor in which water is boiled using heat released from fission. The steam released by boiling then drives turbines and generators to produce electrical power. BWRs operate similarly to electrical plants using fossil fuel, except that the BWRs are heated by nuclear fission in the reactor core. For additional detail, see Boiling Water Reactors (BWRs) [/reactors/bwrs.html] .

**Bone seeker**

A radioisotope [/reading-rm/basic-ref/glossary/radioisotope-radionuclide.html] that tends to accumulate in the bones when it is introduced into the body. An example is strontium-90, which behaves chemically like calcium.

**Brachytherapy**

A medical procedure during which a sealed radioactive source (or sources) is implanted directly into a person being treated for cancer (usually of the mouth, breast, lung, prostate, ovaries, or uterus). The radioactive implant may be temporary or permanent, and the radiation kills cells in the tumor as long as the device remains in place and emits radiation. Brachytherapy uses radioisotopes, such as iridium-192 or iodine-125, which are regulated by the NRC and Agreement States.

**Breeder**

A reactor [/reading-rm/basic-ref/glossary/reactor-nuclear.html] that produces more nuclear fuel [/reading-rm/basic-ref/glossary/nuclear-fuel.html] than it consumes. A fertile material [/reading-rm/basic-ref/glossary/fertile-material.html] , such as uranium-238, when bombarded by neutrons [/reading-rm/basic-ref/glossary/neutron.html] , is transformed into a fissile material [/reading-rm/basic-ref/glossary/fissile-material.html] , such as plutonium-239, which can be used as fuel.

**British thermal unit (Btu)**

The amount of heat required to change the temperature of one pound of water one degree Fahrenheit at sea level.

**Butt weld**

A weld that joins two pipes end to end.

**Byproduct**

See *Byproduct material [/reading-rm/basic-ref/glossary/byproduct-material.html]* .

**Byproduct material**

As defined by NRC regulations includes any radioactive material (except enriched uranium [/reading-rm/basic-ref/glossary/uranium.html] or plutonium [/reading-rm/basic-ref/glossary/plutonium-pu.html] ) produced by a nuclear reactor [/reading-rm/basic-ref/glossary/nuclear-reactor.html] . It also includes the tailings [/reading-rm/basic-ref/glossary/mill-tailings.html] or wastes [/reading-rm/basic-ref/glossary/waste-radioactive.html] produced by the extraction [/materials/uranium-recovery/extraction-methods.html] or concentration of uranium or thorium or the fabrication of fuel [/materials/fuel-cycle-fac/fuel-fab.html] for nuclear reactors. Additionally, it is any material that has been made radioactive through the use of a particle accelerator or any discrete source of radium-226 [/reading-rm/basic-ref/glossary/radium-ra.html] used for a commercial, medical, or research activity. In addition, the NRC, in consultation with the EPA, DOE, DHS and others, can designate as byproduct material any source of naturally-occurring radioactive material, other than source material [/reading-rm/basic-ref/glossary/source-material.html] , that it determines would pose a threat to public health and safety or the common defense and security of the United States. For additional detail, see Byproduct Material [/materials/byproduct-mat.html] .

**Calibration**

The adjustment, as necessary, of a measuring device such that it responds within the required range and accuracy to known values of input.

**Call**

Execution of a specific function within software.

**Canister**

*See Dry cask storage [/reading-rm/basic-ref/glossary/dry-cask-storage.html] .*

**Capability**

The maximum load that a generating unit, generating station, or other electrical apparatus can carry under specified conditions for a given period of time without exceeding approved limits of temperature and stress.

**Capacity**

The amount of electric power that a generator, turbine, transformer, transmission, circuit, or system is able to produce, as rated by the manufacturer.

**Capacity charge**

One of two elements in a two-part pricing method used in capacity transactions (the other element is the energy charge). The capacity charge, sometimes called the demand charge, is assessed on the capacity (amount of electric power) being purchased.

**Capacity factor**

The ratio of the available capacity (the amount of electrical power actually produced by a generating unit) to the theoretical capacity (the amount of electrical power that could theoretically have been produced if the generating unit had operated continuously at full power) during a given time period.

**Capacity factor (gross)**

The ratio of the gross electricity generated, for the time considered, to the energy that could have been generated at continuous full-power operation during the same period.

**Capacity factor (net)**

The ratio of the net electricity generated, for the time considered, to the energy that could have been generated at continuous full-power operation during the same period.

**Capacity utilization**

A percentage representing the extent to which a generating unit fulfilled its capacity in generating electric power over a given time period. This percentage is defined as the margin between the unit's available capacity (the amount of electrical power the unit actually produced) and its theoretical capacity (the amount of electrical power that could have been produced if the unit had operated continuously at full power) during a certain time period. Capacity utilization is computed by dividing the amount actually produced by the theoretical capacity, and multiplying by 100.

**Cask**

A heavily shielded container used for the dry storage or shipment (or both) of radioactive materials such as spent nuclear fuel or other high-level radioactive waste (HLW). Casks are often made from lead, concrete, or steel. Casks must meet regulatory requirements. For additional detail, see Dry Cask Storage [/waste/spent-fuel-storage/dry-cask-storage.html] and Dry Spent Fuel Storage Designs: NRC Approved for General Use [/waste/spent-fuel-storage/designs.html] .

**Categories of radioactive sources**

The International Atomic Energy Agency [/reading-rm/basic-ref/glossary/international-atomic-energy-agency-iaea.html] 's Code of Conduct on the Safety and Security of Radioactive Sources defines the five categories for radiation sources to help ensure that sufficient controls are being used to achieve safety and security:

- **Category 1 sources**, if not safely or securely managed, would be likely to cause permanent injury to a person who handled them or was otherwise in contact with them for more than a few minutes. It would probably be fatal to be close to this amount of unshielded material for a period of a few minutes to an hour. These sources are typically used in radiothermal generators, irradiators, and radiation teletherapy [/reading-rm/basic-ref/glossary/teletherapy.html] .
- **Category 2 sources**, if not safely or securely managed, could cause permanent injury to a person who handled them or was otherwise in contact with them for a short time (minutes to hours). It could possibly be fatal to be close to this amount of unshielded radioactive material for a period of hours to days. These sources are typically used in industrial gamma radiography, high- and medium-dose rate brachytherapy [/reading-rm/basic-ref/glossary/brachytherapy.html] , and radiography [/reading-rm/basic-ref/glossary/radiography.html] .
- **Category 3 sources**, if not safely or securely managed, could cause permanent injury to a person who handled them or was otherwise in contact with them for hours. It could possibly—although it is unlikely to—be fatal to be close to this amount of unshielded radioactive material for a period of days to weeks. These sources are typically used in fixed industrial gauges such as level gauges, dredger gauges, conveyor gauges, spinning pipe gauges, and well-logging [/reading-rm/basic-ref/glossary/well-logging.html] gauges.
- **Category 4 sources**, if not safely managed or securely protected, could possibly cause temporary injury to someone who handled them or was otherwise in contact with or close to them for a period of many weeks, though this is unlikely. It is very unlikely anyone would be permanently injured by this amount of radioactive material. These sources are typically used in fixed or portable gauges, static eliminators, or low-dose brachytherapy.

- **Category 5 sources** cannot cause permanent injury. They are used in x-ray fluorescence devices and electron capture devices.

Only Categories 1 and 2 for radiation sources are defined by NRC requirements

**Categories of special nuclear material**

The NRC groups special nuclear materials and the facilities that possess them into three categories based upon the materials' potential for use in nuclear weapons or their "strategic significance":

- Category I: High strategic significance
- Category II: Moderate strategic significance
- Category III: Low strategic significance

The NRC's physical security and safeguards requirements differ by category, with Category I facilities subject to more stringent requirements because they pose greater security and safeguards risks.

**Cation**

A positively charged ion [/reading-rm/basic-ref/glossary/ion.html] .

**Chain reaction**

A reaction that initiates its own repetition. In a fission [/reading-rm/basic-ref/glossary/fission-fissioning.html] chain reaction, a fissionable [/reading-rm/basic-ref/glossary/fissionable-material.html] nucleus [/reading-rm/basic-ref/glossary/nucleus.html] absorbs a neutron [/reading-rm/basic-ref/glossary/neutron.html] and fissions spontaneously, releasing additional neutrons. These, in turn, can be absorbed by other fissionable nuclei, releasing still more neutrons. A fission chain reaction is self-sustaining when the number of neutrons released in a given time equals or exceeds the number of neutrons lost by absorption in nonfissionable material or by escape from the system.

**Charged particle**

An ion [/reading-rm/basic-ref/glossary/ion.html] . An elementary particle (part of an element [/reading-rm/basic-ref/glossary/element.html] ) carrying a positive or negative electric charge.

**Chemical recombination**

Following an ionization [/reading-rm/basic-ref/glossary/ionization.html] event, the positively and negatively charged ion [/reading-rm/basic-ref/glossary/ion.html] pairs may or may not realign themselves to form the same chemical substance they formed before ionization. Thus, chemical recombination could change the chemical composition of the material bombarded by ionizing radiation [/reading-rm/basic-ref/glossary/radiation-ionizing.html] .

**Circumferential crack**

A crack that is oriented in a plane parallel to the transverse section of a pipe.

**Cladding**

The thin-walled metal tube that forms the outer jacket of a nuclear fuel rod [/reading-rm/basic-ref/glossary/fuel-rod.html] . It prevents corrosion of the fuel [/reading-rm/basic-ref/glossary/nuclear-fuel.html] by the coolant [/reading-rm/basic-ref/glossary/coolant.html] and the release of fission products [/reading-rm/basic-ref/glossary/fission-products.html] into the coolant. Aluminum, stainless steel, and zirconium alloys are common cladding materials.

**Classified information**

Information that has been determined pursuant to an Executive order to require protection against unauthorized disclosure and is marked to indicate its classified status when in documentary form. The NRC has two types of classified information. The first type, known as National Security Information, is information that is classified by an Executive order. Its release would damage national security. The second type, known as Restricted Data, would assist individuals or organizations in designing, manufacturing, or using nuclear weapons. Access to both types of information is restricted to authorized persons who have been properly cleared and have a "need to know" the information to accomplish their official duties.

**Cleanup system**

A system used for continuously filtering and demineralizing a reactor coolant system [/reading-rm/basic-ref/glossary/reactor-coolant-system.html] to reduce contamination [/reading-rm/basic-ref/glossary/contamination.html] levels and to minimize corrosion.

**Coastdown**

An action that permits the reactor [/reading-rm/basic-ref/glossary/reactor-nuclear.html] power level to decrease gradually as the fuel [/reading-rm/basic-ref/glossary/nuclear-fuel.html] in the core [/reading-rm/basic-ref/glossary/reactor-core.html] is depleted [/reading-rm/basic-ref/glossary/spent-depleted-or-used-nuclear-fuel.html] .

**Cold shutdown**

The term used to define a reactor coolant system [/reading-rm/basic-ref/glossary/reactor-coolant-system.html] at atmospheric pressure and at a temperature below 200 degrees Fahrenheit following a reactor cooldown [/reading-rm/basic-ref/glossary/cooldown.html] .

**Collective dose**

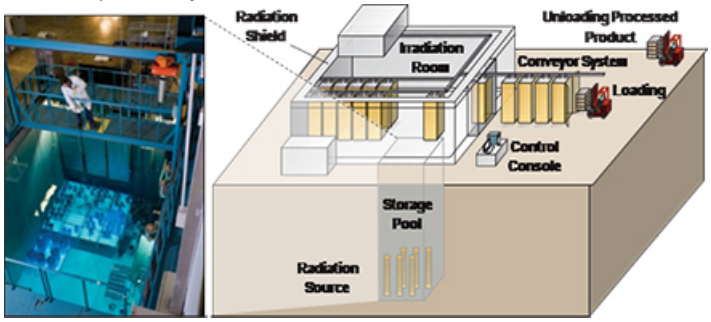
As defined in Title 10, Section 20.1003, of the *Code of Federal Regulations* (10 CFR 20.1003 [/reading-rm/doc-collections/cfr/part020/part020-1003.html] ), this is the sum of the individual doses [/reading-rm/basic-ref/glossary/dose.html] received in a given period by a specified population from exposure [/reading-rm/basic-ref/glossary/exposure.html] to a specified source of radiation [/reading-rm/basic-ref/glossary/radiation-nuclear.html] . For related information, see Doses in Our Daily Lives [/about-nrc/radiation/around-us/doses-daily-lives.html] , Sources of Radiation [/about-nrc/radiation/around-us/sources.html] , and Measuring Radiation [/about-nrc/radiation/health-effects/measuring-radiation.html] .

**Combined license (COL)**

An NRC-issued license that authorizes a licensee to construct and (with certain specified conditions) operate a nuclear power facility, such as a nuclear plant at a specific site. For additional detail, see Combined License Applications [/reactors/new-reactors/col.html] .

**Commercial Irradiator**

A facility that uses high doses of radiation to sterilize or treat products, such as food and spices, medical supplies, and wood flooring. Irradiation can be used to eliminate harmful bacteria, germs, and insects or for hardening or other purposes. The radiation does not leave radioactive residue or make the treated products radioactive. Radiation sources include radioactive materials (e.g., cobalt-60), an x-ray machine, or an electron beam.




**Commercial sector (energy users)**

Generally, nonmanufacturing business establishments, including hotels, motels, and restaurants; wholesalers and retail stores; and health, social, and educational institutions. However, utilities may categorize commercial service as all consumers whose demand or annual usage exceeds some specified limit that is categorized as residential service.

**Committed dose equivalent (CDE)**

As defined in Title 10, Section 20.1003, of the *Code of Federal Regulations* (10 CFR 20.1003 [/reading-rm/doc-collections/cfr/part020/part020-1003.html] ), the CDE (HT,50) is the dose [/reading-rm/basic-ref/glossary/dose.html] to some specific organ or tissue 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 (CEDE)**

As defined in Title 10, Section 20.1003, of the *Code of Federal Regulations* (10 CFR 20.1003 [/reading-rm/doc-collections/cfr/part020/part020-1003.html] ), the CEDE ($H_{E,50}$) is the sum of the products of the committed dose equivalents [/reading-rm/basic-ref/glossary/committed-dose-equivalent-cde.html] for each of the body organs or tissues that are irradiated [/reading-rm/basic-ref/glossary/irradiation.html] multiplied by the weighting factors ($W_T$) applicable to each of those organs or tissues ($H_{E,50} = \Sigma W_T H_{T.50}$).

**Compact**

A group of two or more U.S. States that have formed alliances to dispose of low-level radioactive waste (LLW). For details, see Low-Level Waste Disposal [/waste/llw-disposal.html] , and for locations, see Low-Level Waste Compacts [/waste/llw-disposal/licensing/compacts.html] .

**Compound**

A chemical combination of two or more elements [/reading-rm/basic-ref/glossary/element.html] combined in a fixed and definite proportion by weight.

**Condensate**

Water that has been produced by the cooling of steam in a condenser [/reading-rm/basic-ref/glossary/condenser.html] .

**Condenser**

A large heat exchanger [/reading-rm/basic-ref/glossary/heat-exchanger.html] designed to cool exhaust steam from a turbine [/reading-rm/basic-ref/glossary/turbine.html] below the boiling point so that it can be returned to the heat source as water. In a pressurized-water reactor [/reading-rm/basic-ref/glossary/pressurized-water-reactor-pwr.html] , the water is returned to the steam generator [/reading-rm/basic-ref/glossary/steam-generator.html] . In a boiling-water reactor [/reading-rm/basic-ref/glossary/boiling-water-reactor-bwr.html] , it returns to the reactor core [/reading-rm/basic-ref/glossary/reactor-core.html] . The heat removed from the steam by the condenser is transferred to a circulating water system and is exhausted to the environment, either through a cooling tower [/reading-rm/basic-ref/glossary/cooling-tower.html] or directly into a body of water.

**Configuration management**

A discipline applying technical and administrative direction and surveillance to identify and document the functional and physical characteristics of a configuration item, control changes to those characteristics, record and report change processing and implementation status, and verify compliance with specified requirements.

**Construction recapture**

The maximum number of years that could be added to a facility's license expiration date to recapture the period between the date the NRC issued the facility's construction permit to the date it granted an operating license [/reactors/operating/licensing.html] . A licensee must submit an application to request this extension. For further information, see the Staff Requirements Memorandum [/reading-rm/doc-collections/commission/srm/1998/1998-296srm.pdf] regarding SECY-98-296, "Agency Policy Regarding Licensee Recapture of Low-Power Testing or Shutdown Time for Nuclear Power Plants."

**Containment building**

The air-tight building, which houses a nuclear reactor [/reading-rm/basic-ref/glossary/nuclear-reactor.html] and its pressurizer [/reading-rm/basic-ref/glossary/pressurizer.html] , reactor coolant [/reading-rm/basic-ref/glossary/coolant.html] pumps, steam generator [/reading-rm/basic-ref/glossary/steam-generator.html] , and other equipment or piping that might otherwise release fission products [/reading-rm/basic-ref/glossary/fission-products.html] to the atmosphere in the event of an accident. Such buildings are usually made of steel-reinforced concrete.

**Containment structure**

A gas-tight shell or other enclosure around a nuclear reactor [/reading-rm/basic-ref/glossary/nuclear-reactor.html] to confine fission products [/reading-rm/basic-ref/glossary/fission-products.html] that otherwise might be released to the atmosphere in the event of an accident. Such enclosures are usually dome-shaped and made of steel-reinforced concrete.

**Contamination**

Undesirable radiological or chemical material (with a potentially harmful effect) that is either airborne or deposited in (or on the surface of) structures, objects, soil, water, or living organisms.

**Control rod**

A rod, plate, or tube containing a material such as hafnium, boron, etc., used to control the power of a nuclear reactor [/reading-rm/basic-ref/glossary/nuclear-reactor.html] . By absorbing neutrons [/reading-rm/basic-ref/glossary/neutron.html] , a control rod prevents the neutrons from causing further fissions [/reading-rm/basic-ref/glossary/fission-fissioning.html] .

**Control room**

The area in a nuclear power plant [/reading-rm/basic-ref/glossary/nuclear-power-plant.html] from which most of the plant's power production and emergency safety equipment can be operated by remote control.

**Controlled area**

At a nuclear facility, an area outside a restricted area [/reading-rm/basic-ref/glossary/restricted-area.html] but within the site boundary, to which the licensee [/reading-rm/basic-ref/glossary/licensee.html] can limit access for any reason.

**Coolant**

A substance circulated through a nuclear reactor [/reading-rm/basic-ref/glossary/nuclear-reactor.html] to remove or transfer heat. The most commonly used coolant in the United States is water. Other coolants include heavy water [/reading-rm/basic-ref/glossary/heavy-water-d2o.html] , air, carbon dioxide, helium, liquid sodium, and a sodium-potassium alloy.

**Cooldown**

The gradual decrease in reactor fuel rod [/reading-rm/basic-ref/glossary/fuel-rod.html] temperature caused by the removal of heat from the reactor coolant system [/reading-rm/basic-ref/glossary/reactor-coolant-system.html] after the reactor [/reading-rm/basic-ref/glossary/reactor-nuclear.html] has been shutdown [/reading-rm/basic-ref/glossary/shutdown.html] .

**Cooling tower**

A heat exchanger [/reading-rm/basic-ref/glossary/heat-exchanger.html] designed to aid in the cooling of water that was used to cool exhaust steam exiting the turbines [/reading-rm/basic-ref/glossary/turbine.html] of a power plant [/reading-rm/basic-ref/glossary/nuclear-power-plant.html] . Cooling towers transfer exhaust heat into the air instead of into a body of water.

**Core**

The central portion of a nuclear reactor [/reading-rm/basic-ref/glossary/reactor-nuclear.html] , which contains the fuel assemblies [/reading-rm/basic-ref/glossary/fuel-assembly-fuel-bundle-fuel-element.html] , moderator [/reading-rm/basic-ref/glossary/moderator.html] , neutron poisons [/reading-rm/basic-ref/glossary/nuclear-poison-or-neutron-poison.html] , control rods [/reading-rm/basic-ref/glossary/control-rod.html] , and support structures. The reactor core is where fission [/reading-rm/basic-ref/glossary/fission-fissioning.html] takes place.

**Core damage frequency**

An expression of the likelihood that, given the way a reactor [/reading-rm/basic-ref/glossary/reactor-nuclear.html] is designed and operated, an accident could cause the fuel [/reading-rm/basic-ref/glossary/nuclear-fuel.html] in the reactor to be damaged.

**Core melt accident**

An event or sequence of events that result in the melting of part of the fuel [/reading-rm/basic-ref/glossary/nuclear-fuel.html] in the reactor core [/reading-rm/basic-ref/glossary/reactor-core.html] .

**Cornerstone of Safety**

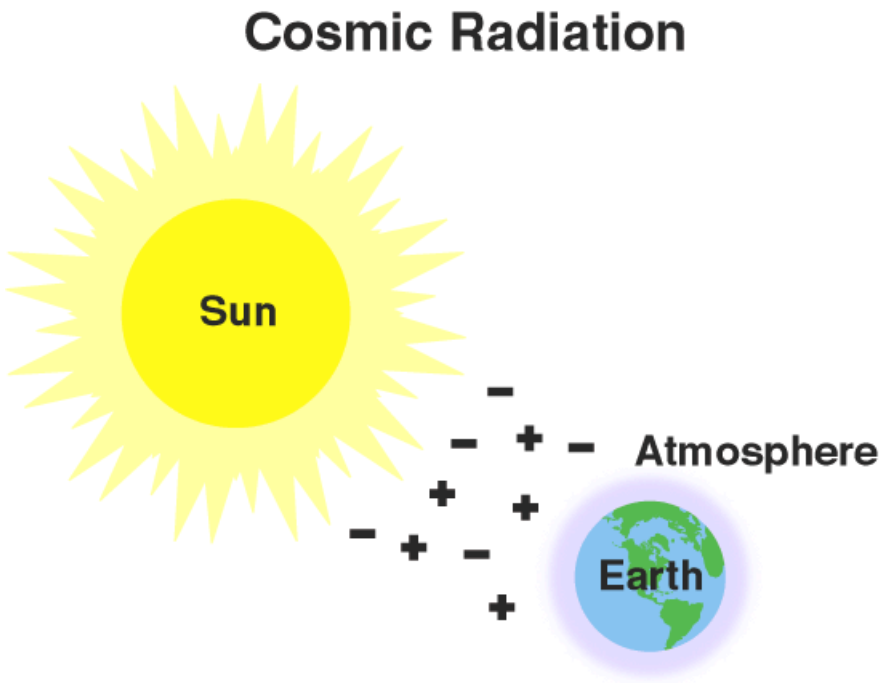
Nuclear plant activities that are essential for the safe operation of the facility. These cornerstones are grouped under the categories of reactor safety, radiation safety, and safeguards.

**Corrective Action Program**

The system by which a utility finds and fixes problems at the nuclear plant. It includes a process for evaluating the safety significance of the problems, setting priorities in correcting the problems, and tracking them until they have been corrected.

**Cosmic radiation**

A source of natural background radiation [/reading-rm/basic-ref/glossary/background-radiation.html] , which originates in outer space and is composed of penetrating ionizing radiation [/reading-rm/basic-ref/glossary/radiation-ionizing.html] (both particulate and electromagnetic). The sun and stars send a constant stream of cosmic radiation to Earth, much like a steady drizzle of rain. Differences in elevation, atmospheric conditions, and the Earth's magnetic field can change the amount (or dose [/reading-rm/basic-ref/glossary/dose.html] ) of cosmic radiation that we receive. Secondary cosmic rays, formed by interactions in the Earth's atmosphere, account for about 45 to 50 millirem [/reading-rm/basic-ref/glossary/millirem.html] of the 360 millirem of background radiation that an average individual receives in a year. For related information, see Natural Background Sources [/about-nrc/radiation/around-us/sources/nat-bg-sources.html] .




**Counter**

A general designation applied to radiation detection instruments [/reading-rm/basic-ref/glossary/radiation-detection-instrument.html] or survey meters [/reading-rm/basic-ref/glossary/survey-meter.html] that detect and measure radiation. The signal that announces an ionization [/reading-rm/basic-ref/glossary/ionization.html] event is called a count. For related information, see Detecting Radiation [/about-nrc/radiation/health-effects/detection-radiation.html] .

**Crack coalescence**

The combination of two cracks into one.

**Crack growth**

A process by which a crack becomes progressively longer or deeper.

**Crack initiation**

Formation of a crack before it is detectable by usual nondestructive examination techniques and before it can be analyzed using fracture mechanics.

**Critical mass**

The smallest mass of fissionable material [/reading-rm/basic-ref/glossary/fissionable-material.html] that will support a self-sustaining chain reaction [/reading-rm/basic-ref/glossary/chain-reaction.html] .

**Critical organ**

That part of the body that is most susceptible to radiation damage under the specific conditions under consideration.

**Critical ratio**

An indication of how close a pipe is to rupture.

**Criticality**

The condition involving fission of nuclear materials when the number of neutrons produced equals or exceeds the nuclear containment. During normal reactor operations, nuclear fuel sustains a fission chain reaction or criticality. A reactor achieves criticality (and is said to be critical) when each fission event releases a sufficient number of neutrons to sustain an ongoing series of reactions.

**Cross-cutting Area**

Nuclear plant activity that affects most or all safety cornerstones. These include the problem identification and resolution, human performance, and "safety-conscious work environment."

**Crud**

A colloquial term for corrosion and wear products (rust particles, etc.) that become radioactive (i.e., activated) when exposed to radiation.

**Cumulative dose**

The total dose [/reading-rm/basic-ref/glossary/dose.html] that an occupationally exposed worker receives as a result of repeated exposures [/reading-rm/basic-ref/glossary/exposure.html] to ionizing radiation [/reading-rm/basic-ref/glossary/radiation-ionizing.html] to to the same portion of the body, or to the whole body, over time. For additional detail, see Information for Radiation Workers [/about-nrc/radiation/health-effects/info.html] .

**Curie (Ci)**

One of three units used to measure the intensity of radioactivity [/reading-rm/basic-ref/glossary/radioactivity.html] in a sample of material. This value refers to the amount of ionizing radiation [/reading-rm/basic-ref/glossary/radiation-ionizing-radiation.html] released when an element [/reading-rm/basic-ref/glossary/element.html] (such as uranium [/reading-rm/basic-ref/glossary/uranium.html] ) spontaneously emits energy as a result of the radioactive decay [/reading-rm/basic-ref/glossary/radioactive-decay.html] (or disintegration) of an unstable atom [/reading-rm/basic-ref/glossary/atom.html] . Radioactivity is also the term used to describe the rate at which radioactive material emits radiation, or how many atoms in the material decay (or disintegrate) in a given time period. As such, 1 Ci is equal to 37 billion ($3.7 \times 10^{10}$) disintegrations per second, so 1 Ci also equals 37 billion ($3.7 \times 10^{10}$) Bequerels (Bq) [/reading-rm/basic-ref/glossary/becquerel-bq.html] . A curie is also a quantity of any radionuclide [/reading-rm/basic-ref/glossary/radioisotope-radionuclide.html] that decays at a rate of 37 billion disintegrations per second (1 gram of radium [/reading-rm/basic-ref/glossary/radium-ra.html] , for example). The curie is named for Marie and Pierre Curie, who discovered radium in 1898.

**Daughter products**

Isotopes [/reading-rm/basic-ref/glossary/isotope.html] that are formed by the radioactive decay [/reading-rm/basic-ref/glossary/radioactive-decay.html] of some other isotope. In the case of radium-226 [/reading-rm/basic-ref/glossary/radium-ra.html] , for example, there are 10 successive daughter products, ending in the stable isotope lead-206.

**Decay heat**

The heat produced by the decay [/reading-rm/basic-ref/glossary/decay-radioactive.html] of radioactive fission products [/reading-rm/basic-ref/glossary/fission-products.html] after a reactor [/reading-rm/basic-ref/glossary/reactor-nuclear.html] has been shut down.

**Decay, radioactive**

The spontaneous transformation of one radioisotope [/reading-rm/basic-ref/glossary/radioisotope-radionuclide.html] into one or more different isotopes [/reading-rm/basic-ref/glossary/isotope.html] (known as “decay products” or “daughter products [/reading-rm/basic-ref/glossary/daughter-products.html] ”), accompanied by a decrease in radioactivity [/reading-rm/basic-ref/glossary/radioactivity.html] (compared to the parent material). This transformation takes place over a defined period of time (known as a “half-life [/reading-rm/basic-ref/glossary/half-life.html] ”), as a result of electron [/reading-rm/basic-ref/glossary/electron.html] capture; fission [/reading-rm/basic-ref/glossary/fission-fissioning.html] ; or the emission of alpha particles [/reading-rm/basic-ref/glossary/alpha-particle.html] , beta particles [/reading-rm/basic-ref/glossary/beta-particle.html] , or photons [/reading-rm/basic-ref/glossary/photon.html] (gamma radiation [/reading-rm/basic-ref/glossary/gamma-radiation.html] or x-rays [/reading-rm/basic-ref/glossary/x-rays.html] ) from the nucleus [/reading-rm/basic-ref/glossary/nucleus.html] of an unstable atom [/reading-rm/basic-ref/glossary/atom.html] . Each isotope in the sequence (known as a “decay chain”) decays to the next until it forms a stable, less energetic end product. In addition, radioactive decay may refer to gamma-ray and conversion electron emission, which only reduces the excitation energy of the nucleus.

**Declared pregnant woman**

A woman who is an occupational radiation worker and has voluntarily informed her employer, in writing, of her pregnancy and the estimated date of conception (see 10 CFR 20.1003 [/reading-rm/doc-collections/cfr/part020/part020-1003.html] and 20.1208 [/reading-rm/doc-collections/cfr/part020/part020-1208.html] ).

**Decommissioning**

The process of safely closing a nuclear power plant (or other facility where nuclear materials are handled) to retire it from service after its useful life has ended. This process primarily involves decontaminating the facility to reduce residual radioactivity and then releasing the property for unrestricted or (under certain conditions) restricted use. This often includes dismantling the facility or dedicating it to other purposes. See SAFSTOR. For additional information, see Decommissioning of Nuclear Facilities [/waste/decommissioning.html] and Find Sites Undergoing Decommissioning [/info-finder/decommissioning/] .

**DECON**

A phase of reactor decommissioning in which structures, systems, and components that contain radioactive contamination are removed from a site and safely disposed of at a commercially operated low-level waste disposal facility or decontaminated to a level that permits the site to be released for unrestricted use.

**Decontamination**

A process used to reduce, remove, or neutralize radiological or chemical contamination to reduce the risk of exposure. Decontamination may be accomplished by cleaning or treating surfaces to reduce or remove the contamination, filtering contaminated air or water, or subjecting contamination to evaporation and precipitation. The process can also simply allow adequate time for radioactive decay to decrease the radioactivity.

**Deep-Dose Equivalent (DDE)**

The external whole-body exposure [/reading-rm/basic-ref/glossary/whole-body-exposure.html] dose equivalent [/reading-rm/basic-ref/glossary/dose-equivalent.html] at a tissue depth of 1 cm (1000 mg/cm$^2$). For further information, see Measuring Radiation [/about-nrc/radiation/health-effects/measuring-radiation.html] .

**Defense in depth**

An approach to designing and operating nuclear facilities that prevents and mitigates accidents that release radiation or hazardous materials. The key is creating multiple independent and redundant layers of defense to compensate for potential human and mechanical failures so that no single layer, no matter how robust, is exclusively relied upon. Defense in depth includes the use of access controls, physical barriers, redundant and diverse key safety functions, and emergency response measures.

**Departure from nuclear boiling ratio (DNBR)**

The ratio of the heat flux [/reading-rm/basic-ref/glossary/flux.html] needed to cause departure from nucleate boiling [/reading-rm/basic-ref/glossary/departure-from-nucleate-boiling-dnb.html] to the actual local heat flux of a fuel rod [/reading-rm/basic-ref/glossary/fuel-rod.html] .

**Departure from nucleate boiling (DNB)**

The point at which the heat transfer from a fuel rod [/reading-rm/basic-ref/glossary/fuel-rod.html] rapidly decreases due to the insulating effect of a steam blanket that forms on the rod surface when the temperature continues to increase.

**Depleted uranium**

Uranium with a percentage of uranium-235 lower than the 0.7 percent (by mass) contained in natural uranium. Depleted uranium is the byproduct of the uranium enrichment process. Depleted uranium can be blended with highly enriched uranium, such as that from weapons, to make reactor fuel.

**Derived air concentration (DAC)**

The concentration of a given radionuclide [/reading-rm/basic-ref/glossary/radionuclide.html] in air which, if breathed by the reference man [/reading-rm/basic-ref/glossary/reference-man.html] for a working year of 2,000 hours under conditions of light work (with an inhalation rate of 1.2 cubic meters of air per hour), results in an intake of one annual limit on intake (ALI) [/reading-rm/basic-ref/glossary/annual-limit-on-intake-ali.html] . Established DAC values are given in Table 1, Column 3, of Appendix B [/reading-rm/doc-collections/cfr/part020/part020-appb.html] to Title 10, Part 20, of the *Code of Federal Regulations* (10 CFR Part 20 [/reading-rm/doc-collections/cfr/part020/] ), "Standards for Protection Against Radiation."

**Derived Air Concentration-Hour (DAC-hour)**

The product of the concentration of radioactive material in air (expressed as a fraction or multiple of the derived air concentration [/reading-rm/basic-ref/glossary/derived-air-concentration-dac.html] for each radionuclide [/reading-rm/basic-ref/glossary/radionuclide.html] ) and the time of exposure [/reading-rm/basic-ref/glossary/exposure.html] to that radionuclide, in hours. A licensee may take 2,000 DAC-hours to represent one annual limit on intake (ALI) [/reading-rm/basic-ref/glossary/annual-limit-on-intake-ali.html] , equivalent to a committed effective dose equivalent of 5 rems [/reading-rm/basic-ref/glossary/rem-roentgen-equivalent-man.html] (0.05 Sv [/reading-rm/basic-ref/glossary/sievert-sv.html] ).

**Design certification**

Certification and approval by the NRC of a standard nuclear power plant design independent of a specific site or an application to construct or operate a plant. A design certification is valid for 15 years from the date of issuance but can be renewed for an additional 10 to 15 years.

**Design-basis accident**

A postulated accident that a nuclear facility must be designed and built to withstand without loss to the systems, structures, and components necessary to ensure public health and safety.

**Design-basis phenomena**

Earthquakes, tornadoes, hurricanes, floods, etc., that a nuclear facility must be designed and built to withstand without loss of systems, structures, and components necessary to ensure public health and safety.

**Design-basis threat (DBT)**

A description of the type, composition, and capabilities of an adversary, against which a security system is designed to protect. The NRC uses the DBT as a basis for designing safeguards systems to protect against acts of radiological sabotage and to prevent the theft of special nuclear material. Certain nuclear facility licensees are required to defend against the DBT.

**Detector**

A material or device that is sensitive to ionizing radiation [/reading-rm/basic-ref/glossary/ionizing-radiation.html] and can display its characteristics and/or produce a signal suitable for measurement or analysis. See also radiation detection instrument [/reading-rm/basic-ref/glossary/radiation-detection-instrument.html] .

**Deterministic (probabilistic)**

Consistent with the principles of "determinism," which hold that specific causes completely and certainly determine effects of all sorts. As applied in nuclear technology, it generally deals with evaluating the safety of a nuclear power plant [/reading-rm/basic-ref/glossary/nuclear-power-plant.html] in terms of the consequences of a predetermined bounding subset of accident sequences. The term "probabilistic" is associated with an evaluation that explicitly accounts for the likelihood and consequences of possible accident sequences in an integrated fashion. See also Probabilistic risk assessment (PRA) [/reading-rm/basic-ref/glossary/probabilistic-risk-assessment-pra.html] .

**Deterministic effect**

The health effects of radiation, the severity of which varies with the dose [/reading-rm/basic-ref/glossary/dose.html] and for which a threshold is believed to exist. Radiation-induced cataract formation is an example of a deterministic effect (also called a non-stochastic effect) (see 10 CFR 20.1003 [/reading-rm/doc-collections/cfr/part020/part020-1003.html] ).

**Deuterium**

An isotope [/reading-rm/basic-ref/glossary/isotope.html] of hydrogen with one proton [/reading-rm/basic-ref/glossary/proton.html] and one neutron [/reading-rm/basic-ref/glossary/neutron.html] in the nucleus [/reading-rm/basic-ref/glossary/nucleus.html] .

**Deuteron**

The nucleus [/reading-rm/basic-ref/glossary/nucleus.html] of deuterium [/reading-rm/basic-ref/glossary/deuterium.html] . It contains one proton [/reading-rm/basic-ref/glossary/proton.html] and one neutron [/reading-rm/basic-ref/glossary/neutron.html] . See also Heavy water (D2O) [/reading-rm/basic-ref/glossary/heavy-water-d2o.html] .

**Differential pressure (dp or dP)**

The difference in pressure between two points of a system, such as between the inlet and outlet of a pump.

**Doppler coefficient**

Another name used for the "fuel temperature coefficient of reactivity," or the change in reactivity per degree of change in the temperature of nuclear fuel [/reading-rm/basic-ref/glossary/nuclear-fuel.html] . The physical property of fuel pellet [/reading-rm/basic-ref/glossary/pellet-fuel.html] material (uranium-238) that causes the uranium [/reading-rm/basic-ref/glossary/uranium.html] to absorb more neutrons [/reading-rm/basic-ref/glossary/neutron.html] away from the fission [/reading-rm/basic-ref/glossary/fission-fissioning.html] process as fuel pellet temperature increases. This acts to stabilize power reactor [/reading-rm/basic-ref/glossary/power-reactor.html] operations.

**Dose (radiation)**

The National Council on Radiation Protection and Measurements estimates that an average person in the United States receives a total annual dose of about 0.62 rem (620 millirem or 6.2 millisieverts) from all radiation sources, a level that has not been shown to cause humans any harm. Of this total, natural background sources of radiation—including radon and thoron gas, natural radiation from soil and rocks, radiation from space, and radiation sources that are found naturally within the human body—account for about 50 percent. Medical procedures such as computed tomography (CT) scans and nuclear medicine account for about another 48 percent. Other small contributors of exposure to the U.S. population include consumer products and activities, industrial and research uses, and occupational tasks. The maximum permissible yearly dose for a person working with or around nuclear material is 5 rem (50 millisieverts).

**Dose equivalent**

A measure of the biological damage to living tissue as a result of radiation exposure [/reading-rm/basic-ref/glossary/exposure.html] . Also known as the " biological dose," the dose equivalent is calculated as the product of absorbed dose [/reading-rm/basic-ref/glossary/dose-absorbed.html] in tissue multiplied by a quality factor [/reading-rm/basic-ref/glossary/quality-factor.html] and then sometimes multiplied by other necessary modifying factors at the location of interest. The dose equivalent is expressed numerically in rems [/reading-rm/basic-ref/glossary/rem-roentgen-equivalent-man.html] or sieverts (Sv) [/reading-rm/basic-ref/glossary/sievert-sv.html] (see 10 CFR 20.1003 [/reading-rm/doc-collections/cfr/part020/part020-1003.html] ). For additional information, see Doses in Our Daily Lives [/about-nrc/radiation/around-us/doses-daily-lives.html] and Measuring Radiation [/about-nrc/radiation/health-effects/measuring-radiation.html] .

**Dose rate**

The dose [/reading-rm/basic-ref/glossary/dose.html] of ionizing radiation [/reading-rm/basic-ref/glossary/ionizing-radiation.html] delivered per unit time. For example, rems [/reading-rm/basic-ref/glossary/rem-roentgen-equivalent-man.html] or sieverts (Sv) [/reading-rm/basic-ref/glossary/sievert-sv.html] per hour.

**Dose, absorbed**

The amount of energy absorbed by an object or person per unit mass. Known as the “absorbed dose [/reading-rm/basic-ref/glossary/dose-absorbed.html] ,” this reflects the amount of energy that ionizing radiation [/reading-rm/basic-ref/glossary/ionizing-radiation.html] sources deposit in materials through which they pass, and is measured in units of radiation-absorbed dose (rad) [/reading-rm/basic-ref/glossary/rad-radiation-absorbed-dose.html] . The related international system unit is the gray (Gy) [/reading-rm/basic-ref/glossary/gray-gy.html] , where 1 Gy is equivalent to 100 rad. For additional information, see Doses in Our Daily Lives [/about-nrc/radiation/around-us/doses-daily-lives.html] and Measuring Radiation [/about-nrc/radiation/health-effects/measuring-radiation.html] .

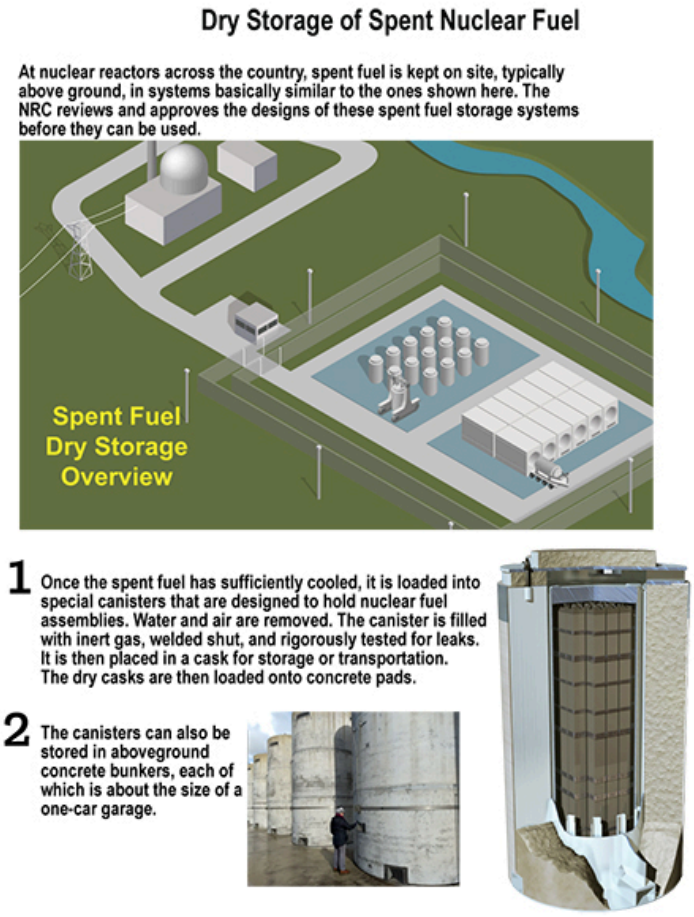
**Dosimeter**

A small portable instrument (such as a film badge [/reading-rm/basic-ref/glossary/film-badge.html] , thermoluminescent dosimeter [/reading-rm/basic-ref/glossary/thermoluminescent-dosimeter.html] , or pocket dosimeter [/reading-rm/basic-ref/glossary/pocket-dosimeter.html] ) used to measure and record the total accumulated personal dose [/reading-rm/basic-ref/glossary/dose.html] of ionizing radiation [/reading-rm/basic-ref/glossary/ionizing-radiation.html] . For additional information, see Detecting Radiation [/about-nrc/radiation/health-effects/detection-radiation.html] .

**Dosimetry**

The theory and application of the principles and techniques involved in measuring and recording doses [/reading-rm/basic-ref/glossary/dose.html] of ionizing radiation [/reading-rm/basic-ref/glossary/ionizing-radiation.html] .

**Dry cask storage**




A method for storing spent nuclear fuel [/reading-rm/basic-ref/glossary/spent-depleted-or-used-nuclear-fuel.html] in special containers known as casks [/reading-rm/basic-ref/glossary/cask.html] . After fuel has been cooled in a spent fuel pool [/reading-rm/basic-ref/glossary/spent-fuel-pool.html] for at least 1 year, dry cask storage allows spent fuel assemblies [/reading-rm/basic-ref/glossary/fuel-assembly-fuel-bundle-fuel-element.html] to be sealed in casks or canisters and surrounded by inert gas. They are welded or bolted closed, and each is surrounded by steel, concrete, lead, or other material to provide leak-tight containment and radiation shielding [/reading-rm/basic-ref/glossary/shielding.html] . The casks may store the fuel horizontally or vertically in concrete vaults or on concrete pads.

**Drywell**

The containment structure [/reading-rm/basic-ref/glossary/containment-structure.html] enclosing the vessel and recirculation system of a boiling-water reacto [/reading-rm/basic-ref/glossary/boiling-water-reactor-bwr.html] r. The drywell provides both a pressure suppression system and a fission product [/reading-rm/basic-ref/glossary/fission-products.html] barrier under accident conditions. For related information, see Boiling-Water Reactors [/reactors/bwrs.html] .

**Early site permit (ESP)**

A permit granted by the NRC to approve one or more proposed sites for a nuclear power facility, independent of a specific nuclear plant design or an application for a construction permit or combined license. An ESP is valid for 10 to 20 years but can be renewed for an additional 10 to 20 years.

**Earthquake, operating basis**

An earthquake that could be expected to affect the site of a nuclear reactor [/reading-rm/basic-ref/glossary/reactor-nuclear.html] , but for which the plant's power production equipment is designed to remain functional without undue risk to public health and safety.

**Economic Simplified Boiling-Water Reactor (ESBWR)**

A 4,500-MWt [/reading-rm/basic-ref/glossary/megawatt-mw.html] nuclear reactor [/reading-rm/basic-ref/glossary/nuclear-reactor.html] design, which has passive safety features and uses natural circulation (with no recirculation pumps or associated piping) for normal operation. GE-Hitachi Nuclear Energy (GEH) submitted an application for final design approval and standard design certification for the ESBWR on August 24, 2005. For detail, see Design Certification Application Review: Economic Simplified Boiling-Water Reactor (ESBWR) [/reactors/new-reactors/design-cert/esbwr.html] .

**Effective Dose Equivalent**

The sum of the products of the dose equivalent [/reading-rm/basic-ref/glossary/dose-equivalent.html] 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 [/reading-rm/basic-ref/glossary/irradiation.html] ($H_E = \Sigma W_T H_T$).

**Effective half-life**

The time required for the activity [/reading-rm/basic-ref/glossary/activity.html] of a particular radioisotope [/reading-rm/basic-ref/glossary/radioisotope-radionuclide.html] deposited in a living organism, such as a human or an animal, to be reduced by 50 percent as a result of the combined action of radioactive decay [/reading-rm/basic-ref/glossary/radioactive-decay.html] and biological elimination. Effective half-life is related to, but different from, the radiological half-life [/reading-rm/basic-ref/glossary/half-life-radiological.html] and the biological half-life [/reading-rm/basic-ref/glossary/half-life-biological.html] .

**Efficiency, plant**

The percentage of the total energy content of a power plant's fuel that is converted into electricity. The remaining energy is lost to the environment as heat.

**Electric power grid**

A system of synchronized power providers and consumers, connected by transmission and distribution lines and operated by one or more control centers. In the continental United States, the electric power grid consists of three systems–the Eastern Interconnect, the Western Interconnect, and the Texas Interconnect. In Alaska and Hawaii, several systems encompass areas smaller than the State.

**Electric utility**

A corporation, agency, authority, person, or other legal entity that owns and/or operates facilities within the United States, its territories, or Puerto Rico for the generation, transmission, distribution, or sale of electric power (primarily for use by the public). Facilities that qualify as cogenerators or small power producers under the Public Utility Regulatory Policies Act (PURPA) are not considered electric utilities.

**Electrical generator**

An electromagnetic device that converts mechanical (rotational) energy into electrical energy. Most large electrical generators are driven by steam or water turbine systems.

**Electromagnetic radiation**

A traveling wave motion resulting from changing electric or magnetic fields. Familiar electromagnetic radiation range from x-rays [/reading-rm/basic-ref/glossary/x-rays.html] (and gamma rays [/reading-rm/basic-ref/glossary/gamma-radiation.html] ) of short wavelength, through the ultraviolet [/reading-rm/basic-ref/glossary/ultraviolet.html] , visible, and infrared regions, to radar and radio waves of relatively long wavelength.

**Electron**

An elementary particle with a negative charge and a mass 1/1837 that of a proton [/reading-rm/basic-ref/glossary/proton.html] . Electrons surround the positively charged nucleus [/reading-rm/basic-ref/glossary/nucleus.html] of an atom [/reading-rm/basic-ref/glossary/atom.html] , and determine its chemical properties.

**Element**

One of the 103 known chemical substances that cannot be broken down further without changing its chemical properties. Some examples include hydrogen, nitrogen, gold, lead, and uranium [/reading-rm/basic-ref/glossary/uranium.html] . See the periodic table of elements [/reading-rm/basic-ref/about-nuc/periodic.html] .

**Emergency classifications**

Sets of plant conditions that indicate various levels of risk to the public and that might require response by an offsite emergency response organization to protect citizens near the site. The four emergency classification levels used for commercial nuclear power plants, in ascending order of severity, are: Notification of Unusual Event, Alert, Site Area Emergency, and General Emergency.

**Emergency Notification System**

A telephone system used by the NRC to receive notifications of significant nuclear events with an actual or potential effect on the health and safety of the public and the environment. Significant events are reported to the NRC by licensees, Agreement States, other Federal agencies, the public, and other countries.

**Emergency core cooling systems (ECCS)**

Reactor system components (pumps, valves, heat exchangers [/reading-rm/basic-ref/glossary/heat-exchanger.html] , tanks, and piping) that are specifically designed to remove residual heat from the reactor fuel rods [/reading-rm/basic-ref/glossary/fuel-rod.html] in the event of a failure of the normal core cooling system (reactor coolant system [/reading-rm/basic-ref/glossary/reactor-coolant-system.html] ).

**Emergency feedwater**

Another name for auxiliary feedwater [/reading-rm/basic-ref/glossary/auxiliary-feedwater.html] .

**Emergency preparedness (EP)**

The programs, plans, training, exercises, and resources used to prepare for and rapidly identify, evaluate, and respond to emergencies, including those arising from terrorism or natural events such as hurricanes. EP strives to ensure that operators of nuclear power plants and certain fuel cycle facilities can implement measures to protect public health and safety in the event of a radiological emergency. Licensees that operate certain nuclear facilities, such as nuclear power plants, must develop and maintain EP plans that meet NRC requirements. For further detail, see Emergency Preparedness and Response [/about-nrc/emerg-preparedness.html] and Backgrounder on Emergency Preparedness at Nuclear Power Plants [/reading-rm/doc-collections/fact-sheets/emerg-plan-prep-nuc-power.html] .

**Energy Information Administration (EIA)**

The agency, within the U.S. Department of Energy, that provides policy-neutral statistical data, forecasts, and analyses to promote sound policymaking, efficient markets, and public understanding regarding energy and its interaction with the economy and the environment.

**Enrichment**

See *Uranium enrichment [/reading-rm/basic-ref/glossary/uranium-enrichment.html]* .

**ENTOMB**

A method of decommissioning [/reading-rm/basic-ref/glossary/decommissioning.html] , in which radioactive contaminants [/reading-rm/basic-ref/glossary/radioactive-contamination.html] are encased in a structurally long-lived material, such as concrete. The entombed structure is maintained and surveillance is continued until the entombed radioactive waste decays [/reading-rm/basic-ref/glossary/decay-radioactive.html] to a level permitting termination of the license and unrestricted release of the property. During the entombment period, the licensee maintains the license previously issued by the NRC. For further information, see the Fact Sheet on Decommissioning Nuclear Power Plants [/reading-rm/doc-collections/fact-sheets/decommissioning.html] .

**Environmental qualification**

A process for ensuring that equipment will be capable of withstanding the ambient conditions that could exist when the specific function to be performed by the equipment is actually called upon to be performed under accident conditions.

**Epistemic**

A type of uncertainty that is due to lack of knowledge.

**Event Notification System**

An automated event tracking system used internally by the NRC's Headquarters Operations Center [/reading-rm/basic-ref/glossary/nrc-operations-center.html] to track incoming notifications of significant nuclear events with an actual or potential effect on the health and safety of the public and the environment. Significant events are reported to the Operations Center by the NRC's licensees, Agreement States [/reading-rm/basic-ref/glossary/agreement-state.html] , other Federal agencies, the public, and other stakeholders.

**Event tree**

An event tree graphically represents the various accident scenarios that can occur as a result of an initiating event (i.e., a challenge to plant operation). Toward that end, an event tree starts with an initiating event and develops scenarios, or sequences, based on whether a plant system succeeds or fails in performing its function. The event tree then considers all of the related systems that could respond to an initiating event, until the sequence ends in either a safe recovery or reactor core [/reading-rm/basic-ref/glossary/reactor-core.html] damage. For additional information, see Probabilistic Risk Assessment [/about-nrc/regulatory/risk-informed/pra.html] .

**Exclusion area**

The area surrounding the reactor where the reactor licensee has the authority to determine all activities, including exclusion or removal of personnel and property.

**Excursion**

A sudden, very rapid rise in the power level of a reactor [/reading-rm/basic-ref/glossary/nuclear-reactor.html] caused by supercriticality [/reading-rm/basic-ref/glossary/supercriticality.html] . Excursions are usually quickly suppressed by the moderator temperature coefficient [/reading-rm/basic-ref/glossary/moderator-temperature-coefficient-of-reactivity.html] , the fuel temperature coefficient [/reading-rm/basic-ref/glossary/fuel-temperature-coefficient-of-reactivity.html] , or the void coefficient of reactivity [/reading-rm/basic-ref/glossary/void-coefficient-of-reactivity.html] (depending upon reactor design), or by rapid insertion of control rods [/reading-rm/basic-ref/glossary/control-rod.html] .

**Exposure**

Absorption of ionizing radiation or the amount of a hazardous substance that has been ingested, inhaled, or in contact with the skin. Acute exposure occurs over a short period of time. Chronic exposure is exposure received over a long period of time, such as during a lifetime. See Occupational dose [/reading-rm/basic-ref/glossary/occupational-dose.html] .

**External radiation**

Exposure [/reading-rm/basic-ref/glossary/exposure.html] to ionizing radiation [/reading-rm/basic-ref/glossary/ionizing-radiation.html] when the radiation source [/reading-rm/basic-ref/glossary/radiation-source.html] is located outside the body.

**Extremities**

The hands, forearms, elbows, feet, knees, leg below the knees, and ankles. Permissible radiation exposures [/reading-rm/basic-ref/glossary/exposure.html] in these regions are generally greater than those for whole body exposure [/reading-rm/basic-ref/glossary/whole-body-exposure.html] because the extremities contain fewer blood-forming organs and have smaller volumes for energy absorption. (See 10 CFR 20.1003 [/reading-rm/doc-collections/cfr/part020/part020-1003.html] .)

**Fast fission**

Fission [/reading-rm/basic-ref/glossary/fission-fissioning.html] of a "heavy" atom [/reading-rm/basic-ref/glossary/atom.html] (such as uranium-238 [/reading-rm/basic-ref/glossary/uranium.html] ) when it absorbs a fast (high energy) neutron [/reading-rm/basic-ref/glossary/fast-neutron.html] . All fissionable materials [/reading-rm/basic-ref/glossary/fissionable-material.html] can fission with fast neutrons. However, some (such as uranium-235 and Plutonium-239 [/reading-rm/basic-ref/glossary/plutonium-pu.html] ) fission more readily with slow (thermal) neutrons [/reading-rm/basic-ref/glossary/neutron-thermal.html] .

**Fast neutron**

A neutron [/reading-rm/basic-ref/glossary/neutron.html] with kinetic energy [/reading-rm/basic-ref/glossary/kinetic-energy.html] greater than its surroundings when released during fission [/reading-rm/basic-ref/glossary/fission-fissioning.html] .

**Fatigue**

A degradation mechanism caused by the simultaneous action of cyclic, tensile stress. Fatigue may culminate in crack initiation and growth that may cause fracture after enough cycles.

**Fault tree**

A fault tree identifies all of the pathways that lead to a system failure. Toward that end, the fault tree starts with the *top event [/reading-rm/basic-ref/glossary/top-event.html]* , as defined by the event tree [/reading-rm/basic-ref/glossary/event-tree.html] , and identifies (using the AND, OR, M out of N logic connectors) what equipment and operator actions, if failed, would prevent successful operation of the system. All components and operator actions that are necessary for system function are considered. Thus, the fault tree is developed to a point where data are available for the failure rate of the modeled component or operator action. For additional information, see Probabilistic Risk Assessment [/about-nrc/regulatory/risk-informed/pra.html] .

**Federal Emergency Management Agency (FEMA)**

A component of the U.S. Department of Homeland Security responsible for protecting the Nation and reducing the loss of life and property from all hazards such as natural disasters and acts of terrorism. FEMA leads and supports a risk-based, comprehensive emergency management system of preparedness, protection, response, recovery, and mitigation.

**Federal Energy Regulatory Commission (FERC)**

An independent agency that regulates the interstate transmission of electricity, natural gas, and oil. FERC also regulates and oversees hydropower projects, and the construction of liquefied natural gas terminals and interstate natural gas pipelines. FERC protects the economic, environmental, and safety interests of the American public, while working abundant, reliable energy in a fair, competitive market.

**Feedwater**

Water supplied to the reactor pressure vessel [/reading-rm/basic-ref/glossary/pressure-vessel.html] in a boiling-water reactor (BWR) [/reading-rm/basic-ref/glossary/boiling-water-reactor-bwr.html] or the steam generator [/reading-rm/basic-ref/glossary/steam-generator.html] in a pressurized-water reactor (PWR) [/reading-rm/basic-ref/glossary/pressurized-water-reactor-pwr.html] that removes heat from the reactor fuel rods [/reading-rm/basic-ref/glossary/fuel-rod.html] by boiling and becoming steam. The steam becomes the driving force for the plant's turbine generator [/reading-rm/basic-ref/glossary/turbine-generator-tg.html] .

**Fertile material**

A material, which is not itself fissile [/reading-rm/basic-ref/glossary/fissile-material.html] (fissionable by thermal neutrons), that can be converted into a fissile material by irradiation [/reading-rm/basic-ref/glossary/irradiation.html] in a reactor [/reading-rm/basic-ref/glossary/nuclear-reactor.html] . There are two basic fertile materials: uranium-238 and thorium-232. When these fertile materials capture neutrons [/reading-rm/basic-ref/glossary/neutron.html] , they are converted into fissile plutonium-239 and uranium-233, respectively.

**Film badge**

Photographic film used to measure exposure [/reading-rm/basic-ref/glossary/exposure.html] to ionizing radiation [/reading-rm/basic-ref/glossary/ionizing-radiation.html] for purposes of personnel monitoring. The film badge may contain two or three films of differing sensitivities, and it may also contain a filter that shields part of the film from certain types of radiation.

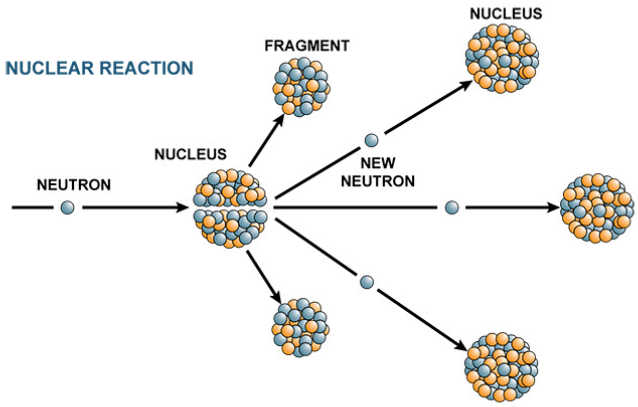
**Fiscal year (FY)**

The 12-month period from October 1 through September 30 used by the Federal Government for budget formulation and execution. The fiscal year is designated by the calendar year in which it ends; for example, FY 2009 runs from October 1, 2008, through September 30, 2009.

**Fissile material**

A nuclide [/reading-rm/basic-ref/glossary/nuclide.html] that is capable of undergoing fission [/reading-rm/basic-ref/glossary/fission-fissioning.html] after capturing low-energy thermal (slow) neutrons [/reading-rm/basic-ref/glossary/neutron.html] . Although sometimes used as a synonym for fissionable material [/reading-rm/basic-ref/glossary/fissionable-material.html] , this term has acquired its more-restrictive interpretation with the limitation that the nuclide must be fissionable by *thermal neutrons*. With that interpretation, the three primary fissile materials are uranium-233, uranium-235, and plutonium-239. This definition excludes natural uranium [/reading-rm/basic-ref/glossary/uranium.html] and depleted uranium [/reading-rm/basic-ref/glossary/depleted-uranium.html] that have not been irradiated [/reading-rm/basic-ref/glossary/irradiation.html] , or have only been irradiated in thermal reactors [/reading-rm/basic-ref/glossary/thermal-reactor.html] .

**Fission (fissioning)**




The splitting of an atom [/reading-rm/basic-ref/glossary/atom.html] , which releases a considerable amount of energy (usually in the form of heat) that can be used to produce electricity. Fission may be spontaneous, but is usually caused by the nucleus [/reading-rm/basic-ref/glossary/nucleus.html] of an atom becoming unstable (or "heavy") after capturing or absorbing a neutron [/reading-rm/basic-ref/glossary/neutron.html] . During fission, the heavy nucleus splits into roughly equal parts, producing the nuclei of at

least two lighter elements. In addition to energy, this reaction usually releases gamma radiation [/reading-rm/basic-ref/glossary/gamma-radiation.html] and two or more daughter neutrons.

**Fission gases**

Those fission products [/reading-rm/basic-ref/glossary/fission-products.html] that exist in the gaseous state. In nuclear power reactors [/reading-rm/basic-ref/glossary/nuclear-reactor.html] , this includes primarily the noble gases [/reading-rm/basic-ref/glossary/noble-gas.html] , such as krypton and xenon.

**Fission products**

The nuclei (fission fragments) formed by the fission of heavy elements, plus the nuclide formed by the fission fragments' radioactive decay.

**Fissionable material**

A nuclide [/reading-rm/basic-ref/glossary/nuclide.html] that is capable of undergoing fission [/reading-rm/basic-ref/glossary/fission-fissioning.html] after capturing either high-energy (fast) neutrons [/reading-rm/basic-ref/glossary/fast-neutron.html] or low-energy thermal (slow) neutrons [/reading-rm/basic-ref/glossary/neutron-thermal.html] . Although formerly used as a synonym for fissile material [/reading-rm/basic-ref/glossary/fissile-material.html] , fissionable materials also include those (such as uranium-238) that can be fissioned [/reading-rm/basic-ref/glossary/fission-fissioning.html] *only* with high-energy neutrons. As a result, fissile materials (such as uranium-235) are a subset of fissionable materials.

Uranium-235 fissions with low-energy thermal neutrons because the binding energy [/reading-rm/basic-ref/glossary/binding-energy.html] resulting from the absorption of a neutron is greater than the critical energy required for fission; therefore uranium-235 is a fissile material. By contrast, the binding energy released by uranium-238 absorbing a thermal neutron is less than the critical energy, so the neutron must possess additional energy for fission to be possible. Consequently, uranium-238 is a fissionable material.

**Flux**

A term applied to the amount of some type of particle (neutrons [/reading-rm/basic-ref/glossary/neutron.html] , alpha particles [/reading-rm/basic-ref/glossary/alpha-particle.html] , etc.) or energy (photons [/reading-rm/basic-ref/glossary/photon.html] , heat, etc.) crossing a unit area per unit time. The unit of flux is the number of particles, energy, etc., per square centimeter per second.

**Force-on-Force**

A type of security exercise designed to evaluate and improve the effectiveness of a security system. For the NRC, force-on-force exercises are used to assess the ability of the licensee to defend a nuclear power plant and other nuclear facilities against a design-basis threat. For further detail, see Backgrounder on Force-on-Force Exercises at Nuclear Power Plants [https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/force-on-force-bg.html] and Protecting Our Nation [https://www.nrc.gov/reading-rm/doc-collections/nuregs/brochures/br0314/] .

**Foreign Assignee Program**

A personnel exchange program for foreign regulatory counterparts. This helps the NRC and partners better understand each other's regulatory programs, capabilities, and commitments and fosters relationships between the NRC and key officials in other countries. The assignees' regulatory authorities generally identify the individuals participating and pay their salaries.

**Formula quantity**

Strategic Special nuclear material, in any combination, in a quantity of 5000 grams or more computed by the formula, grams = (grams contained U-235) + 2.5 (grams U-233 + grams plutonium). This class of material is sometimes referred to as a Category I [/security/domestic/mca/snm.html#I] quantity of material (see 10 CFR 70.4 [/reading-rm/doc-collections/cfr/part070/part070-0004.html] ).

**Fracture mechanics**

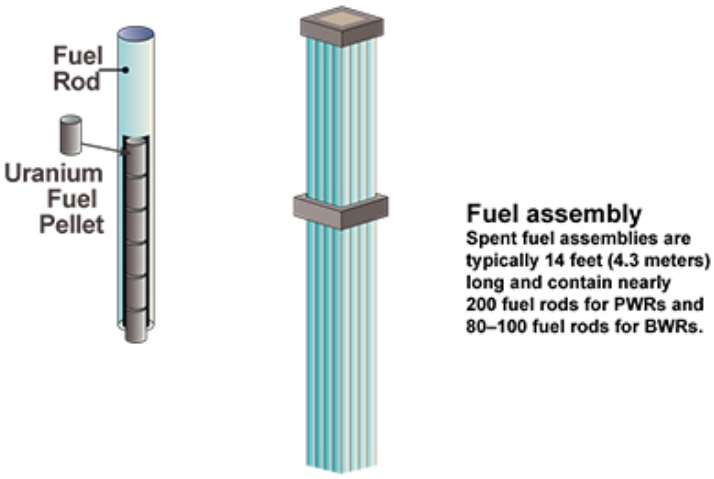
The field of mechanics concerned with the study of the propagation of cracks in materials.

**Freedom of Information Act (FOIA)**

A Federal law that requires Federal agencies to provide, upon written request, access to records or information. Some material is exempt from FOIA, and FOIA does not apply to records that are maintained by State and local governments, or Federal contractors, grantees or private organizations or businesses. For detail, see Freedom of Information Act and Privacy Act Requests [/reading-rm/foia/foia-privacy.html] .

**Fuel assembly (fuel bundle, fuel element)**

A structured group of fuel rods (long, slender, metal tubes containing pellets of fissionable material, which provide fuel for nuclear reactors). Depending on the design, each reactor core may have dozens of fuel assemblies (also known as fuel bundles), each of which contains dozens of fuel rods.




**Fuel cycle**

The series of steps involved in supplying fuel for nuclear power reactors. The uranium fuel cycle includes the following:

- uranium recovery to extract and concentrate the uranium to produce yellowcake
- conversion of yellowcake into uranium hexafluoride ($UF_6$)
- enrichment to increase the concentration of uranium in $UF_6$
- fuel fabrication to convert enriched $UF_6$ into fuel for nuclear reactors
- use of the fuel in reactors (nuclear power research or naval propulsion) interim storage of spent nuclear fuel
- reprocessing of spent fuel to recover the fissionable material remaining in the spent fuel (currently not done in the United States)
- final disposition of high-level radioactive waste (HLW)
- transportation of the uranium in all forms, including spent fuel

The NRC regulates these processes.

The processing of reactor fuel to separate the unused fissionable material from waste material. Reprocessing extracts uranium and plutonium from spent nuclear fuel so they can be used again as reactor fuel. Commercial reprocessing is not practiced in the United States, although it has been in the past. However, DOE operates reprocessing facilities at Hanford, WA, and Savannah River, SC, for national defense purposes.

**Fuel reprocessing (recycling)**

The processing of reactor fuel to separate the unused fissionable material [/reading-rm/basic-ref/glossary/fissionable-material.html] from waste material [/reading-rm/basic-ref/glossary/waste-radioactive.html] . Reprocessing extracts isotopes [/reading-rm/basic-ref/glossary/isotope.html] from spent nuclear fuel [/reading-rm/basic-ref/glossary/spent-depleted-or-used-nuclear-fuel.html] so they can be used again as reactor fuel. Commercial reprocessing is not practiced in the U.S., although it has been practiced in the past. However, the U.S. Department of Defense oversees reprocessing programs at DOE facilities [/waste/incidental-waste/wir-process/wir-locations.html] such as in Hanford, WA, and Savannah River, SC. These wastes as well as those wastes at a formerly operating commercial reprocessing facility at West Valley, NY [/waste/incidental-waste/wir-process/wir-locations/west-valley.html] , are not regulated by the NRC. For related information, see High-Level Waste [/waste/high-level-waste.html] and Waste Incidental to Reprocessing [/waste/incidental-waste.html] .

**Fuel rod**

A long, slender, zirconium metal tube containing pellets [/reading-rm/basic-ref/glossary/pellet-fuel.html] of fissionable material [/reading-rm/basic-ref/glossary/fissionable-material.html] , which provide fuel for nuclear reactors [/reading-rm/basic-ref/glossary/nuclear-reactor.html] . Fuel rods are assembled into bundles called fuel assemblies [/reading-rm/basic-ref/glossary/fuel-assembly-fuel-bundle-fuel-element.html] , which are loaded individually into the reactor core [/reading-rm/basic-ref/glossary/reactor-core.html] .

**Fuel temperature coefficient of reactivity**

The change in reactivity per degree of change in the temperature of nuclear fuel [/reading-rm/basic-ref/glossary/nuclear-fuel.html] . The physical property of fuel pellet [/reading-rm/basic-ref/glossary/pellet-fuel.html] material (uranium-238) that causes the uranium [/reading-rm/basic-ref/glossary/uranium.html] to absorb more neutrons [/reading-rm/basic-ref/glossary/neutron.html] away from the fission [/reading-rm/basic-ref/glossary/fission-fissioning.html] process as fuel pellet temperature increases. This acts to

stabilize power reactor [/reading-rm/basic-ref/glossary/power-reactor.html] operations. This coefficient is also known as the Doppler coefficient.

**Full-time equivalent (FTE)**

A human resources measurement equal to one staff person working full-time for one year.

**Fusion reaction**

A reaction in which at least one heavier, more stable nucleus [/reading-rm/basic-ref/glossary/nucleus.html] is produced from two lighter, less stable nuclei. Reactions of this type are responsible for enormous release of energy, such as the energy given off by stars.

**Gamma radiation**

High-energy, short-wavelength, electromagnetic radiation [/reading-rm/basic-ref/glossary/electromagnetic-radiation.html] emitted from the nucleus [/reading-rm/basic-ref/glossary/nucleus.html] of an atom [/reading-rm/basic-ref/glossary/atom.html] . Gamma radiation frequently accompanies emissions of alpha particles [/reading-rm/basic-ref/glossary/alpha-particle.html] and beta particles [/reading-rm/basic-ref/glossary/beta-particle.html] , and always accompanies fission [/reading-rm/basic-ref/glossary/fission-fissioning.html] . Gamma rays are similar to x-rays [/reading-rm/basic-ref/glossary/x-rays.html] , but are very penetrating and are best stopped or shielded by dense materials, such as lead or depleted uranium [/reading-rm/basic-ref/glossary/depleted-uranium.html] .

**Gap**

The space inside a reactor fuel rod [/reading-rm/basic-ref/glossary/fuel-rod.html] that exists between the fuel pellet [/reading-rm/basic-ref/glossary/pellet-fuel.html] and the fuel rod cladding [/reading-rm/basic-ref/glossary/cladding.html] .

**Gas centrifuge**

Uranium enrichment technology that uses many rotating cylinders that are connected in long lines to increase the concentration of uranium-235. Gas is placed in the cylinder, which spins at a high speed, creating a strong centrifugal force. Heavier gas molecules move to the cylinder wall, while lighter molecules collect near the center. The stream, slightly enriched, is fed into the next cylinder. The depleted stream is recycled back into the previous cylinder. For additional information on facilities that were licensed but not yet operational, see Gas Centrifuge Enrichment Facility Licensing [https://www.nrc.gov/materials/fuel-cycle-fac/gas-centrifuge.html] . The Fact Sheet on Uranium Enrichment [https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/enrichment.html] provides additional information on the process.

**Gas chromatography**

A way of separating chemical substances from a mixed sample by passing the sample, carried by a moving stream of gas, through a tube packed with a finely divided solid that may be coated with a liquid film. Gas chromatography devices are used to analyze air pollutants, blood alcohol content, essential oils, and food products.

**Gas-cooled reactor**

A nuclear reactor [/reading-rm/basic-ref/glossary/nuclear-reactor.html] in which the coolant [/reading-rm/basic-ref/glossary/coolant.html] is a gas.

**Gaseous diffusion**

A uranium enrichment [/materials/fuel-cycle-fac/ur-enrichment.html] process used to prepare uranium [/reading-rm/basic-ref/glossary/uranium.html] for use in fabricating fuel [/materials/fuel-cycle-fac/fuel-fab.html] for nuclear reactors [/reading-rm/basic-ref/glossary/nuclear-reactor.html] by separating its isotopes [/reading-rm/basic-ref/glossary/isotope.html] (as gases) based on their slight difference in velocity. (Lighter isotopes diffuse faster through a porous membrane or vessel than do heavier isotopes.) This process involves filtering uranium hexafluoride ($UF_6$) gas to separate uranium-234 and uranium-235 from uranium-238, in order to increase the percentage of uranium-235 from 1 to 3 percent. The only gaseous diffusion plant in operation in the United States is in Paducah, KY. A similar plant near Piketon, OH, was closed in March 2001. Both plants are leased by the United States Enrichment Corporation (USEC) from the DOE and regulated by the NRC since March 4, 1997. For additional information, see Gaseous Diffusion [/materials/fuel-cycle-fac/ur-enrichment.html#diffusion] .

**Gaseous diffusion plant**

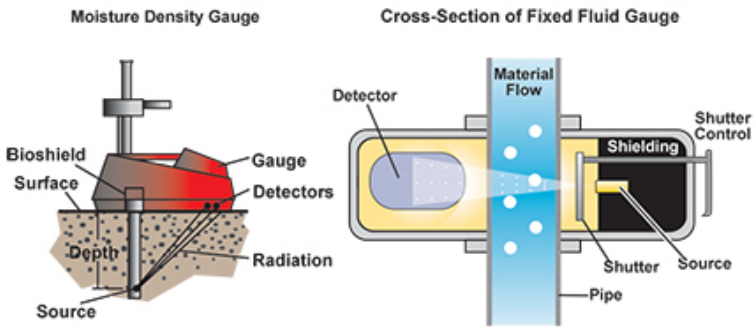
A facility where uranium hexafluoride gas is filtered. Uranium-235 is separated from uranium-238, increasing the percentage of uranium-235 from 1 to about 3 percent. The process requires enormous amounts of electric power. For additional detail, see Gaseous diffusion [/reading-rm/basic-ref/glossary/gaseous-diffusion.html] .

**Gases**

A substance possessing perfect molecular mobility and the property of indefinite expansion, as opposed to a solid or liquid; any such fluid or mixture of fluids other than air. Normally, these formless substances completely fill the space, and take the shape of, their container.

**Gauging devices**

Devices used to measure, monitor, and control the thickness of sheet metal, textiles, paper napkins, newspaper, plastics, photographic film, and other products as they are manufactured. Gauges mounted in fixed locations are designed for measuring or controlling material density, flow, level, thickness, or weight. The gauges contain sealed sources [/reading-rm/basic-ref/glossary/sealed-source.html] that radiate through the substance being measured to a readout or controlling device. Portable gauging devices, such as moisture density gauges, are used at field locations. These gauges contain a gamma [/reading-rm/basic-ref/glossary/gamma-radiation.html] -emitting sealed source, usually cesium-137, or a sealed neutron source, usually americium-241 or beryllium. For additional detail, see Gauging Devices [/materials/miau/industrial.html#gauging] .




**Geiger-Mueller counter**

A radiation detection and measuring instrument [/reading-rm/basic-ref/glossary/radiation-detection-instrument.html] . It consists of a gas-filled tube containing electrodes, between which there is an electrical voltage, but no current, flowing. When ionizing radiation [/reading-rm/basic-ref/glossary/ionizing-radiation.html] passes through the tube, a short, intense pulse of current passes from the negative electrode to the positive electrode and is measured or counted. The number of pulses per second measures the intensity of the radiation field. It was named for Hans Geiger and W. Mueller, who invented it in the 1920s. It is sometimes called simply a Geiger counter or a G-M counter and is the most commonly used portable radiation instrument. For related information, see Detecting Radiation [/about-nrc/radiation/health-effects/detection-radiation.html] .

**Generation (gross)**

The total amount of electric energy produced by a generating station as measured at the generator terminals.

**Generation (net)**

The gross amount of electric energy produced by a generating station, minus the amount used to operate the station. Net generation is usually measured in watthours (Wh) [/reading-rm/basic-ref/glossary/watthour.html] .

**Generator capacity**

The maximum amount of electric energy that a generator [/reading-rm/basic-ref/glossary/electrical-generator.html] can produce (from the mechanical energy of the turbine [/reading-rm/basic-ref/glossary/turbine.html] ), adjusted for ambient conditions. Generator capacity is commonly expressed in megawatts (MW) [/reading-rm/basic-ref/glossary/megawatt-mw.html] .

**Generator nameplate capacity**

The maximum amount of electric energy that a generator [/reading-rm/basic-ref/glossary/electrical-generator.html] can produce under specific conditions, as rated by the manufacturer. Generator nameplate capacity is usually expressed in kilovolt-amperes (kVA) and kilowatts (kW) [/reading-rm/basic-ref/glossary/kilowatt-kw.html] , as indicated on a nameplate that is physically attached to the generator.

**Geological repository**

An excavated, underground facility that is designed, constructed, and operated for safe and secure permanent disposal of HLW. A geological repository uses an engineered barrier system and a portion of the site's natural geology, hydrology, and geochemical systems to isolate the radioactivity of the waste. For further detail, see High-Level Waste Disposal [/waste/hlw-disposal.html] .

**Gigawatt (GW)**

A unit of power equivalent to one billion watts [/reading-rm/basic-ref/glossary/watt.html] .

**Gigawatthour (GWh)**

One billion watthours [/reading-rm/basic-ref/glossary/watthour.html] .

**Graphite**

A form of carbon, similar to that used in pencils, used as a moderator [/reading-rm/basic-ref/glossary/moderator.html] in some nuclear reactors [/reading-rm/basic-ref/glossary/nuclear-reactor.html] .

**Gray (Gy)**

One of the two units used to measure the amount of radiation absorbed by an object or person, known as the "absorbed dose [/reading-rm/basic-ref/glossary/dose-absorbed.html] ," which reflects the amount of energy that radioactive sources (with any type of ionizing radiation [/reading-rm/basic-ref/glossary/ionizing-radiation.html] ) deposit in materials (e.g., water, tissue, air) through which they pass. One gray (Gy) is the international system of units (SI) equivalent of 100 rads [/reading-rm/basic-ref/glossary/rad-radiation-absorbed-dose.html] , which is equal to an absorbed dose of 1 Joule/kilogram. An absorbed dose of 0.01 Gy means that 1 gram of material absorbed 100 ergs of energy (a small but measurable amount) as a result of exposure to radiation. For additional information, see Doses in Our Daily Lives [/about-nrc/radiation/around-us/doses-daily-lives.html] and Measuring Radiation [/about-nrc/radiation/health-effects/measuring-radiation.html] .

**Grid**

See *Electric Power Grid [/reading-rm/basic-ref/glossary/electric-power-grid.html] .*

**Half-life**

The time in which one half of the atoms of a particular radioactive substance disintegrate into another nuclear form. Measured half-lives vary from millionths of a second to billions of years. Also called physical or radiological half-life.

**Half-life (radiological)**

The time required for half the atoms [/reading-rm/basic-ref/glossary/atom.html] of a particular radioisotope [/reading-rm/basic-ref/glossary/radioisotope-radionuclide.html] to decay [/reading-rm/basic-ref/glossary/decay-radioactive.html] into another isotope [/reading-rm/basic-ref/glossary/isotope.html] . A specific half-life is a characteristic property of each radioisotope. Measured half-lives range from millionths of a second to billions of years, depending on the stability of the nucleus [/reading-rm/basic-ref/glossary/nucleus.html] . Radiological half-life is related to, but different from, the biological half-life [/reading-rm/basic-ref/glossary/half-life-biological.html] and the effective half-life [/reading-rm/basic-ref/glossary/half-life-effective.html] .

**Half-life, biological**

The time required for the body to eliminate one half of the material taken in by natural biological means.

**Half-life, effective**

The time required for the activity [/reading-rm/basic-ref/glossary/activity.html] of a particular radioisotope [/reading-rm/basic-ref/glossary/radioisotope-radionuclide.html] deposited in a living organism, such as a human or an animal, to be reduced by 50 percent as a result of the combined action of radioactive decay [/reading-rm/basic-ref/glossary/radioactive-decay.html] and biological elimination. Effective half-life is related to, but different from, the radiological half-life [/reading-rm/basic-ref/glossary/half-life-radiological.html] and the biological half-life [/reading-rm/basic-ref/glossary/half-life-biological.html] .

**Half-thickness**

Any given absorber that will reduce the intensity of an original beam of ionizing radiation to one-half of its initial value.

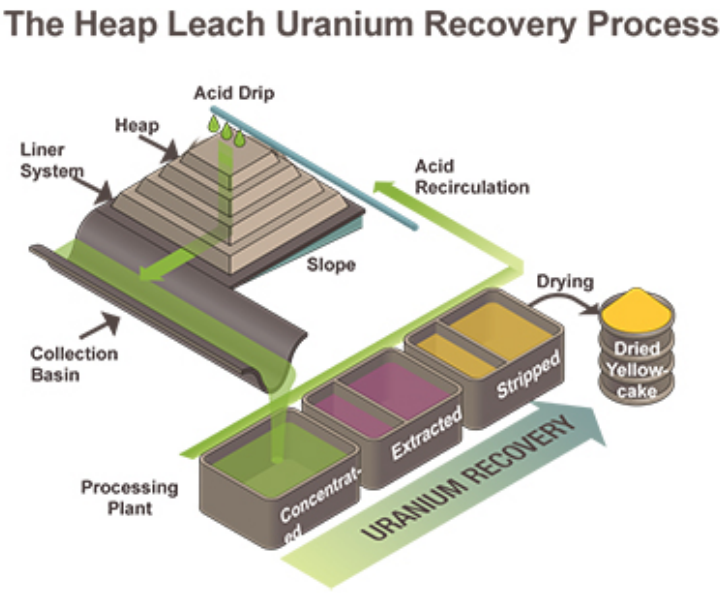
**Head, reactor vessel**

The removable top section of a reactor pressure vessel. It is bolted in place during power operation and removed during refueling to permit access of fuel handling equipment to the core.

**Health physics**

The science concerned with recognizing and evaluating the effects of ionizing radiation [/reading-rm/basic-ref/glossary/ionizing-radiation.html] on the health and safety of people and the environment, monitoring radiation exposure [/reading-rm/basic-ref/glossary/exposure.html] ., and controlling the associated health risks and environmental hazards to permit the safe use of technologies that produce ionizing radiation. For further information, see Frequently Asked Questions About Health Physics Based on [/about-nrc/radiation/protects-you/hppos/hppos-qa.html] 10 CFR Part 20 [/reading-rm/doc-collections/cfr/part020/] .

**Heap leach recovery process**




A method for extracting uranium from ore. The ore is placed in piles or heaps on top of liners. The liners prevent uranium and other chemicals from moving into the ground. Sulfuric acid is dripped onto the heap and dissolves uranium as it moves through the ore. Uranium solution drains into collection basins, where it is piped to a processing plant. At the plant, uranium is extracted, concentrated, and dried to form yellowcake.

**Heat exchanger**

Any device that transfers heat from one fluid (liquid or gas) to another fluid or to the environment.

**Heat sink**

Anything that absorbs heat. It is usually part of the environment, such as the air, a river, or a lake.

**Heatup**

The rise in temperature of the reactor fuel rods resulting from an increase in the rate of fission in the core.

**Heavy water (D2O)**

Water containing significantly more than the natural proportions (one in 6,500) of heavy hydrogen (deuterium, D) atoms to ordinary hydrogen atoms. Heavy water is used as a moderator in some reactors because it slows down neutrons effectively and also has a low probability of absorption of neutrons.

**Heavy water moderated reactor**

A reactor that uses heavy water as its moderator. Heavy water is an excellent moderator and thus permits the use of unenriched uranium as a fuel.

**High radiation area**

Any area with dose rates greater than 100 millirems (1 millisievert) in one hour 30 centimeters from the source or from any surface through which the ionizing radiation penetrates. Areas at licensee facilities must be posted as "high radiation areas" and access into these areas is maintained under strict control.

**High-enriched uranium**

Uranium enriched to at least 20 percent uranium-235 (a higher concentration than exists in natural uranium ore [/reading-rm/basic-ref/glossary/uranium.html] ). For detail, see Uranium Enrichment [/materials/fuel-cycle-fac/ur-enrichment.html] .

**High-level radioactive waste (HLW)**

The highly radioactive materials produced as byproducts of fuel reprocessing [/reading-rm/basic-ref/glossary/fuel-reprocessing-recycling.html] or of the reactions that occur inside nuclear reactors [/reading-rm/basic-ref/glossary/nuclear-reactor.html] . HLW includes:

- Irradiated spent nuclear fuel [/reading-rm/basic-ref/glossary/spent-depleted-or-used-nuclear-fuel.html] discharged from commercial nuclear power reactors [/reading-rm/basic-ref/glossary/nuclear-power-plant.html]
- The highly radioactive liquid and solid materials resulting from the reprocessing of spent nuclear fuel, which contain fission products [/reading-rm/basic-ref/glossary/fission-products.html] in concentration (this includes some reprocessed HLW from defense activities and a small quantity of reprocessed commercial HLW)
- Other highly radioactive materials that the Commission may determine require permanent isolation

For further information, see High-Level Waste [/waste/high-level-waste.html] .

**High-level waste**

The highly radioactive materials produced as byproducts of fuel reprocessing or of the reactions that occur inside nuclear reactors. HLW includes:

- Irradiated spent nuclear fuel discharged from commercial nuclear power reactors
- The highly radioactive liquid and solid materials resulting from the reprocessing of spent nuclear fuel, which contain fission products in concentration (this includes some reprocessed HLW from defense activities and a small quantity of reprocessed commercial HLW)
- Other highly radioactive materials that the Commission may determine require permanent isolation

**Highly (or High-) enriched uranium**

Uranium enriched to at least 20 percent uranium-235 (a higher concentration than exists in natural uranium ore [/reading-rm/basic-ref/glossary/uranium.html] ). For detail, see Uranium Enrichment [/materials/fuel-cycle-fac/ur-enrichment.html] .

**Hot**

A colloquial term meaning highly radioactive.

**Hot spot**

The region in a radiation/contamination area where the level of radiation/contamination is significantly greater than in neighboring regions in the area.

**Idealized surface crack**

A planar crack on the inside surface of a component that has a semielliptical shape.

**Idealized through-wall crack**

A planar crack that extends from the inside surface of a piping component to the outside surface with equal radial inner and outer lengths.

**IMPEP**

Acronym for the Integrated Materials Performance Evaluation Program [https://scp.nrc.gov/impeptools.html] . The U.S. Nuclear Regulatory Commission (NRC) implemented this program in 1996 to ensure that public health and safety are adequately protected from the potential hazards associated with the use of radioactive materials, and that Agreement State programs [/about-nrc/state-tribal/agreement-states.html] are compatible with the NRC's program.

**In situ leach**

A process using a solution called lixiviant [/reading-rm/basic-ref/glossary/lixiviant.html] to extract uranium [/reading-rm/basic-ref/glossary/uranium.html] from underground ore bodies in place (in other words, in situ). Lixiviant, which typically contains an oxidant such as oxygen and/or hydrogen peroxide mixed with sodium carbonate or carbon dioxide, is injected through wells into the ore body in a confined aquifer to dissolve the uranium. This solution is then pumped via other wells to the surface for processing. For additional detail, see In Situ Recovery Facilities [/materials/uranium-recovery/extraction-methods/isl-recovery-facilities.html] .

**In situ recovery (ISR)**

A common method currently used to extract uranium from ore bodies without physical excavation of the ore. This technique is also known as “solution mining” or in situ leaching. For additional detail, see In Situ Recovery Facilities [/materials/uranium-recovery/extraction-methods/isl-recovery-facilities.html] .

**In vitro**

From the Latin for "in glass," isolated from the living organism and artificially maintained, as in a test tube.

**In vivo**

From the Latin for "in one that is living," occurring within the living.

**Incident response (IR)**

Activities that address the short-term, direct effects of a natural or human-caused event and require an emergency response to protect life or property. For detail, see Emergency Preparedness and Response [/about-nrc/emerg-preparedness.html] and the NRC Incident Response Plan (NUREG-0728) [/about-nrc/emerg-preparedness/respond-to-emerg/incident-response.pdf] .

**Independent spent fuel storage installation (ISFSI)**

A complex designed and constructed for the interim storage of spent nuclear fuel [/reading-rm/basic-ref/glossary/spent-depleted-or-used-nuclear-fuel.html] ; solid, reactor-related, greater than Class C waste; and other associated radioactive materials. A spent fuel storage facility may be considered independent, even if it is located on the site of another NRC-licensed facility. For further information, see Storage of Spent Nuclear Fuel [/waste/spent-fuel-storage.html] and Locations of Independent Spent Fuel Storage Installations [/waste/spent-fuel-storage/map-fuel-storage-facilities.pdf] .

**Indicator function**

A random variable for an event that equals 1 when the event happens and zero when the event does not happen.

**Individual plant examination (IPE)**

As requested by the NRC in Generic Letter 88-20, "Individual Plant Examination for Severe Accident Vulnerabilities" (November 23, 1988), a risk analysis that considers the unique aspects of a particular nuclear power plant, identifying the specific vulnerabilities to severe accident of that plant.

**Individual plant examination for external events (IPEEE)**

While the "individual plant examination" takes into account events that could challenge the design from things that could go awry internally (in the sense that equipment might fail because components do not work as expected), the "individual plant examination for external events" considers challenges such as earthquakes, internal fires, and high winds.

**Induced radioactivity**

Radioactivity that is created when stable substances are bombarded by ionizing radiation. For example, the stable isotope cobalt-59 becomes the radioactive isotope cobalt-60 under neutron bombardment.

**Inspection Reports**

Reports are issued periodically to document inspection findings. These may cover a specific time period for the baseline inspection or a particular event or problem examined in a reactive inspection. All inspection reports are public documents and, when issued, are posted to the NRC's internet web site.

**Integrated plant evaluation**

An evaluation that considers the plant as a whole rather than system by system.

**International Atomic Energy Agency (IAEA)**

A United Nations agency established in 1957 to serve as a world center of cooperation in the nuclear field. The agency works with nearly 171 member States and multiple partners worldwide to promote safe, secure, and peaceful nuclear technology.

**International Nuclear Regulators Association (INRA)**

An association established in 1997 to give national nuclear regulators with mature civilian nuclear reactor and materials programs a forum to discuss nuclear safety and security issues of mutual interest. Canada, France, Germany, Japan, the Republic of Korea, Spain, Sweden, the United Kingdom, and the United States are members.

**Iodine spiking factor**

The magnitude of a rapid, short-term increase in the appearance rate of radioiodine in the reactor coolant system. This increase is generally caused by a reactor transient that results in a rapid drop in reactor coolant system pressure relative to the fuel rod internal pressure.

**Ion**

(1) An atom that has too many or too few electrons, causing it to have an electrical charge, and therefore, be chemically active. (2) An electron that is not associated (in orbit) with a nucleus.

**Ion-exchange**

A common method for concentrating uranium from a solution. The uranium solution is passed through a resin bed where the uranium-carbonate complex ions are transferred to the resin by exchange with a negative ion like chloride. After build-up of the uranium complex on the resin, the uranium is eluted with a salt solution and the uranium is precipitated in another process.

**Ionization**

The process of adding one or more electrons to, or removing one or more electrons from, atoms or molecules, thereby creating ions. High temperatures, electrical discharges, or nuclear radiations can cause ionization.

**Ionization chamber**

An instrument that detects and measures ionizing radiation by measuring the electrical current that flows when radiation ionizes gas in a chamber, making the gas a conductor of electricity.

**Ionizing radiation**

A form of radiation, which includes alpha particles [/reading-rm/basic-ref/glossary/alpha-particle.html] , beta particles [/reading-rm/basic-ref/glossary/beta-particle.html] , gamma rays [/reading-rm/basic-ref/glossary/gamma-radiation.html] , x-rays [/reading-rm/basic-ref/glossary/x-rays.html] , neutrons [/reading-rm/basic-ref/glossary/neutron.html] , high-speed electrons [/reading-rm/basic-ref/glossary/electron.html] , high-speed protons [/reading-rm/basic-ref/glossary/proton.html] , and other particles capable of producing ions [/reading-rm/basic-ref/glossary/ion.html] . Compared to non-ionizing radiation, such as radio- or microwaves, or visible, infrared, or ultraviolet [/reading-rm/basic-ref/glossary/ultraviolet.html] light, ionizing radiation is considerably more energetic. When ionizing radiation passes through material such as air, water, or living tissue, it deposits enough energy to produce ions by breaking molecular bonds and displace (or remove) electrons [/reading-rm/basic-ref/glossary/electron.html] from atoms or molecules. This electron displacement may lead to changes in living cells. Given this ability, ionizing radiation has a number of beneficial uses, including treating cancer or sterilizing medical equipment. However, ionizing radiation is potentially harmful if not used correctly, and high doses may result in severe skin or tissue damage. It is for this reason that the NRC strictly regulates commercial and institutional uses of the various types of ionizing radiation. Radiation, as used in 10 CFR Part 20 [/reading-rm/doc-collections/cfr/part020/] , does not include non-ionizing radiation (see also 10 CFR 20.1003 [/reading-rm/doc-collections/cfr/part020/part020-1003.html] ).

**Irradiation**

Exposure to ionizing radiation. Irradiation may be intentional, such as in cancer treatments or in sterilizing medical instruments. Irradiation may also be accidental, such as from exposure to an unshielded source. Irradiation does not usually result in radioactive contamination, but damage can occur, depending on the dose received.

**Isotope**

Two or more forms (or atomic configurations) of a given element [/reading-rm/basic-ref/glossary/element.html] that have identical atomic numbers [/reading-rm/basic-ref/glossary/atomic-number.html] (the same number of protons [/reading-rm/basic-

ref/glossary/proton.html] in their nuclei [/reading-rm/basic-ref/glossary/nucleus.html] ) and the same or very similar chemical properties but different atomic masses (different numbers of neutrons in their nuclei) and distinct physical properties. Thus, carbon-12, carbon-13, and carbon-14 are isotopes of the element carbon, and the numbers denote the approximate atomic masses. Among their distinct physical properties, some isotopes (known as radioisotopes [/reading-rm/basic-ref/glossary/radioisotope-radionuclide.html] ) are radioactive because their nuclei emit radiation [/about-nrc/radiation/rad-around-us.html] as they strive toward a more stable nuclear configuration. For example, carbon-12 and carbon-13 are stable, but carbon-14 is unstable and radioactive.

**Isotope separation**

The process of separating isotopes from one another, or changing their relative abundances, as by gaseous diffusion or electromagnetic separation. Isotope separation is a step in the isotopic enrichment process.

**Isotopic enrichment**

A process by which the relative abundance of the isotopes of a given element are altered, thus producing a form of the element that has been enriched in one particular isotope and depleted in its other isotopic forms.

**Kilo-**

A Greek prefix meaning "thousand" in the nomenclature of the metric system. This prefix multiplies a unit by 1000.

**Kilovolt**

The unit of electrical potential equal to 1000 volts.

**Kilowatt (KW)**

A unit of power equivalent to one thousand watts [/reading-rm/basic-ref/glossary/watt.html] .

**Kinetic energy**

The energy that a body possesses by virtue of its mass and velocity. Also called the energy of motion.

**Latent cancer fatality (LCF)**

Death resulting from cancer that became active after a latent period following exposure [/reading-rm/basic-ref/glossary/exposure.html] to radiation.

**Leak before break**

The concept that a leaking crack will be detected before it becomes unstable and leads to a rupture.

**Lens Dose Equivalent**

The external exposure dose equivalent to the lens of the eye at a tissue depth of 0.3 centimeters (300 mg/cm$^2$).

**Lethal dose (LD)**

The dose of radiation expected to cause death to 50 percent of an exposed population within 30 days (LD 50/30). Typically, the LD 50/30 is in the range from 400 to 450 rem (4 to 5 sieverts) received over a very short period.

**Licensed material**

Source material, byproduct material, or special nuclear material that is received, possessed, used, transferred, or disposed of under a general or specific license issued by the NRC or Agreement States and is not otherwise exempt from regulation.

**Licensee**

A company, organization, institution, or other entity to which the NRC or an Agreement State [/reading-rm/basic-ref/glossary/agreement-state.html] has granted a general license [/materials/miau/general-use.html] or specific license to construct or operate a nuclear facility, or to receive, possess, use, transfer, or dispose of source material [/reading-rm/basic-ref/glossary/source-material.html] , byproduct material [/reading-rm/basic-ref/glossary/byproduct-material.html] , or special nuclear material [/reading-rm/basic-ref/glossary/special-nuclear-material.html] .

**Licensing basis**

The collection of documents or technical criteria that provides the basis upon which the NRC issues a license to construct or operate a nuclear facility; to conduct operations involving the emission of radiation; or to receive, possess, use, transfer, or dispose of source material [/reading-rm/basic-ref/glossary/source-material.html] , byproduct material [/reading-rm/basic-

ref/glossary/byproduct-material.html] , or special nuclear material [/reading-rm/basic-ref/glossary/special-nuclear-material.html] . For related information, see Licensing [/about-nrc/regulatory/licensing.html] .

**Licensing Support Network (LSN) Library**

A library providing access to publicly available documents related to the hearings regarding DOE's application for authorization to construct a high-level nuclear waste geologic repository at Yucca Mountain, NV. The LSN Library is affiliated with the Agencywide Documents Access and Management System (ADAMS), the agency's official recordkeeping system.

**Light water**

Ordinary water as distinguished from heavy water [/reading-rm/basic-ref/glossary/heavy-water-d2o.html] .

**Light-water reactor**

A term used to describe reactors using ordinary water as a moderated coolant, including boiling- water reactors (BWRs) and pressurized-water reactors (PWRs), the most common types used in the United States.

**Limit load**

The maximum load a pipe with or without cracks can withstand before it is predicted to fail.

**Limiting condition for operation**

The section of Technical Specifications that identifies the lowest functional capability or performance level of equipment required for safe operation of the facility.

**Limiting safety system settings**

Settings for automatic protective devices related to those variables having significant safety functions. Where a limiting safety system setting is specified for a variable on which a safety limit has been placed, the setting will ensure that automatic protective action will correct the abnormal situation before a safety limit is exceeded.

**Linear heat generation rate**

The heat generation rate per unit length of fuel rod, commonly expressed in kilowatts per foot (kw/ft) of fuel rod.

**Lixiviant**

A liquid medium used to selectively extract [/materials/uranium-recovery/extraction-methods.html] (or leach) uranium from ore bodies where they are normally found underground (in other words, in situ). This liquid medium, which typically contains an oxidant such as oxygen and/or hydrogen peroxide mixed with sodium carbonate or carbon dioxide, is injected through wells into the ore body in a confined aquifer to dissolve the uranium. The resulting solution is then pumped via other wells to the surface, where the uranium is recovered from it in a concentrated form for processing. For additional detail, see In Situ Recovery Facilities [/materials/uranium-recovery/extraction-methods/isl-recovery-facilities.html] .

**Loop**

In a pressurized water reactor, the coolant flow path through piping from the reactor pressure vessel to the steam generator, to the reactor coolant pump, and back to the reactor pressure vessel. Large PWRs may have as many as four separate loops.

**Loss of coolant accident (LOCA)**

A potential accident in which a breach in a reactor's pressure boundary causes the coolant water to rush out of the reactor faster than makeup water can be added back in. Without sufficient coolant, the reactor core could heat up and potentially melt the zirconium fuel cladding, causing a major release of radioactivity.

**Low population zone (LPZ)**

An area of low population density often required around a nuclear installation before it's built. The number and density of residents is of concern in emergency planning so that certain protective measures (such as notification and instructions to residents) can be accomplished in a timely manner.

**Low-level radioactive waste (LLW)**

A general term for a wide range of waste that is contaminated with radioactive material or has become radioactive through exposure to neutron radiation. A variety of industries,
hospitals and medical institutions, educational and research institutions, private or government laboratories, and nuclear fuel cycle facilities generate LLW. Some examples include radioactively contaminated protective shoe covers and clothing; cleaning rags,

mops, filters, and reactor water treatment residues; equipment and tools; medical tubes, swabs, and hypodermic syringes; and carcasses and tissues from laboratory animals.

**Low-level waste**

A general term for a wide range of items that have become contaminated [/reading-rm/basic-ref/glossary/radioactive-contamination.html] with radioactive material or have become radioactive through exposure to neutron radiation. A variety of industries, hospitals and medical institutions, educational and research institutions, private or government laboratories, and nuclear fuel cycle facilities generate LLW as part of their day-to-day use of radioactive materials. Some examples include radioactively contaminated protective shoe covers and clothing; cleaning rags, mops, filters, and reactor water treatment residues; equipment and tools; medical tubes, swabs, and hypodermic syringes; and carcasses and tissues from laboratory animals. The radioactivity in these wastes can range from just above natural background [/about-nrc/radiation/around-us/sources/nat-bg-sources.html] levels to much higher levels, such as seen in parts from inside the reactor vessel in a nuclear power plant [/reading-rm/basic-ref/glossary/nuclear-power-plant.html] . Low-level waste is typically stored onsite by licensees [/reading-rm/basic-ref/glossary/licensee.html] , either until it has decayed [/reading-rm/basic-ref/glossary/decay-radioactive.html] away and can be disposed of as ordinary trash, or until the accumulated amount becomes large enough to warrant shipment to a low-level waste disposal [/waste/llw-disposal.html] site. For further information, see Low-Level Waste [/waste/low-level-waste.html] .

**Mass number**

The number of nucleons (neutrons and protons) in the nucleus of an atom. Also known as the atomic weight.

**Mass-energy equation**

The equation developed by Albert Einstein, which is usually given as $E = mc^2$, showing that, when the energy of a body changes by an amount E (no matter what form the energy takes), the mass (m) of the body will change by an amount equal to $E/c^2$. The factor c squared, the speed of light in a vacuum (3 x 10 to the eighth power), may be regarded as the conversion factor relating units of mass and energy. The equation predicted the possibility of releasing enormous amounts of energy by the conversion of mass to energy. It is also called the Einstein equation.

**Maximum dependable capacity (gross)**

The maximum amount of electricity that the main generating unit of a nuclear power reactor can reliably produce during the summer or winter (usually summer, but whichever represents the most restrictive seasonal conditions, with the least electrical output). The dependable capacity varies during the year because temperature variations in cooling water affect the unit's efficiency. Thus, this is the gross electrical output as measured (in watts unless otherwise noted) at the output terminals of the turbine generator.

**Maximum dependable capacity (net)**

The gross maximum dependable capacity of the main generating unit in a nuclear power reactor, minus the amount used to operate the station. Net maximum dependable capacity is measured in watts unless otherwise noted.

**Mega-**

A prefix that multiplies a basic unit by 1,000,000 (10 to the sixth power).

**Megacurie**

One million curies.

**Megawatt (MW)**

A unit of power equivalent to one million watts [/reading-rm/basic-ref/glossary/watt.html] .

**Megawatt-hour (MWh)**

A unit of energy equivalent to 1,000 kilowatts of electricity used continuously for 1 hour.

**Metric ton**

A unit of measurement equivalent to 1,000 kilograms or about 2,000 pounds.

**Micro-**

A prefix that divides a unit into one million parts (0.000001).

**Microcurie**

One millionth of a curie. That amount of radioactive material that disintegrates (decays) at the rate of 37 thousand atoms per second.

**Mill tailings**

Primarily, the solid residue from a conventional uranium recovery facility in which uranium or thorium ore is crushed and processed mechanically or chemically to recover the uranium, thorium, or other valuable materials. This naturally radioactive ore residue contains the radioactive decay products from the uranium chains (mainly the uranium-238 chain). Although the milling process recovers about 93 percent of the uranium, the "tailings" contain several naturally occurring radioactive elements, including uranium, thorium, radium, polonium, and radon, as well as heavy metals and other constituents. For further information, see Uranium Mill Tailings [/waste/mill-tailings.html] and the Backgrounder on Uranium Mill Tailings [/reading-rm/doc-collections/fact-sheets/mill-tailings.html] .

**Milli-**

A prefix that divides a basic unit by 1000.

**Millirem**

One thousandth of a rem (0.001 rem).

**Milliroentgen (mR)**

One thousandth of a roentgen (R). 1mR = $10^{-3}$ R = 0.001 R.

**Mixed-oxide (MOX) fuel**

A type of nuclear reactor fuel that contains plutonium oxide mixed with either natural or depleted uranium oxide, in ceramic pellet form. This differs from conventional nuclear fuel, which is made of uranium oxide. The U.S. Department of Energy program to produce an MOX fuel under an agreement with Russia was canceled in 2018. The NRC terminated the facility's construction authorization in February 2019. For further detail, see the Backgrounder on Mixed Oxide Fuel [/reading-rm/doc-collections/fact-sheets/mox-bg.html] and Frequently Asked Questions About Mixed Oxide Fuel [/materials/fuel-cycle-fac/mox/faq.html] .

**Model**

A mathematical representation of a physical process or phenomenon.

**Moderator**

A material, such as ordinary water, heavy water, or graphite, that is used in a reactor to slow down high-velocity neutrons, thus increasing the likelihood of fission.

**Moderator temperature coefficient of reactivity**

As the moderator (water) increases in temperature, it becomes less dense and slows down fewer neutrons, which results in a negative change of reactivity. This negative temperature coefficient acts to stabilize atomic power reactor operations.

**Module**

An individual component of a software product.

**Molecule**

A group of atoms held together by chemical forces. A molecule is the smallest unit of a compound that can exist by itself and retain all of its chemical properties.

**Monitoring of radiation**

Periodic or continuous determination of the amount of ionizing radiation [/reading-rm/basic-ref/glossary/ionizing-radiation.html] or radioactive contamination [/reading-rm/basic-ref/glossary/radioactive-contamination.html] in a region. Radiation monitoring is a safety measure to protect the health and safety of the public and the environment through the use of bioassay [/reading-rm/basic-ref/glossary/bioassay.html] , alpha scans, and other radiological survey [/reading-rm/basic-ref/glossary/radiological-survey.html] methods to monitor air, surface water and ground water, soil and sediment, equipment surfaces, and personnel. For related information, see Radiation Monitoring at Nuclear Power Plants [/about-nrc/radiation/protects-you/radiation-monitoring.html] and the related fact sheets listed on that page.

**Nano-**

A prefix that divides a basic unit by one billion ($10^{-9}$).

**Nanocurie**

One billionth $10^{-9}$ of a curie.

**National Environmental Policy Act (NEPA)**

A U.S. environmental law enacted on January 1, 1970. The NRC implements NEPA as part of its regulatory process by evaluating the relevant environmental effects for particular actions. A typical review will include an analysis of impacts to air, water, animal life, vegetation, natural resources, and resources of historical, archaeological, or architectural significance. The review will also evaluate cumulative economic, social, cultural, and other impacts affecting environmental justice.

**National Response Framework**

The guiding principles, roles, and structures that enable all domestic incident response partners to prepare for and provide a unified national response to disasters and emergencies. It describes how the Federal Government, States, Tribes, communities, and the private sector work together to coordinate a national response. The fourth edition of the framework, which became effective in October 2019, is built on the scalable, flexible and adaptable concepts identified in the National Incident Management System to align key roles and responsibilities.

**National Source Tracking System (NSTS)**

A secure, Web-based data system that helps the NRC and its Agreement States [https://scp.nrc.gov/asdirectory.html] track and regulate the medical, industrial, and academic uses [/materials/medical.html] of certain nuclear materials, from the time they are manufactured or imported to the time of their disposal or exportation. This information enhances the ability of the NRC and Agreement States to conduct inspections and investigations, communicate information to other government agencies, and verify the ownership and use of nationally tracked sources. For additionaldetail, see the NSTS [/security/byproduct/nsts.html] page.

**Natural circulation**

The circulation of the coolant in the reactor coolant system without the use of the reactor coolant pumps. The circulation is due to the natural convection resulting from the different densities of relative cold and heated portions of the system.

**Natural uranium**

Uranium containing the relative concentrations of isotopes found in nature: 0.7 percent uranium-235, 99.3 percent uranium-238, and a trace amount of uranium-234 by mass. In terms of radioactivity, however, natural uranium contains about 2.2 percent uranium-235, 48.6 percent uranium-238, and 49.2 percent uranium-234. Natural uranium can be used as fuel in nuclear reactors or as feedstock for uranium enrichment facilities.

**Net electric generation**

The gross amount of electric energy produced by a generating station, minus the amount used to operate the station. *Note*: Electricity required for pumping at pumped-storage plants is regarded as electricity for station operation and is deducted from gross generation. Net electric generation is measured in watthours [/reading-rm/basic-ref/glossary/watthour.html] (Wh), except as otherwise noted.

**Net summer capacity**

The steady hourly output that generating equipment is expected to supply to system load, exclusive of auxiliary power, as demonstrated by measurements at the time of peak demand (summer). Net summer capacity is measured in watts [/reading-rm/basic-ref/glossary/watt.html] unless otherwise noted.

**Neutron**

An uncharged elementary particle, with a mass slightly greater than that of the proton, found in the nucleus of every atom heavier than hydrogen.

**Neutron capture**

The reaction that occurs when a nucleus captures a neutron. The probability that a given material will capture a neutron is proportional to its neutron capture cross section and depends on the energy of the neutrons and the nature of the material.

**Neutron chain reaction**

A measure of the intensity of neutron radiation, determined by the rate of flow of neutrons [/reading-rm/basic-ref/glossary/neutron.html] . The neutron flux value is calculated as the neutron density (n) multiplied by neutron velocity (v), where n is the number of neutrons per cubic centimeter (expressed as neutrons/$c^3$) and v is the distance the neutrons travel in 1 second (expressed in centimeters per second, or c/sec). Consequently, neutron flux (nv) is measured in neutrons/$cm^2$-sec.

**Neutron flux**

A measure of the intensity of neutron radiation, determined by the rate of flow of neutrons [/reading-rm/basic-ref/glossary/neutron.html] . The neutron flux value is calculated as the neutron density (n) multiplied by neutron velocity (v), where n is the number of neutrons per cubic centimeter (expressed as neutrons/$cm^3$) and v is the distance the neutrons travel in 1 second (expressed in centimeters per second, or cm/sec). Consequently, neutron flux (nv) is measured in neutrons/$cm^2$/sec.

**Neutron generation**

The release, thermalization, and absorption of fission neutrons by a fissile material and the fission of that material producing a second generation of neutrons. In a typical nuclear power reactor system, there are about 40,000 generations of neutrons every second.

**Neutron leakage**

Neutrons that escape from the vicinity of the fissionable material in a reactor core. Neutrons that leak out of the fuel region are no longer available to cause fission and must be absorbed by shielding placed around the reactor pressure vessel for that purpose.

**Neutron source**

Any material that emits neutrons, such as a mixture of radium and beryllium, that can be inserted into a reactor to ensure a neutron flux large enough to be distinguished from background to register on neutron detection equipment.

**Neutron, thermal**

A neutron that has (by collision with other particles) reached an energy state equal to that of its surroundings, typically on the order of 0.025 eV (electron volts).

**Noble gas**

A gaseous chemical element that does not readily enter into chemical combination with other elements. An inert gas. Examples are helium, argon, krypton, xenon, and radon.

**Non-stochastic effect**

The health effects of radiation, the severity of which vary with the dose and for which a threshold is believed to exist. Radiation-induced cataract formation is an example of a non-stochastic effect (also called a deterministic effect) (see 10 CFR 20.1003 [/reading-rm/doc-collections/cfr/part020/part020-1003.html] ).

**Non-vital plant systems**

Systems at a nuclear facility that may or may not be necessary for the operation of the facility (i.e., power production) but that would have little or no effect on public health and safety should they fail. These systems are not safety related.

**Nonpower reactor**

Reactors used for research, training, and test purposes, and for the production of radioisotopes [/reading-rm/basic-ref/glossary/radioisotope-radionuclide.html] for medical, industrial, and academic uses [/materials/medical.html] . For additional information, see Research and Test Reactors [/reactors/non-power.html] .

**Nonpower reactor (research and test reactor)**

A nuclear reactor that is used for research, training, or development purposes (which may include producing radioisotopes for medical and industrial uses) but has no role in producing electrical power. These reactors, which are also known as research and test reactors, contribute to almost every field of science, including physics, chemistry, biology, medicine, geology, archeology, and ecology.

**Not Applicable (NA)**

Specifies that a particular field is not applicable to the event.

**Not Reported (NR)**

Specifies that information applicable to the particular field was not included in the event report.

**Nozzle**

As used in power water reactors and boiling water reactors, the interface (inlet and outlet) between reactor plant components (pressure vessel, coolant pumps, steam generators, etc.) and their associated piping systems.

**NRC Operations Center**

The primary center of communication and coordination among the NRC, its licensees, State and Tribal agencies, and other Federal agencies, regarding operating events involving nuclear reactors [/reactors.html] or materials [/materials.html] . Located in Rockville, MD, the Operations Center is staffed 24 hours a day by employees trained to receive and evaluate event reports and coordinate incident response activities. For additional detail, see How We Respond to an Emergency [/about-nrc/emerg-preparedness/respond-to-emergency.html] .

**NSTS**

A secure, Web-based data system that helps the NRC and its Agreement States [https://scp.nrc.gov/asdirectory.html] track and regulate the medical, industrial, and academic uses [/materials/medical.html] of certain nuclear materials, from the time they are manufactured or imported to the time of their disposal or exportation. This information enhances the ability of the NRC and Agreement States to conduct inspections and investigations, communicate information to other government agencies, and verify the ownership and use of nationally tracked sources. For additional detail, see the NSTS [/security/byproduct/nsts.html] page.

**Nuclear energy**

See *Atomic energy [/reading-rm/basic-ref/glossary/atomic-energy.html]* .

**Nuclear Energy Agency (NEA)**

A specialized agency within the Organisation for Economic Co-operation and Development (OECD), which was created to assist its member countries in maintaining and further developing the scientific, technological, and legal bases for safe, environmentally friendly, and economical use of nuclear energy for peaceful purposes. The NEA's current membership consists of 33 countries in Europe, North America, and the Asia-Pacific region, which account for about 85 percent of the world's installed nuclear capacity. The OECD is an intergovernmental organization, based in Paris, France, that provides a forum for discussion and cooperation among the governments of industrialized countries committed to democracy and the market economy.

**Nuclear force**

A powerful short-ranged attractive force that holds together the particles inside an atomic nucleus.

**Nuclear fuel**

Fissionable material [/reading-rm/basic-ref/glossary/fissionable-material.html] that has been enriched [/materials/fuel-cycle-fac/ur-enrichment.html] to a composition that will support a self-sustaining fission chain reaction [/reading-rm/basic-ref/glossary/chain-reaction.html] when used to fuel a nuclear reactor [/reading-rm/basic-ref/glossary/nuclear-reactor.html] , thereby producing energy (usually in the form of heat or useful radiation) for use in other processes.

**Nuclear Material Management and Safeguards System (NMMSS)**

A centralized U.S. Government database used to track and account for source and special nuclear material. The system contains current and historical data on the possession, use, and shipment of source and special nuclear material within the United States, as well as all exports and imports of such material. The database is jointly funded by the NRC and DOE and is operated under a DOE contract.

**Nuclear materials**

See *Special nuclear material [/reading-rm/basic-ref/glossary/special-nuclear-material.html]* , *Source material [/reading-rm/basic-ref/glossary/source-material.html]* , and *Byproduct material [/reading-rm/basic-ref/glossary/byproduct-material.html]* . For additional detail, see Nuclear Materials [/materials.html] .

**Nuclear poison (or neutron poison)**

In reactor physics, a substance (other than fissionable material [/reading-rm/basic-ref/glossary/fissionable-material.html] ) that has a large capacity for absorbing neutrons [/reading-rm/basic-ref/glossary/neutron.html] in the vicinity of the reactor core [/reading-rm/basic-ref/glossary/reactor-core.html] . This effect may be undesirable in some reactor applications because it may prevent or disrupt the fission chain reaction [/reading-rm/basic-ref/glossary/chain-reaction.html] , thereby affecting normal operation. However, neutron-absorbing materials (commonly known as "poisons") are intentionally inserted into some types of reactors [/reading-rm/basic-ref/glossary/nuclear-reactor.html] to decrease the reactivity of their initial fresh fuel load. (Adding poisons, such as control rods [/reading-rm/basic-ref/glossary/control-rod.html] or boron, is described as adding "negative reactivity [/reading-rm/basic-ref/glossary/reactivity.html] " to the reactor.)

**Nuclear power plant**

A thermal power plant, in which the energy (heat) released by the fissioning of nuclear fuel is used to boil water to produce steam. The steam spins the propeller-like blades of a turbine that turns the shaft of a generator to produce electricity. Of the various nuclear power plant designs, pressurized- water reactors and boiling-water reactors are in commercial operation in the United States. These facilities generate about 20 percent of U.S. electrical power.

**Nuclear Radiological Incident Annex**

An annex to the National Response Framework [/reading-rm/basic-ref/glossary/national-response-framework-nrf.html] , which provides for a timely, coordinated response by Federal agencies to nuclear or radiological accidents or incidents within the United States. This annex covers radiological dispersal devices and improvised nuclear devices, as well as accidents involving commercial reactors or weapons production facilities, lost radioactive sources, transportation accidents involving radioactive material, and foreign accidents involving nuclear or radioactive material. For additional detail, please see the NRC Incident Response Plan (NUREG-0728) [/about-nrc/emerg-preparedness/respond-to-emerg/incident-response.pdf] .

**Nuclear reactor**

The heart of a nuclear power plant [/reading-rm/basic-ref/glossary/nuclear-power-plant.html] or nonpower reactor [/reading-rm/basic-ref/glossary/nonpower-reactor-research-and-test-reactor.html] , in which nuclear fission [/reading-rm/basic-ref/glossary/fission-fissioning.html] may be initiated and controlled in a self-sustaining chain reaction [/reading-rm/basic-ref/glossary/chain-reaction.html] to generate energy or produce useful radiation. Although there are many types of nuclear reactors, they all incorporate certain essential features, including the use of fissionable material [/reading-rm/basic-ref/glossary/fissionable-material.html] as fuel, a moderator (such as water) to increase the likelihood of fission (unless reactor operation relies on fast neutrons), a reflector [/reading-rm/basic-ref/glossary/reflector.html] to conserve escaping neutrons [/reading-rm/basic-ref/glossary/neutron.html] , coolant [/reading-rm/basic-ref/glossary/coolant.html] provisions for heat removal, instruments for monitoring and controlling reactor operation, and protective devices (such as control rods [/reading-rm/basic-ref/glossary/control-rod.html] and shielding [/reading-rm/basic-ref/glossary/shielding.html] ). For additional detail, see Nuclear Reactors [/reactors.html] .

**Nuclear steam supply system**

The reactor and the reactor coolant pumps (and steam generators for a pressurized water reactor) and associated piping in a nuclear power plant used to generate the steam needed to drive the turbine generator unit.

**Nuclear waste**

A subset of radioactive waste [/reading-rm/basic-ref/glossary/waste-radioactive.html] that includes unusable byproducts produced during the various stages of the nuclear fuel cycle [/materials/fuel-cycle-fac/stages-fuel-cycle.html] , including recovery [/materials/uranium-recovery.html] (or extraction), conversion [/materials/fuel-cycle-fac/ur-conversion.html] , and enrichment [/materials/fuel-cycle-fac/ur-enrichment.html] of uranium [/reading-rm/basic-ref/glossary/uranium.html] ; fuel fabrication [/materials/fuel-cycle-fac/fuel-fab.html] ; and use of the fuel in nuclear reactors [/reading-rm/basic-ref/glossary/nuclear-reactor.html] . Specifically, these stages produce a variety of nuclear waste materials, including uranium mill tailings [/reading-rm/basic-ref/glossary/mill-tailings.html] , depleted uranium [/reading-rm/basic-ref/glossary/depleted-uranium.html] , and spent (depleted) fuel [/reading-rm/basic-ref/glossary/spent-depleted-or-used-nuclear-fuel.html] , all of which are regulated by the NRC. (By contrast, "radioactive waste" is a broader term, which includes all wastes that contain radioactivity [/reading-rm/basic-ref/glossary/radioactivity.html] , regardless of how they are produced. It is not considered "nuclear waste" because it is not produced through the nuclear fuel cycle and is generally not regulated by the NRC.)

**Nucleon**

Common name for a constituent particle of the atomic nucleus. At present, applied to protons and neutrons, but may include any other particles found to exist in the nucleus.

**Nucleus**

The small, central, positively charged region of an atom. Except for the nucleus of ordinary hydrogen, which has only a proton, all atomic nuclei contain both protons and neutrons. The number of protons determines the total positive charge or atomic number. This number is the same for all the atomic nuclei of a given chemical element. The total number of neutrons and protons is called the mass number.

**Nuclide**

A general term referring to all known isotopes, both stable (279) and unstable (about 2,700), of the chemical elements.

**Occupational Dose**

The internal and external dose [/reading-rm/basic-ref/glossary/dose.html] of ionizing radiation [/reading-rm/basic-ref/glossary/ionizing-radiation.html] received by workers in the course of employment in such areas as fuel cycle facilities [/materials/fuel-cycle-fac.html] , industrial radiography [/materials/miau/industrial.html#industrial] , nuclear medicine [/materials/miau/med-use.html] , and nuclear power plants [/reading-rm/basic-ref/glossary/nuclear-power-plant.html] . These workers are exposed to varying amounts of radiation, depending on their jobs and the sources with which they work. The NRC requires its licensees [/reading-rm/basic-ref/glossary/licensee.html] to limit occupational exposure [/reading-rm/basic-ref/glossary/exposure.html] to 5,000 mrem [/reading-rm/basic-ref/glossary/millirem.html] (50 mSv) per year. Occupational dose does not include the dose received from natural background sources [/about-nrc/radiation/around-us/sources/nat-bg-

sources.html] , doses received as a medical patient or participant in medical research programs, or "second-hand doses" received through exposure to individuals treated with radioactive materials. For additional detail, see Information for Radiation Workers [/about-nrc/radiation/health-effects/info.html] and Measuring Radation [/about-nrc/radiation/health-effects/measuring-radiation.html] .

**Operable**

A system, subsystem, train, component, or device is operable or has operability when it is capable of performing its specified functions and when all necessary attendant instrumentation, controls, electrical power, cooling or seal water, lubrication, or other auxiliary equipment that are required for the system, subsystem, train, component, or device to perform its functions are also capable of performing their related support functions.

**Operational mode**

In a nuclear power reactor, an operational mode corresponds to any one inclusive combination of core reactivity condition, power level, and average reactor coolant temperature.

**Organisation for Economic Co-operation and Development (OECD)**

An intergovernmental organization (based in Paris, France) which provides a forum for discussion and cooperation among the governments of industrialized countries committed to democracy and the market economy. The primary goal of the OECD and its member countries is to support sustainable economic growth, boost employment, raise living standards, maintain financial stability, assist other countries' economic development, and contribute to growth in world trade. In addition, the OECD is a reliable source of comparable statistics and economic and social data. The OECD also monitors trends, analyzes and forecasts economic developments, and researches social changes and evolving patterns in trade, environment, agriculture, technology, taxation, and other areas.

**Orphan sources (unwanted radioactive material)**

Sealed sources [/reading-rm/basic-ref/glossary/sealed-source.html] of radioactive material contained in a small volume (but not radioactively contaminated [/reading-rm/basic-ref/glossary/radioactive-contamination.html] soils and bulk metals) in any one or more of the following conditions:

- An uncontrolled condition that requires removal to protect public health and safety from a radiological threat
- A controlled or uncontrolled condition, for which a responsible party cannot be readily identified
- A controlled condition, compromised by an inability to ensure the continued safety of the material (e.g., the licensee [/reading-rm/basic-ref/glossary/licensee.html] may have few or no options to provide for safe disposition of the material)
- An uncontrolled condition, in which the material is in the possession of a person who did not seek, and is not licensed, to possess it
- An uncontrolled condition, in which the material is in the possession of a State radiological protection program solely to mitigate a radiological threat resulting from one of the above conditions, and for which the State does not have the necessary means to provide for the appropriate disposition of the material

**Outage**

The period during which a generating unit, transmission line, or other facility is out of service. Outages may be forced [/reading-rm/basic-ref/glossary/outage-forced.html] or scheduled [/reading-rm/basic-ref/glossary/outage-scheduled.html] , and full or partial.

**Outage (forced)**

The shutdown of a generating unit, transmission line, or other facility for emergency reasons, or a condition in which the equipment is unavailable as a result of an unanticipated breakdown. An outage [/reading-rm/basic-ref/glossary/outage.html] (whether full, partial, or attributable to a failed start) is considered "forced" if it could not reasonably be delayed beyond 48 hours from identification of the problem, if there had been a strong commercial desire to do so. In particular, the following problems may result in forced outages:

- Any failure of mechanical, fuel handling, or electrical equipment or controls within the generator's ownership or direct responsibility (i.e., from the point the generator is responsible for the fuel [/reading-rm/basic-ref/glossary/nuclear-fuel.html] through to the electrical connection point)
- A failure of a mine or fuel transport system dedicated to that power station with a resulting fuel shortage that cannot be economically managed

- Inadvertent or operator error
- Limitations caused by fuel quality

Forced outages do not include scheduled outages [/reading-rm/basic-ref/glossary/outage-scheduled.html] for inspection, maintenance, or refueling.

**Outage (full forced)**

A forced outage [/reading-rm/basic-ref/glossary/outage-forced.html] that causes a generating unit to be removed from the Committed state (when the unit is electrically connected and generating or pumping) or the Available state (when the unit is available for dispatch as a generator or pump but is not electrically connected and not generating or pumping). Full-forced outages do not include failed starts.

**Outage (scheduled)**

The shutdown of a generating unit, transmission line, or other facility for inspection, maintenance, or refueling, which is scheduled well in advance (even if the schedule changes). Scheduled outages do not include forced outages [/reading-rm/basic-ref/glossary/outage-forced.html] and could be deferred if there were a strong commercial reason to do so.

**Parent**

A radionuclide that upon radioactive decay or disintegration yields a specific nuclide (the daughter).

**Parts per million (ppm)**

Parts (molecules) of a substance contained in a million parts of another substance (e.g., water).

**Pellet, fuel**

A thimble-sized ceramic cylinder (approximately 3/8-inch in diameter and 5/8-inch in length), consisting of uranium [/reading-rm/basic-ref/glossary/uranium.html] (typically uranium oxide, $UO_2$), which has been enriched [/materials/fuel-cycle-fac/ur-enrichment.html] to increase the concentration of uranium-235 (U-235) to fuel a nuclear reactor [/reading-rm/basic-ref/glossary/reactor-nuclear.html] . Modern reactor cores [/reading-rm/basic-ref/glossary/reactor-core.html] in pressurized-water reactors (PWRs) [/reading-rm/basic-ref/glossary/pressurized-water-reactor-pwr.html] and boiling-water reactors (BWRs) [/reading-rm/basic-ref/glossary/boiling-water-reactor-bwr.html] may contain up to 10 million pellets, stacked in the fuel rods [/reading-rm/basic-ref/glossary/fuel-rod.html] that form fuel assemblies [/reading-rm/basic-ref/glossary/fuel-assembly-fuel-bundle-fuel-element.html] .

**Performance indicator**

A quantitative measure of a particular attribute of licensee [/reading-rm/basic-ref/glossary/licensee.html] performance that shows how well a plant is performing when measured against established thresholds. Licensees submit their data quarterly; the NRC regularly conducts inspections [/about-nrc/regulatory/safety-oversight.html] to verify the submittals and then uses its own inspection data plus the licensees' submittals to assess each plant's performance. For additional detail, see Assessment of Performance [/about-nrc/regulatory/perm-assess.html] , What is a performance indicator? [/reactors/operating/oversight/pi-summary.html] and Reactor Performance Assessment Basics [/reactors/operating/oversight/pi-summary-faq.html] .

**Performance-based regulation**

A regulatory approach that focuses on desired, measurable outcomes, rather than prescriptive processes, techniques, or procedures. Performance-based regulation leads to defined results without specific direction regarding how those results are to be obtained. At the NRC, performance-based regulatory actions focus on identifying performance measures that ensure an adequate safety margin and offer incentives for licensees [/reading-rm/basic-ref/glossary/licensee.html] to improve safety without formal regulatory intervention by the agency. For additional detail, see Risk Assessment in Regulation [/about-nrc/regulatory/risk-informed.html] .

**Performance-based regulatory action**

Licensee attainment of defined objectives and results without detailed direction from the NRC on how these results are to be obtained. (See the Communication Plan for Performance-Based Regulation by using accession number ML021120533 in ADAMS [/reading-rm/adams.html] .)

**Periodic table**

An arrangement of chemical elements in order of increasing atomic number. Elements of similar properties are placed one under the other, yielding groups or families of elements. Within each group, there is a variation of chemical and physical properties, but in general, there is a similarity of chemical behavior within each group. (See an online periodic table [/reading-rm/basic-ref/about-nuc/periodic.html] .)

**Personnel monitoring**

The use of portable survey meters to determine the amount of radioactive contamination on individuals, or the use of dosimetry to determine an individual's occupational radiation dose.

**Photon**

A quantum (or packet) of energy emitted in the form of electromagnetic radiation. Gamma rays and x-rays are examples of photons.

**Pico-**

A prefix that divides a basic unit by one trillion ($10^{-12}$).

**Picocurie**

One trillionth ($10^{-12}$) of a curie.

**Pig**

A colloquial term describing a container (usually lead or depleted uranium) used to ship or store radioactive materials. The thick walls of this shielding device protect the person handling the container from radiation. Large containers used for spent fuel storage are commonly called casks.

**Pile**

A colloquial term describing the first nuclear reactors. They are called piles because the earliest reactors were "piles" of graphite and uranium blocks.

**Piping**

Individual pieces that, when joined together, make a piping system. Examples include straight pipes, welds, elbows, tees, nozzles, and valves.

**Planned special exposure**

An infrequent exposure to radiation, separate from and in addition to the annual dose limits (see 10 CFR 20.1003 [/reading-rm/doc-collections/cfr/part020/part020-1003.html] and 20.1206 [/reading-rm/doc-collections/cfr/part020/part020-1206.html] ).

**Plausible accidents**

Postulated events that meet a probability test rather than the more challenging test represented by a design-basis event.

**Plutonium (Pu)**

A heavy, radioactive, manmade metallic element with atomic number 94. Its most important isotope is fissile plutonium-239, which is produced by neutron irradiation of uranium-238. It exists in only trace amounts in nature.

**Pocket dosimeter**

A small ionization detection instrument that indicates ionizing radiation exposure directly. An auxiliary charging device is usually necessary.

**Poison, neutron**

In reactor physics, a substance (other than fissionable material [/reading-rm/basic-ref/glossary/fissionable-material.html] ) that has a large capacity for absorbing neutrons [/reading-rm/basic-ref/glossary/neutron.html] in the vicinity of the reactor core [/reading-rm/basic-ref/glossary/reactor-core.html] . This effect may be undesirable in some reactor applications because it may prevent or disrupt the fission chain reaction [/reading-rm/basic-ref/glossary/chain-reaction.html] , thereby affecting normal operation. However, neutron-absorbing materials (commonly known as "poisons") are intentionally inserted into some types of reactors [/reading-rm/basic-ref/glossary/nuclear-reactor.html] to decrease the reactivity of their initial fresh fuel load. (Adding poisons, such as control rods [/reading-rm/basic-ref/glossary/control-rod.html] or boron, is described as adding "negative reactivity [/reading-rm/basic-ref/glossary/reactivity.html] " to the reactor.)

**Pool reactor**

A reactor in which the fuel elements are suspended in a pool of water that serves as the reflector, moderator, and coolant. Popularly called a "swimming pool reactor," it is used for research and training, not for electrical generation.

**Positron**

Particle equal in mass but opposite in charge to the electron. A positive electron.

**Possession-only license**

A license, issued by the NRC, that authorizes the licensee [/reading-rm/basic-ref/glossary/licensee.html] to possess specific nuclear material [/reading-rm/basic-ref/glossary/nuclear-materials.html] but does not authorize its use or the operation of a nuclear facility. For additional detail, see Licensing [/about-nrc/regulatory/licensing.html] .

**Power coefficient of reactivity**

The change in reactivity per percent change in power. The power coefficient is the summation of the moderator temperature coefficient of reactivity, the fuel temperature coefficient of reactivity, and the void coefficient of reactivity.

**Power defect**

The total amount of reactivity added due to a given change in power. It can also be expressed as the integrated power coefficient over the range of the power change.

**Power reactor**

A reactor designed to produce heat for electric generation (as distinguished from reactors used for research), for producing radiation or fissionable materials or for reactor component testing.

**Power uprate**

The process of increasing the maximum power level at which a commercial nuclear power plant [/reading-rm/basic-ref/glossary/nuclear-power-plant.html] may operate. This power level, regulated by the NRC, is included in the plant's operating license and technical specifications [/reactors/operating/licensing/techspecs.html] . A licensee [/reading-rm/basic-ref/glossary/licensee.html] may only change its maximum power output after the NRC approves an uprate application. The NRC analyses must demonstrate that the plant could continue to operate safely with its proposed new configuration. When all requisite conditions are fulfilled, the NRC may grant the power uprate by amending the plant's operating license and technical specifications. For additional detail, see Power Uprates [/reactors/operating/licensing/power-uprates.html] .

**PRA acceptability**

PRA Acceptability describes the ability of a PRA to support risk-informed regulatory decisionmaking. PRA Acceptability is measured in terms of its appropriateness with respect to scope, conformance with the technical elements of a PRA, level of detail, and plant representation.

**Preliminary Notification (PN)**

A brief summary report issued by the NRC staff to notify the Commission of the occurrence of a significant event that appears to have health and safety significance or major public or media interest. PNs are based on information provided by State radiation control program staff.

**Pressure vessel**

A strong-walled container housing the core of most types of power reactors. It usually also contains the moderator, neutron reflector, thermal shield, and control rods.

**Pressurized-water reactor (PWR)**

A common nuclear power reactor [/reading-rm/basic-ref/glossary/reactor-nuclear.html] design in which very pure water is heated to a very high temperature by fission [/reading-rm/basic-ref/glossary/fission-fissioning.html] , kept under high pressure (to prevent it from boiling), and converted to steam by a steam generator (rather than by boiling, as in a boiling-water reactor [/reading-rm/basic-ref/glossary/boiling-water-reactor-bwr.html] ). The resulting steam is used to drive turbines [/reading-rm/basic-ref/glossary/turbine.html] , which activate generators [/reading-rm/basic-ref/glossary/turbine-generator-tg.html] to produce electrical power. A pressurized-water reactor (PWR) essentially operates like a pressure cooker, where a lid is tightly placed over a pot of heated water, causing the pressure inside to increase as the temperature increases (because the steam cannot escape) but keeping the water from boiling at the usual 212°F (100°C). About two-thirds of the operating nuclear reactor power plants [/reading-rm/basic-ref/glossary/nuclear-power-plant.html] in the United States are PWRs. For additional detail, see Pressurized Water Reactors (PWRs) [/reactors/pwrs.html] .

**Pressurizer**

A tank or vessel that acts as a head tank (or surge volume) to control the pressure in a pressurized water reactor.

**Primary system**

A term that may be used for referring to the reactor coolant system.

**Primary water stress-corrosion cracking (PWSCC)**

A stress-corrosion cracking degradation mechanism to which certain materials used in nuclear power plant piping systems are susceptible.

**Probability distribution**

A mathematical characterization of uncertainty. Examples include normal, lognormal, and uniform.

**Probabilistic risk analysis**

A systematic method for addressing the risk triplet as it relates to the performance of a complex system to understand likely outcomes, sensitivities, areas of importance, system interactions, and areas of uncertainty. The risk triplet is the set of three questions that the NRC uses to define "risk": (1) What can go wrong? (2) How likely is it? and (3) What are the consequences? NRC identifies important scenarios from such an assessment.

**Probabilistic risk assessment (PRA)**

A systematic method for assessing three questions that the NRC uses to define "risk [/reading-rm/basic-ref/glossary/risk.html] ." These questions consider (1) what can go wrong, (2) how likely it is, and (3) what its consequences might be. These questions allow the NRC to understand likely outcomes, sensitivities, areas of importance, system interactions, and areas of uncertainty, which the staff can use to identify risk-significant scenarios. The NRC uses PRA to determine a numeric estimate of risk to provide insights into the strengths and weaknesses of the design and operation of a nuclear power plant [/reading-rm/basic-ref/glossary/nuclear-power-plant.html] . For additional detail, see Risk Assessment in Regulation [/about-nrc/regulatory/risk-informed.html] and Probabilistic Risk Assessment [/about-nrc/regulatory/risk-informed/pra.html] .

**Production expense**

Production expense is one component of the cost of generating electric power, which includes costs associated with fuel, as well as plant operation and maintenance.

**Proportional counter**

A radiation instrument in which an electronic detection system receives pulses that are proportional to the number of ions formed in a gas-filled tube by ionizing radiation.

**Proprietary information**

Privately owned knowledge or data, such as that protected by a registered patent, copyright, or trademark.

**Proton**

An elementary nuclear particle with a positive electric charge located in the nucleus of an atom.

**Public Dose**

The dose received by a member of the public from exposure to radiation or to radioactive material released by a licensee, or to any other source of radiation under the control of a licensee. 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 materials and released in accordance with 10 CFR 35.75 [/reading-rm/doc-collections/cfr/part035/part035-0075.html] , or from voluntary participation in medical research programs.

**Quality factor**

The factor by which the absorbed dose (rad or gray) is to be multiplied to obtain a quantity that expresses, on a common scale for all ionizing radiation, the biological damage (rem or sievert) to an exposed individual. It is used because some types of radiation, such as alpha particles, are more biologically damaging internally than other types.

**Quantum theory**

The concept that energy is radiated intermittently in units of definite magnitude, called quanta, and absorbed in a like manner.

**Rad (radiation absorbed dose)**

One of the two units used to measure the amount of radiation absorbed by an object or person, known as the "absorbed dose [/reading-rm/basic-ref/glossary/dose-absorbed.html] ," which reflects the amount of energy that radioactive sources deposit in materials through which they pass. The radiation-absorbed dose (rad) is the amount of energy (from any type of ionizing radiation [/reading-rm/basic-ref/glossary/ionizing-radiation.html] ) deposited in any medium (e.g., water, tissue, air). An absorbed dose of 1 rad means that 1 gram of material absorbed 100 ergs of energy (a small but measurable amount) as a result of exposure to radiation. The related international system unit is the gray (Gy) [/reading-rm/basic-ref/glossary/gray-gy.html] , where 1 Gy is equivalent to 100 rad. For additional information, see Doses in Our Daily Lives [/about-nrc/radiation/around-us/doses-daily-lives.html] and Measuring Radiation [/about-nrc/radiation/health-effects/measuring-radiation.html] .

**Radiation (ionizing radiation)**

Alpha particles [/reading-rm/basic-ref/glossary/alpha-particle.html] , beta particles [/reading-rm/basic-ref/glossary/beta-particle.html] , gamma rays [/reading-rm/basic-ref/glossary/gamma-radiation.html] , x-rays [/reading-rm/basic-ref/glossary/x-rays.html] , neutrons [/reading-rm/basic-ref/glossary/neutron.html] , high-speed electrons [/reading-rm/basic-ref/glossary/electron.html] , high-speed protons [/reading-rm/basic-ref/glossary/proton.html] , and other particles capable of producing ions [/reading-rm/basic-ref/glossary/ion.html] . Radiation, as used in 10 CFR Part 20 [/reading-rm/doc-collections/cfr/part020/] , does not include non-ionizing radiation, such as radio- or microwaves, or visible, infrared, or ultraviolet light (see also 10 CFR 20.1003 [/reading-rm/doc-collections/cfr/part020/part020-1003.html] ). For additional detail, see Radiation, ionizing [/reading-rm/basic-ref/glossary/radiation-ionizing.html] .

**Radiation area**

Any area with radiation levels greater than 5 millirems (0.05 millisievert) in one hour at 30 centimeters from the source or from any surface through which the radiation penetrates.

**Radiation detection instrument**

A device that detects and displays the characteristics of ionizing radiation.

**Radiation shielding**

Reduction of radiation by interposing a shield of absorbing material between any radioactive source and a person, work area, or radiation-sensitive device.

**Radiation sickness (syndrome)**

The complex of symptoms characterizing the disease known as radiation injury, resulting from excessive exposure (greater than 200 rads or 2 gray) of the whole body (or large part) to ionizing radiation. The earliest of these symptoms are nausea, fatigue, vomiting, and diarrhea, which may be followed by loss of hair (epilation), hemorrhage, inflammation of the mouth and throat, and general loss of energy. In severe cases, where the radiation exposure has been approximately 1000 rad (10 gray) or more, death may occur within two to four weeks. Those who survive six weeks after the receipt of a single large dose of radiation to the whole body may generally be expected to recover.

**Radiation source**

A radioactive material or byproduct that is specifically manufactured or obtained for the purpose of using the emitted radiation. Such sources are commonly used in teletherapy [/reading-rm/basic-ref/glossary/teletherapy.html] or industrial radiography [/materials/miau/industrial.html#industrial] ; in various types of industrial gauges [/materials/miau/industrial.html#gauging] , irradiators [/materials/miau/industrial.html#irradiators] , and gamma knives [/images/about-nrc/radiation/gamma-knife.jpg] ; and as power sources for batteries (such as those used in spacecraft). These sources usually consist of a known quantity of radioactive material, which is encased in a manmade capsule, sealed between layers of nonradioactive material, or firmly bonded to a nonradioactive substrate to prevent radiation leakage. Other radiation sources include devices such as accelerators and x-ray generators.

**Radiation standards**

Exposure [/reading-rm/basic-ref/glossary/exposure.html] limits; permissible concentrations; rules for safe handling; and regulations regarding receipt, possession, use, transportation, storage, disposal, and industrial control of radioactive material. For detail, see Title 10, Part 20, of the Code of Federal Regulations (10 CFR Part 20 [/reading-rm/doc-collections/cfr/part020/] ), "Standards for Protection Against Radiation."

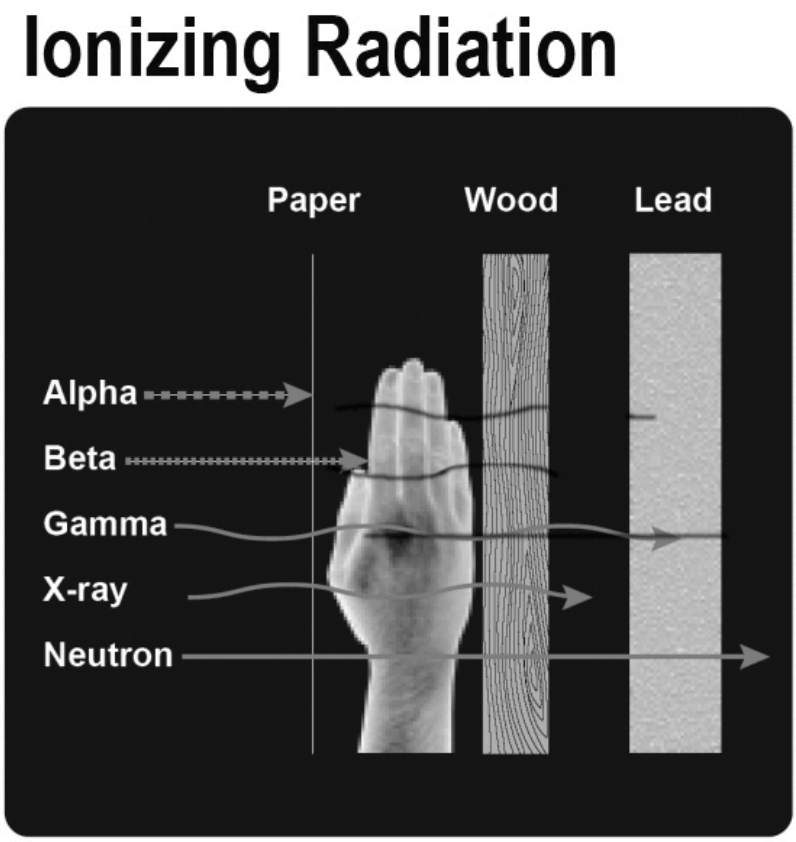
**Radiation therapy (radiotherapy)**

The therapeutic use [/materials/miau/med-use.html] of ionizing radiation [/reading-rm/basic-ref/glossary/radiation-ionizing-radiation.html] to treat disease in patients. Although most radiotherapy procedures are intended to kill cancerous tissue or reduce the size of a tumor, therapeutic doses may also be used to reduce pain or treat benign conditions. For example, intervascular brachytherapy [/reading-rm/basic-ref/glossary/brachytherapy.html] uses radiation to treat clogged blood vessels. Other common radiotherapy procedures include gamma stereotactic radiosurgery (gamma knife [/images/about-nrc/radiation/gamma-knife.jpg] ), teletherapy [/reading-rm/basic-ref/glossary/teletherapy.html] , and iodine treatment to correct an overactive thyroid gland. These procedures use radiation sources [/reading-rm/basic-ref/glossary/radiation-source.html] , regulated by the NRC and its Agreement States [/reading-rm/basic-ref/glossary/agreement-state.html] , that may be applied either inside or outside the body. In either case, the goal of radiotherapy is to deliver the required therapeutic or pain-relieving dose of radiation with high precision and for the required length of time, while preserving the surrounding healthy tissue.

**Radiation warning symbol**

 An officially prescribed magenta or black trefoil on a yellow background, which must be displayed where certain quantities of radioactive materials are present or where certain doses [/reading-rm/basic-ref/glossary/dose.html] of radiation could be received.

**Radiation, ionizing**




A form of radiation, which includes alpha particles, beta particles, gamma rays, x-rays, neutrons, high-speed electrons, and high-speed protons. Compared to nonionizing radiation, such as found in ultraviolet light or microwaves, ionizing radiation is considerably more energetic. When ionizing radiation passes through material such as air, water, or living tissue, it deposits enough energy to break molecular bonds and displace (or remove) electrons. This electron displacement may lead to changes in living cells. Given this ability, ionizing radiation has a number of beneficial uses, including treating cancer or sterilizing medical equipment. However, ionizing radiation is potentially harmful if not used correctly, and high doses may result in severe skin or tissue damage. It is for this reason that the NRC strictly regulates commercial and institutional uses of the various types of ionizing radiation.

**Radiation, nuclear**

Energy given off by matter in the form of tiny, fast-moving particles (alpha particles, beta particles, and neutrons) or pulsating electromagnetic rays or waves (gamma rays) emitted from the nuclei of unstable radioactive atoms. All matter is composed of atoms, which are made up of various parts; the nucleus contains minute particles called protons and neutrons, and the atom's outer shell contains other particles called electrons. The nucleus carries a positive electrical charge, while the electrons carry a negative electrical charge. These forces work toward a strong, stable balance by getting rid of excess atomic energy (radioactivity). In that process, unstable radioactive nuclei may emit energy, and this spontaneous emission is called nuclear radiation. All types of nuclear radiation are also ionizing radiation, but the reverse is not necessarily true; for example, x-rays are a type of ionizing radiation, but they are not nuclear radiation because they do not originate from atomic nuclei. In addition, some elements are naturally radioactive, as their nuclei emit nuclear radiation as a result of radioactive decay, but others become radioactive by being irradiated in a reactor. Naturally occurring nuclear radiation is indistinguishable from induced radiation.

**Radioactive contamination**

Undesirable radioactive material (with a potentially harmful effect) that is either airborne or deposited in (or on the surface of) structures, objects, soil, water, or living organisms (people, animals, or plants) in a concentration that may harm people, equipment, or the environment.

**Radioactive decay**

The spontaneous transformation of one radionuclide into one or more decay products (also known as "daughters"). This transformation is commonly characterized by the emission of an alpha particle, a beta particle, or gamma ray photon(s) from the nucleus of the radionuclide. The rate at which these transformations take place, when a sufficient quantity of the same radionuclide is present, depends on the half-life of the radionuclide. Some radionuclides (e.g., hydrogen-3, also known as "tritium") decay to stable daughters that are not radioactive. However, other radionuclides (e.g., uranium-238) decay to radioactive daughters (e.g., thorium-234) and may be part of a radioactive decay chain consisting of two or more radionuclides linked in a cascading series of radioactive decay.

**Radioactive series**

A succession of nuclides, each of which transforms by radioactive disintegration into the next until a stable nuclide results. The first member is called the parent, the intermediate members are called daughters, and the final stable member is called the end product.

**Radioactivity**

The property possessed by some elements [/reading-rm/basic-ref/glossary/element.html] (such as uranium [/reading-rm/basic-ref/glossary/uranium.html] ) of spontaneously emitting energy in the form of radiation as a result of the decay [/reading-rm/basic-ref/glossary/radioactive-decay.html] (or disintegration) of an unstable atom [/reading-rm/basic-ref/glossary/atom.html] . Radioactivity is also the term used to describe the rate at which radioactive material emits radiation [/reading-rm/basic-ref/glossary/radiation-ionizing-radiation.html] . Radioactivity is measured in curies (Ci) [/reading-rm/basic-ref/glossary/curie-ci.html] , becquerels (Bq) [/reading-rm/basic-ref/glossary/becquerel-bq.html] , or disintegrations per second.. For related information, see Measuring Radiation [/about-nrc/radiation/health-effects/measuring-radiation.html] .

**Radiography**

The use of sealed sources [/reading-rm/basic-ref/glossary/sealed-source.html] of ionizing radiation [/reading-rm/basic-ref/glossary/radiation-ionizing-radiation.html] for nondestructive examination of the structure of materials. When the radiation penetrates the material, it produces a shadow image by blackening a sheet of photographic film that has been placed behind the material, and the differences in blackening suggest flaws and unevenness in the material.

**Radioisotope (Radionuclide)**

An unstable isotope [/reading-rm/basic-ref/glossary/isotope.html] of an element [/reading-rm/basic-ref/glossary/element.html] that decays [/reading-rm/basic-ref/glossary/radioactive-decay.html] or disintegrates spontaneously, thereby emitting radiation [/reading-rm/basic-ref/glossary/radiation-ionizing-radiation.html] . Approximately 5,000 natural and artificial radioisotopes have been identified.

**Radiological sabotage**

Any deliberate act directed against a plant or transport in which an activity licensed pursuant to 10 CFR Part 73 [/reading-rm/doc-collections/cfr/part073/] of NRC's regulations is conducted or against a component of such a plant or transport that could directly or indirectly endanger the public health and safety by exposure to radiation.

**Radiological survey**

The evaluation of the radiation hazards accompanying the production, use, or existence of radioactive materials under a specific set of conditions. Such evaluation customarily includes a physical survey of the disposition of materials and equipment, measurements or estimates of the levels of radiation that may be involved, and a sufficient knowledge of processes affecting these materials to predict hazards resulting from expected or possible changes in materials or equipment.

**Radiology**

That branch of medicine dealing with the diagnostic and therapeutic applications of radiant energy, including x-rays and radioisotopes.

**Radionuclide**

An unstable isotope [/reading-rm/basic-ref/glossary/isotope.html] of an element [/reading-rm/basic-ref/glossary/element.html] that decays [/reading-rm/basic-ref/glossary/radioactive-decay.html] or disintegrates spontaneously, thereby emitting radiation [/reading-rm/basic-ref/glossary/radiation-ionizing-radiation.html] . Approximately 5,000 natural and artificial radioisotopes have been identified.

**Radiopharmaceutical**

A pharmaceutical drug that emits radiation and is used in diagnostic or therapeutic medical procedures. Radioisotopes that have short half-lives are generally preferred to minimize the radiation dose to the patient and the risk of prolonged exposure. In most cases, these short-lived radioisotopes decay to stable elements within minutes, hours, or days, allowing patients to be released from the hospital in a relatively short time.

**Radiosensitivity**

The relative susceptibility of cells, tissues, organs, organisms, or other substances to the injurious action of radiation.

**Radium (Ra)**

A radioactive substance found in nature. The Energy Policy Act of 2005 gives the NRC regulatory authority for the safe use of radium under certain conditions.

**Radon (Rn)**

A radioactive element that is one of the heaviest gases known. Its atomic number is 86. It is a daughter of radium.

**Reaction**

Any process involving a chemical or nuclear change.

**Reactive Inspection**

An inspection to examine the circumstances surrounding an operational problem or event occurring at a nuclear plant.

**Reactivity**

A term expressing the departure of a reactor system from criticality. A positive reactivity addition indicates a move toward supercriticality (power increase). A negative reactivity addition indicates a move toward subcriticality (power decrease).

**Reactor coolant system**

The system used to remove energy from the reactor core and transfer that energy either directly or indirectly to the steam turbine.

**Reactor core**

The central portion of a nuclear reactor [/reading-rm/basic-ref/glossary/reactor-nuclear.html] , which contains the fuel assemblies [/reading-rm/basic-ref/glossary/fuel-assembly-fuel-bundle-fuel-element.html] , moderator [/reading-rm/basic-ref/glossary/moderator.html] , neutron poisons [/reading-rm/basic-ref/glossary/nuclear-poison-or-neutron-poison.html] , control rods [/reading-rm/basic-ref/glossary/control-rod.html] , and support structures. The reactor core is where fission [/reading-rm/basic-ref/glossary/fission-fissioning.html] takes place.

**Reactor Oversight Process (ROP)**

The process by which the NRC monitors and evaluates the performance of commercial nuclear power plants [/reading-rm/basic-ref/glossary/nuclear-power-plant.html] . Designed to focus on those plant activities that are most important to safety, the process uses inspection [/about-nrc/regulatory/safety-oversight.html] findings and performance indicators [/reading-rm/basic-ref/glossary/performance-indicator.html] to assess each plant's safety performance. For additional detail, see Reactor Oversight Process (ROP) [/reactors/operating/oversight.html] .

**Reactor, nuclear**

The heart of a nuclear power plant [/reading-rm/basic-ref/glossary/nuclear-power-plant.html] or nonpower reactor [/reading-rm/basic-ref/glossary/nonpower-reactor-research-and-test-reactor.html] , in which nuclear fission [/reading-rm/basic-ref/glossary/fission-fissioning.html] may be initiated and controlled in a self-sustaining chain reaction [/reading-rm/basic-ref/glossary/chain-reaction.html] to generate energy or produce useful radiation. Although there are many types of nuclear reactors, they all incorporate certain essential features, including the use of fissionable material [/reading-rm/basic-ref/glossary/fissionable-material.html] as fuel, a moderator (such as water) to increase the likelihood of fission (unless reactor operation relies on fast neutrons), a reflector [/reading-rm/basic-ref/glossary/reflector.html] to conserve escaping neutrons [/reading-rm/basic-ref/glossary/neutron.html] , coolant [/reading-rm/basic-ref/glossary/coolant.html] provisions for heat removal, instruments for monitoring and controlling reactor operation, and protective devices (such as control rods [/reading-rm/basic-ref/glossary/control-rod.html] and shielding [/reading-rm/basic-ref/glossary/shielding.html] ). For additional detail, see Nuclear Reactors [/reactors.html] .

**Realization**

One execution or trial of a probabilistic simulation using a set of deterministic input values sampled from probability distributions.

**Reasonable**

Rational, sensible, or resulting from sound judgment.

**Reference man**

A person with the anatomical and physiological characteristics of an average individual that is used in calculations assessing internal dose (also may be called "standard man").

**Refueling**

The process of removing older fuel and loading new fuel. These actions are all performed underwater to supply continuous cooling for the fuel and provide shielding from the radioactive spent fuel.

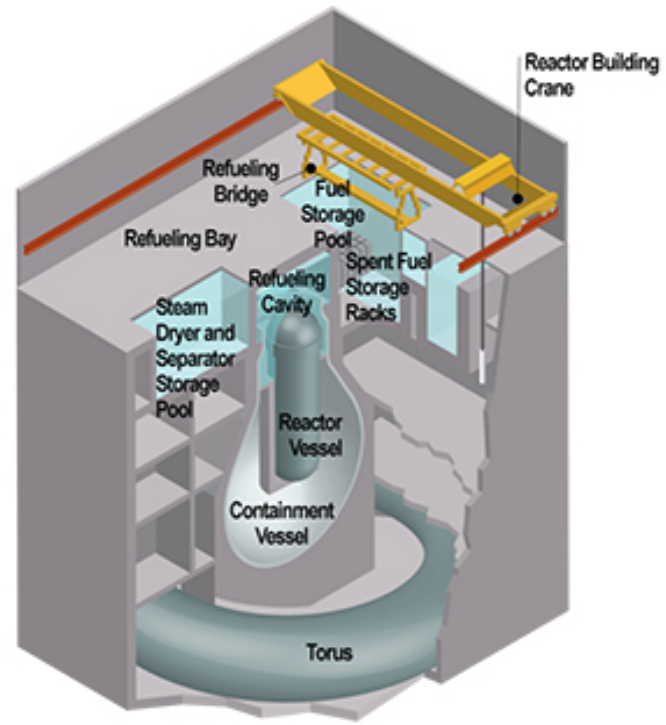
**Reflector**

A layer of material immediately surrounding a reactor core that scatters back (or reflects) into the core many neutrons that would otherwise escape. The returned neutrons can then cause more fissions and improve the neutron economy of the reactor. Common reflector materials are graphite, beryllium, water, and natural uranium.

**Refueling**

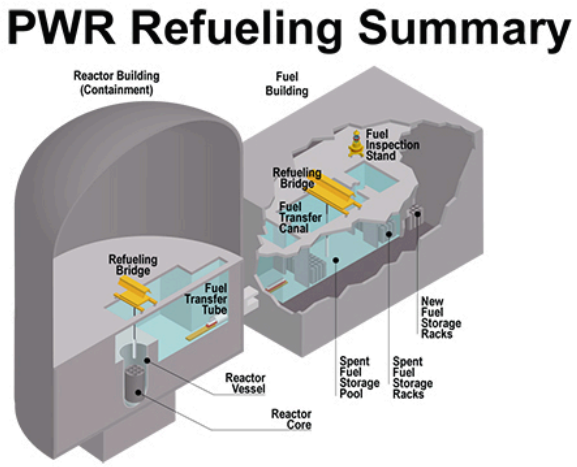
The process of removing older fuel and loading new fuel. These actions are all performed underwater to supply continuous cooling for the fuel and provide shielding from the radioactive spent fuel.

**Refueling BWR**




As new fuel shipping canisters arrive in the reactor building, the reactor building crane lifts them to the refueling floor, where the fuel is removed from the canister and inspected for defects. The fuel can then be stored either the new fuel storage area (which is dry) or in the refueling pool, depending upon the needs of the site. Fuel in the new fuel storage area is moved into the fuel pool before refueling begins. To refuel the reactor, the containment vessel lid and the reactor vessel head are removed, the refueling cavity above the reactor vessel is flooded, and the gates between the reactor cavity and fuel pool are removed. The refueling bridge removes one fuel bundle at a time from the reactor and transfers it to the spent fuel storage racks until about a third of the fuel is removed. The process is reversed when fuel is removed from the fuel pool and placed in the reactor. In BWRs, the fuel remains in a vertical position throughout the process.

**Refueling PWR**




As new fuel shipping canisters arrive in the fuel building, the reactor building crane (not shown) lifts them to the fuel inspection stand, where the fuel is removed from the canister and inspected for defects. Fuel in the new fuel storage area is moved into the fuel pool before refueling begins. The fuel can then be stored in either the new fuel storage racks (which are dry) or in the refueling pool, depending upon the needs of the site. Fuel in the new fuel storage area is moved into the fuel pool before refueling begins. To refuel the reactor, the vessel head is removed, the fuel transfer canals and transfer tube areas are flooded, and removable gates are opened in order to connect the refueling canal to the fuel pool. The reactor building refueling bridge is used to remove a fuel assembly from the reactor vessel and transfer it to the “up-ender” basket, which is then tilted until it is horizontal, sent through the transfer tube into the fuel building, and returned upright. The refueling bridge then moves the fuel assembly into the spent fuel storage racks. This process is reversed when fuel is loaded into the reactor.

**Regulation**

The governmental function of controlling or directing economic entities through the process of rulemaking and adjudication.

**Regulatory Conference**

A meeting between the NRC and a reactor licensee to discuss an inspection finding that was preliminarily assessed as greater-than-Green in significance to gather more information before a final decision on significance is made by the agency.

**Regulatory Information Conference**

An annual NRC conference that brings together NRC staff, regulated utilities, materials users, and other interested stakeholders to discuss nuclear safety topics and significant and timely regulatory activities through informal dialogue to ensure an open regulatory process.

**Rem**

One of the two standard units used to measure the dose equivalent [/reading-rm/basic-ref/glossary/dose-equivalent.html] (or effective dose), which combines the amount of energy (from any type of ionizing radiation [/reading-rm/basic-ref/glossary/ionizing-radiation.html] that is deposited in human tissue), along with the medical effects of the given type of radiation. For beta [/reading-rm/basic-ref/glossary/beta-particle.html] and gamma [/reading-rm/basic-ref/glossary/gamma-radiation.html] radiation, the dose equivalent is the same as the absorbed dose [/reading-rm/basic-ref/glossary/dose-absorbed.html] . By contrast, the dose equivalent is larger than the absorbed dose for alpha [/reading-rm/basic-ref/glossary/alpha-particle.html] and neutron [/reading-rm/basic-ref/glossary/neutron-source.html] radiation, because these types of radiation are more damaging to the human body. Thus, the dose equivalent (in rems) is equal to the absorbed dose (in rads [/reading-rm/basic-ref/glossary/rad-radiation-absorbed-dose.html] ) multiplied by the quality factor [/reading-rm/basic-ref/glossary/quality-factor.html] of the type of radiation [see Title 10, Section 20.1004, of the *Code of Federal Regulations* (10 CFR 20.1004 [/reading-rm/doc-collections/cfr/part020/part020-1004.html] ), "Units of Radiation Dose"]. The related international system unit is the sievert (Sv) [/reading-rm/basic-ref/glossary/sievert-sv.html] , where 100 rem is equivalent to 1 Sv. For additional information, see Doses in Our Daily Lives [/about-nrc/radiation/around-us/doses-daily-lives.html] and Measuring Radiation [/about-nrc/radiation/health-effects/measuring-radiation.html] .

**Renewable resources**

Natural, but limited, energy resources that can be replenished, including biomass, hydro, geothermal, solar, and wind. These resources are virtually inexhaustible but limited in the amount of energy that is available per unit of time. In the future, renewable resources could also include the use of ocean thermal, wave, and tidal action technologies. Utility renewable resource applications include bulk electricity generation, onsite electricity generation, distributed electricity generation, nongrid-connected generation, and demand-reduction (energy efficiency) technologies. The Information Digest [/reading-rm/doc-collections/nuregs/staff/sr1350/] has included conventional hydroelectric and storage hydroelectric in a separate category from other resources.

**Resident Inspector**

An NRC inspector assigned to inspect a nuclear plant on a full-time basis. Each site has at least two resident inspectors who have an office on site.

**Restricted area**

Any area to which access is controlled for the protection of individuals from exposure to radiation and radioactive materials.

**Risk**

The combined answer to three questions that consider (1) what can go wrong, (2) how likely it is to occur, and (3) what the consequences might be. These three questions allow the NRC to understand likely outcomes, sensitivities, areas of importance, system interactions, and areas of uncertainty, which can be used to identify risk-significant scenarios. For additional detail, see Risk Assessment in Regulation [https://www.nrc.gov/about-nrc/regulatory/risk-informed.html] and the Fact Sheet on Nuclear Reactor Risk [https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/reactor-risk.html] .

**Risk-based decisionmaking**

An approach to regulatory decisionmaking that considers only the results of a probabilistic risk assessment [/reading-rm/basic-ref/glossary/probabilistic-risk-assessment-pra.html] . For additional detail, see Risk Assessment in Regulation [/about-nrc/regulatory/risk-informed.html] and the Fact Sheet on Nuclear Reactor Risk [/reading-rm/doc-collections/fact-sheets/reactor-risk.html] .

**Risk-informed decisionmaking**

An approach to regulatory decisionmaking, in which insights from probabilistic risk assessment [/reading-rm/basic-ref/glossary/probabilistic-risk-assessment-pra.html] are considered with other engineering insights. For additional detail, see Risk Assessment in Regulation [/about-nrc/regulatory/risk-informed.html] and the Fact Sheet on Nuclear Reactor Risk [/reading-rm/doc-collections/fact-sheets/reactor-risk.html] .

**Risk-informed regulation**

An approach to regulation taken by the NRC, which incorporates an assessment of safety significance or relative risk [/reading-rm/basic-ref/glossary/risk.html] . This approach ensures that the regulatory burden imposed by an individual regulation or process is appropriate to its importance in protecting the health and safety of the public and the environment. For additional detail, see Risk Assessment in Regulation [/about-nrc/regulatory/risk-informed.html] and the Fact Sheet on Nuclear Reactor Risk [/reading-rm/doc-collections/fact-sheets/reactor-risk.html] .

**Risk significant**

The term referring to a facility's system, structure, component, or accident sequence that exceeds a predetermined limit for contributing to the risk associated with the facility. The term also describes a level of risk exceeding a predetermined significance level.

**Roentgen (R)**

A unit of exposure to ionizing radiation. It is the amount of gamma or x-rays required to produce ions resulting in a charge of 0.000258 coulombs/kilogram of air under standard conditions. Named after Wilhelm Roentgen, the German scientist who discovered x-rays in 1895.

**Rubblization**

A decommissioning technique involving demolition and burial of formerly operating nuclear facilities. All equipment from buildings is removed and the surfaces are decontaminated. Above-grade structures are demolished into rubble and buried in the structure's foundation below ground. The site surface is then covered, regraded and, landscaped for unrestricted use.

**Rupture**

A complete break or catastrophic structural failure of a component.

**Safe shutdown earthquake**

Is the maximum earthquake potential for which certain structures, systems, and components, important to safety, are designed to sustain and remain functional.

**Safeguards**

The use of material control and accounting [/security/domestic/mca.html] programs to verify that all special nuclear material [/materials/sp-nucmaterials.html] is properly controlled and accounted for, as well as the physical protection [/security/domestic/phys-protect.html] (or physical security) equipment and security forces. As used by the International Atomic Energy Agency [/reading-rm/basic-ref/glossary/international-atomic-energy-agency-iaea.html] , this term also means verifying that the peaceful use commitments made in binding nonproliferation agreements, both bilateral and multilateral, are honored. For additional detail, see Nuclear Security and Safeguards [/security.html] .

**Safeguards information (SGI)**

A special category of sensitive unclassified information that must be protected. Safeguards information concerns the physical protection [/security/domestic/phys-protect.html] of operating power reactors [/reactors/operating.html] , spent fuel shipments [/waste/spent-fuel-transp.html] , strategic special nuclear material [/materials/sp-nucmaterials.html] , or other radioactive material. For additional detail, see Information Security [/security/info-security.html] .

**Safety Conscious Work Environment**

A working environment in which employees are encouraged to report safety concerns without fear of criticism or retaliation from their supervisors because they raised the issue.

**Safety injection**

The rapid insertion of a chemically soluble neutron poison (such as boric acid) into the reactor coolant system to ensure reactor shutdown.

**Safety limit**

A restriction or range placed upon important process variables that are necessary to reasonably protect the integrity of the physical barriers that guard against the uncontrolled release of radioactivity.

**Safety-related**

In the regulatory arena, this term applies to systems, structures, components, procedures, and controls (of a facility or process) that are relied upon to remain functional during and following design-basis events [/reading-rm/basic-ref/glossary/design-basis-accident.html] . Their functionality ensures that key regulatory criteria, such as levels of radioactivity released, are met. Examples of

safety-related functions include shutting down a nuclear reactor [/reading-rm/basic-ref/glossary/nuclear-reactor.html] and maintaining it in a safe-shutdown condition.

**Safety-significant**

When used to qualify an object, such as a system, structure, component, or accident sequence, this term identifies that object as having an impact on safety, whether determined through risk [/reading-rm/basic-ref/glossary/risk.html] analysis or other means, that exceeds a predetermined significance criterion.

**SAFSTOR**

A long-term storage condition for a permanently shutdown nuclear power plant. During SAFSTOR, radioactive contamination decreases substantially, making subsequent decontamination and demolition easier and reducing the amount of LLW requiring disposal.

**Scattered radiation**

Radiation that, during its passage through a substance, has been changed in direction. It may also have been modified by a decrease in energy. It is one form of secondary radiation.

**Scintillation detector**

The combination of phosphor, photomultiplier tube, and associated electronic circuits for counting light emissions produced in the phosphor by ionizing radiation.

**Scram**

The sudden shutting down of a nuclear reactor [/reading-rm/basic-ref/glossary/nuclear-reactor.html] , usually by rapid insertion of control rods [/reading-rm/basic-ref/glossary/control-rod.html] , either automatically or manually by the reactor operator. Also known as a "reactor trip".

**Sealed source**

Any radioactive material or byproduct encased in a capsule designed to prevent leakage or escape of the material.

**Secondary radiation**

Radiation originating as the result of absorption of other radiation in matter. It may be either electromagnetic or particulate in nature.

**Secondary system**

The steam generator tubes, steam turbine, condenser, and associated pipes, pumps, and heaters used to convert the heat energy of the reactor coolant system into mechanical energy for electrical generation. Most commonly used in reference to pressurized water reactors.

**Seismic category I**

Structures, systems, and components that are designed and built to withstand the maximum potential earthquake stresses for the particular region where a nuclear plant is sited.

**Sensitive unclassified nonsafeguards information (SUNSI)**

Information that is generally not publicly available and that encompasses a wide variety of categories, such as proprietary information, personal and private information, or information subject to attorney-client privilege. For additional detail, see Information Security [/security/info-security.html] .

**Severe accident**

A type of accident that may challenge safety systems at a level much higher than expected.

**Shallow-Dose Equivalent (SDE)**

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

**Shielding**

Any material or obstruction that absorbs radiation and thus tends to protect personnel or materials from the effects of ionizing radiation.

**Shutdown**

A decrease in the rate of fission [/reading-rm/basic-ref/glossary/fission-fissioning.html] (and heat/energy production) in a reactor [/reading-rm/basic-ref/glossary/reactor-nuclear.html] (usually by the insertion of control rods [/reading-rm/basic-ref/glossary/control-rod.html] into the core [/reading-rm/basic-ref/glossary/core.html] ).

**Shutdown margin**

The instantaneous amount of reactivity by which the reactor is subcritical or would be subcritical from its present condition assuming all full-length rod cluster assemblies (shutdown and control) are fully inserted except for the single rod cluster assembly of highest reactivity worth that is assumed to be fully withdrawn.

**Sievert (Sv)**

The international system (SI) unit for dose equivalent equal to 1 Joule/kilogram. 1 sievert = 100 rem. Named for physicist Rolf Sievert.

**Significance Determination Process**

The process used by the NRC staff to evaluate inspection findings to determine their safety significance. This involves assessing how the inspection findings affect the risk of a nuclear plant accident, either as a cause of the accident or the ability of plant safety systems or personnel to respond to the accident.

**Somatic effects of radiation**

Effects of radiation limited to the exposed individual, as distinguished from genetic effects, that may also affect subsequent unexposed generations.

**Source material**

Uranium [/reading-rm/basic-ref/glossary/uranium.html] or thorium, or any combination thereof, in any physical or chemical form, or ores that contain, by weight, one-twentieth 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 [/reading-rm/basic-ref/glossary/special-nuclear-material.html] . For additional detail, see Source Material [/materials/srcmaterial.html] .

**Source term**

Types and amounts of radioactive or hazardous material released to the environment following an accident.

**Special nuclear material**

Plutonium [/reading-rm/basic-ref/glossary/plutonium-pu.html] , uranium-233 [/reading-rm/basic-ref/glossary/uranium.html] , or uranium enriched [/materials/fuel-cycle-fac/ur-enrichment.html] in the isotopes [/reading-rm/basic-ref/glossary/isotope.html] uranium-233 or uranium-235. For additional detail, see Special Nuclear Material [/materials/sp-nucmaterials.html] .

**Spent (depleted or used) nuclear fuel**

Nuclear reactor fuel [/reading-rm/basic-ref/glossary/nuclear-fuel.html] that has been used to the extent that it can no longer effectively sustain a chain reaction [/reading-rm/basic-ref/glossary/chain-reaction.html] . For related information, see Storage of Spent Nuclear Fuel [/waste/spent-fuel-storage.html] and Transportation of Spent Nuclear Fuel [/waste/spent-fuel-transp.html] .

**Spent fuel pool**

An underwater storage and cooling facility for spent (depleted) fuel [/reading-rm/basic-ref/glossary/spent-depleted-or-used-nuclear-fuel.html] assemblies that have been removed from a reactor [/reading-rm/basic-ref/glossary/reactor-nuclear.html] . For related information, see Storage of Spent Nuclear Fuel [/waste/spent-fuel-storage.html] and Spent Fuel Pools [/waste/spent-fuel-storage/pools.html] .

**Spent nuclear fuel**

Nuclear reactor fuel [/reading-rm/basic-ref/glossary/nuclear-fuel.html] that has been used to the extent that it can no longer effectively sustain a chain reaction [/reading-rm/basic-ref/glossary/chain-reaction.html] . For related information, see Storage of Spent Nuclear Fuel [/waste/spent-fuel-storage.html] and Transportation of Spent Nuclear Fuel [/waste/spent-fuel-transp.html] .

**Stable isotope**

An isotope that does not undergo radioactive decay.

**Standard Review Plan**

A document that provides guidance to the staff for reviewing an application to obtain an NRC license to construct or operate a nuclear facility or to possess or use nuclear materials.

**Standard Technical Specifications**

NRC staff guidance on model technical specifications for an operating license. (See also Technical Specifications.)

**Startup**

An increase in the rate of fission (and heat production) in a reactor (usually by the removal of control rods from the core).

**Stay time**

The period during which personnel may remain in a restricted area in a reactor before accumulating some permissible occupational dose.

**Steam generator**

The heat exchanger used in some reactor designs to transfer heat from the primary (reactor coolant) system to the secondary (steam) system. This design permits heat exchange with little or no contamination of the secondary system equipment.

**Stochastic effects**

Effects that occur by chance, generally occurring without a threshold level of dose, whose probability is proportional to the dose and whose severity is independent of the dose. In the context of radiation protection, the main stochastic effects are cancer and genetic effects.

**Stress-intensity factor**

A characterization of the driving force for fracture at the tips of a crack.

**Subcritical mass**

An amount of fissionable material insufficient in quantity or of improper geometrical configuration to sustain a fission chain reaction.

**Subcriticality**

The condition of a nuclear reactor [/reading-rm/basic-ref/glossary/reactor-nuclear.html] system, in which nuclear fuel [/reading-rm/basic-ref/glossary/nuclear-fuel.html] no longer sustains a fission chain reaction [/reading-rm/basic-ref/glossary/chain-reaction.html] (that is, the reaction fails to initiate its own repetition, as it would in a reactor's normal operating condition). A reactor becomes subcritical when its fission [/reading-rm/basic-ref/glossary/fission-fissioning.html] events fail to release a sufficient number of neutrons [/reading-rm/basic-ref/glossary/neutron.html] to sustain an ongoing series of reactions, possibly as a result of increased neutron leakage [/reading-rm/basic-ref/glossary/neutron-leakage.html] or poisons [/reading-rm/basic-ref/glossary/poison-neutron.html] .

**Supercritical reactor**

A reactor in which the power level is increasing with time.

**Supercriticality**

The condition for increasing the level of operation of a reactor. The rate of fission neutron production exceeds all neutron losses, and the overall neutron population increases.

**Superheating**

The heating of a vapor, particularly steam, to a temperature much higher than the boiling point at the existing pressure. This is done in some power plants to improve efficiency and to reduce water damage to the turbine.

**Surface crack**

A crack that is open to the inside of a component and does not penetrate through it.

**Survey meter**

Any portable radiation detection instrument especially adapted for inspecting an area or individual to establish the existence and amount of radioactive material present.

**Technical Specifications**

Part of an NRC license authorizing the operation of a nuclear production or utilization facility. A Technical Specification establishes requirements for items such as safety limits, limiting safety system settings, limiting control settings, limiting conditions for operation, surveillance requirements, design features, and administrative controls. (See also Standard Technical Specifications.)

**Teletherapy**

Treatment in which the source of the therapeutic radiation is at a distance from the body. Because teletherapy is often used to treat malignant tumors deep within the body by bombarding them with a high-energy beam of gamma rays [/reading-rm/basic-ref/glossary/gamma-radiation.html] (from a radioisotope [/reading-rm/basic-ref/glossary/radioisotope-radionuclide.html] such as cobalt-60) projected from outside the body, it is often called "external beam radiotherapy [/reading-rm/basic-ref/glossary/radiation-therapy-radiotherapy.html] ." For related information, see the Backgrounder on Medical Use of Radioactive Materials [/reading-rm/doc-collections/fact-sheets/med-use-radioactive-materials.html] .

**Terrestrial radiation**

The portion of the natural background radiation that is emitted by naturally occurring radioactive materials, such as uranium, thorium, and radon in the earth.

**Thermal breeder reactor**

A breeder reactor in which the fission chain reaction is sustained by thermal neutrons.

**Thermal power**

The total core heat transfer rate to the reactor coolant.

**Thermal reactor**

A reactor in which the fission chain reaction is sustained primarily by thermal neutrons. Most current reactors are thermal reactors.

**Thermal shield**

A layer, or layers, of high-density material located within a reactor pressure vessel or between the vessel and the biological shield to reduce radiation heating in the vessel and the biological shield.

**Thermalization**

The process undergone by high-energy (fast) neutrons as they lose energy by collision.

**Thermoluminescent dosimeter**

A small device used to measure radiation by measuring the amount of visible light emitted from a crystal in the detector when exposed to ionizing radiation.

**Thermonuclear**

An adjective referring to the process in which very high temperatures are used to bring about the fusion of light nuclei, such as those of the hydrogen isotopes deuterium and tritium, with the accompanying liberation of energy.

**Through-wall crack**

A crack that penetrates a component and is open to both the inside and outside.

**Title 10 of the Code of Federal Regulations (10 CFR)**


Four volumes of the *Code of Federal Regulations* (CFR) address energy-related topics. Parts 1 to 199 contain the regulations (or rules) established by the NRC. These regulations govern the transportation and storage of nuclear materials [/materials.html] ; use of radioactive materials at nuclear power plants [/reactors/power.html] , research and test reactors [/reactors/non-power.html] , uranium recovery facilities [/materials/uranium-recovery.html] , fuel cycle facilities [/materials/fuel-cycle-fac.html] , waste repositories [/waste.html] , and other nuclear facilities; and use of nuclear materials for medical, industrial, and academic purposes [/materials/medical.html] . To review the regulations, see NRC Regulations - Title 10, Code of Federal Regulations [/reading-rm/doc-collections/cfr/] .

**Top event**

The events across the top of the event tree [/reading-rm/basic-ref/glossary/event-tree.html] , which graphically represent the systems needed to keep the plant in a safe state following an initiating event (i.e., a challenge to plant operation). A top event is the starting point of the fault tree [/reading-rm/basic-ref/glossary/fault-tree.html] , which identifies all of the pathways that lead to a system failure. For additional information, see Probabilistic Risk Assessment [/about-nrc/regulatory/risk-informed/pra.html] .

**Total Effective Dose Equivalent (TEDE)**

The sum of the effective dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures).

**Transient**

A change in the reactor coolant system [/reading-rm/basic-ref/glossary/reactor-coolant-system.html] temperature, pressure, or both, attributed to a change in the reactor's power output. Transients can be caused by (1) adding or removing neutron poisons [/reading-rm/basic-ref/glossary/poison-neutron.html] , (2) increasing or decreasing electrical load on the turbine generator [/reading-rm/basic-ref/glossary/turbine-generator-tg.html] , or (3) accident conditions.

**Transitioning crack**

A through-wall crack whose shape is nonidealized, meaning that it has different lengths on the inside and outside surfaces of the component.

**Transuranic element**

An artificially made, radioactive element that has an atomic number higher than uranium in the periodic table of elements such as neptunium, plutonium, americium, and others.

**Transuranic waste**

Material contaminated with transuranic elements [/reading-rm/basic-ref/glossary/transuranic-element.html] —artificially made, radioactive elements [/reading-rm/basic-ref/glossary/element.html] , such as neptunium, plutonium [/reading-rm/basic-ref/glossary/plutonium-pu.html] , americium, and others—that have atomic numbers [/reading-rm/basic-ref/glossary/atomic-

number.html] higher than uranium [/reading-rm/basic-ref/glossary/uranium.html] in the periodic table of elements [/reading-rm/basic-ref/glossary/periodic-table.html] . Transuranic waste is primarily produced from recycling spent fuel [/reading-rm/basic-ref/glossary/spent-depleted-or-used-nuclear-fuel.html] or using plutonium to fabricate nuclear weapons. For related information, see the Backgrounder on Radioactive Waste [/reading-rm/doc-collections/fact-sheets/radwaste.html] .

**Trip, reactor**

A term that is used by pressurized water reactors for a reactor scram (see Scram).

**Tritium**

A radioactive isotope [/reading-rm/basic-ref/glossary/isotope.html] of hydrogen. Because it is chemically identical to natural hydrogen, tritium can easily be taken into the body by any ingestion path. It decays [/reading-rm/basic-ref/glossary/radioactive-decay.html] by emitting beta particles [/reading-rm/basic-ref/glossary/beta-particle.html] and has a half-life [/reading-rm/basic-ref/glossary/half-life.html] of about 12.5 years. For related information, see the Fact Sheet on Tritium, Radiation Protection Limits, and Drinking Water Standards [/reading-rm/doc-collections/fact-sheets/tritium-radiation-fs.html] .

**Turbine**

A rotary engine made with a series of curved vanes on a rotating shaft, usually turned by water or steam. Turbines are considered the most economical means to turn large electrical generators.

**Turbine generator (TG)**

A steam (or water) turbine directly coupled to an electrical generator. The two devices are often referred to as one unit.

**U.S. Department of Energy (DOE)**

The Federal agency established by Congress to advance the national, economic, and energy security of the United States, among other missions.

**U.S. Department of Homeland Security (DHS)**

The Federal agency responsible for leading the unified national effort to secure the U.S. against those who seek to disrupt the American way of life. DHS is also responsible for preparing for and responding to all hazards and disasters and includes the formerly separate Federal Emergency Management Agency [/reading-rm/basic-ref/glossary/federal-emergency-management-agency-fema.html] , the Coast Guard, and the Secret Service.

**U.S. Environmental Protection Agency (EPA)**

The Federal agency responsible for protecting human health and safeguarding the environment. EPA leads the Nation's environmental science, research, education, and assessment efforts to ensure that attempts to reduce environmental risk are based on the best available scientific information. EPA also ensures that environmental protection is an integral consideration in U.S. policies.

**Ultraviolet**

Electromagnetic radiation of a wavelength between the shortest visible violet and low energy x-rays.

**Uncertainty**

Characterized by multiple possible values of inputs and outputs, on which statistics may be created.

**Uncertainty range**

Defines an interval within which a numerical result is expected to lie within a specified level of confidence. The interval often used is the 5-95 percentile of the distribution reporting the uncertainty.

**Unnecessary regulatory burden**

Regulatory criteria that go beyond the levels that would be reasonably expected to be imposed on licensees given that regulations apply to conditions that incorporate normal operation and design-basis conditions.

**Unrestricted area**

The area outside the owner-controlled portion of a nuclear facility (usually the site boundary). An area in which a person could not be exposed to radiation levels in excess of 2 millirems in any one hour from external sources (see 10 CFR 20.1003 [/reading-rm/doc-collections/cfr/part020/part020-1003.html] ).

**Unstable isotope**

A radioactive isotope (see also stable isotope).

**Unwanted Radioactive Material (Orphan Sources)**

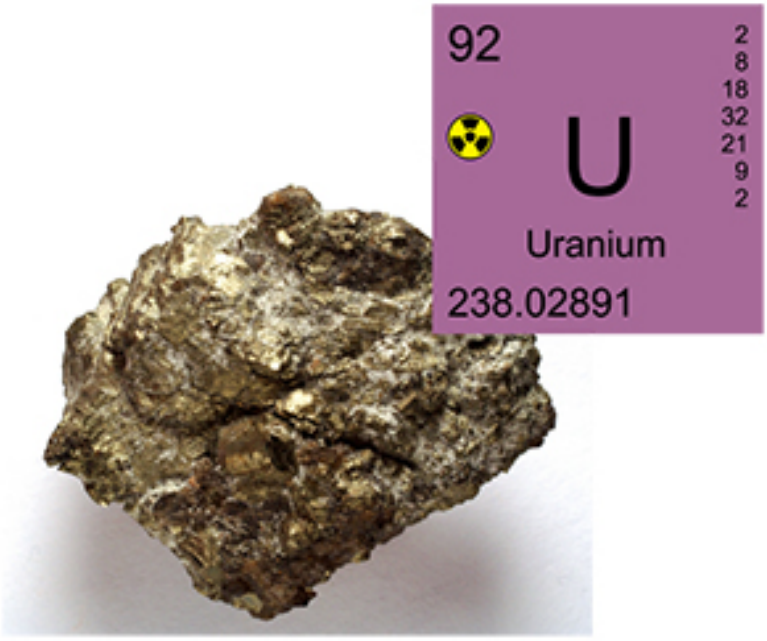
refers to sealed sources of radioactive material contained in a small volume (but not radioactively contaminated soils and bulk metals) in any one or more of the following conditions (taken from the NRC Orphan Source Initiative):

1. In an uncontrolled condition that requires removal to protect public health and safety from a radiological threat;
2. Controlled or uncontrolled, but for which a responsible party cannot be readily identified;
3. Controlled, but the material's continued security cannot be assured. If held by a licensee, the licensee has few or no options for, or is incapable of providing for, the safe disposition of the material;
4. In the possession of a person, not licensed to possess the material, who did not seek to possess the material; or
5. In the possession of a state radiological protection program for the sole purpose of mitigating a radiological threat because of one of the above conditions, and for which the state does not have a means to provide for the material's appropriate disposition.

**Uprate**

See *Power uprate [/reading-rm/basic-ref/glossary/power-uprate.html]* .

**Uranium**




A radioactive element [/reading-rm/basic-ref/glossary/element.html] with the atomic number [/reading-rm/basic-ref/glossary/atomic-number.html] 92 and, as found in natural ores, an atomic weight of approximately 238. The two principal natural isotopes [/reading-rm/basic-ref/glossary/isotope.html] are uranium-235 (which comprises 0.7 percent of natural uranium [/reading-rm/basic-ref/glossary/natural-uranium.html] ), which is fissile [/reading-rm/basic-ref/glossary/fissile-material.html] , and uranium-238 (99.3 percent of natural uranium), which is fissionable [/reading-rm/basic-ref/glossary/fissionable-material.html] by fast neutrons [/reading-rm/basic-ref/glossary/fast-neutron.html] and is fertile [/reading-rm/basic-ref/glossary/fertile-material.html] , meaning that it becomes fissile after absorbing one neutron [/reading-rm/basic-ref/glossary/neutron.html] . Natural uranium also includes a minute amount of uranium-234.

**Uranium enrichment process**

The process of increasing the percentage of uranium-235 (U-235) from 0.7 percent in natural uranium to about 3 to 5 percent for use in fuel for nuclear reactors. Enrichment can be done through gaseous diffusion, gas centrifuges, or laser isotope separation. In May 2013, the last remaining U.S. operating gaseous diffusion plant in Paducah, KY, shut down. A similar plant near Piketon, OH, was closed in March 2001. Another plant in Oak Ridge, TN, closed years ago and was not regulated by the NRC.

**Uranium fuel fabrication facility**

A facility that converts enriched [/materials/fuel-cycle-fac/ur-enrichment.html] uranium hexafluoride (UF6) into fuel [/reading-rm/basic-ref/glossary/nuclear-fuel.html] for commercial light-water power reactors [/reading-rm/basic-ref/glossary/light-water-reactor.html] , research and test reactors [/reading-rm/basic-ref/glossary/nonpower-reactor-research-and-test-reactor.html] , and other nuclear reactors [/reading-rm/basic-ref/glossary/nuclear-reactor.html] . The UF6, in solid form in containers, is heated to a gaseous form and then chemically processed to form uranium dioxide (UO2) powder. This powder is then processed into ceramic pellets [/reading-rm/basic-ref/glossary/pellet-fuel.html] and loaded into metal tubes, which are subsequently bundled into fuel assemblies [/reading-rm/basic-ref/glossary/fuel-assembly-fuel-bundle-fuel-element.html] . Fabrication also can involve mixed-oxide (MOX) fuel [/reading-rm/basic-ref/glossary/mixed-oxide-mox-fuel.html] , which contains plutonium oxide mixed with either natural or depleted uranium oxide, in ceramic pellet form. For related information, see Fuel Fabrication [/materials/fuel-cycle-fac/fuel-fab.html] .

**Uranium hexafluoride production facility (or uranium conversion facility)**

A facility that receives natural uranium [/reading-rm/basic-ref/glossary/natural-uranium.html] in the form of ore concentrate (known as “yellowcake [/reading-rm/basic-ref/glossary/yellowcake.html] ”) and converts it into uranium hexafluoride (UF6), in preparation for fabricating fuel [/reading-rm/basic-ref/glossary/nuclear-fuel.html] for nuclear reactors [/reading-rm/basic-ref/glossary/nuclear-reactor.html] . For additional detail, see Uranium Conversion [/materials/fuel-cycle-fac/ur-conversion.html] .

**Vapor**

The gaseous form of substances that are normally in liquid or solid form.

**Very high radiation area**

An area accessible to individuals, in which radiation levels exceed 500 rad (5 gray) in one hour at 1 meter from the source or from any surface that the radiation penetrates (see 10 CFR 20.1003 [/reading-rm/doc-collections/cfr/part020/part020-1003.html] ).

**Viability assessment**

A decisionmaking process used by the U.S. Department of Energy (DOE) [/reading-rm/basic-ref/glossary/u.s.-department-of-energy-doe.html] to assess the prospects for safe and secure permanent disposal [/waste/hlw-disposal.html] of high-level radioactive waste [/waste/high-level-waste.html] in an excavated, underground facility, known as a geologic repository. This decisionmaking process is based on (1) specific design work on the critical elements of the repository and waste package, (2) a total system performance assessment that will describe the probable behavior of the repository, (3) a plan and cost estimate for the work required to complete the license application, and (4) an estimate of the costs to construct and operate the repository.

**Void**

In a nuclear power reactor, an area of lower density in a moderating system (such as steam bubbles in water) that allows more neutron leakage than does the more dense material around it.

**Void coefficient of reactivity**

A rate of change in the reactivity of a water reactor system resulting from a formation of steam bubbles as the power level and temperature increase.

**Waste classification (classes of waste)**

Classification of low-level waste (LLW) according to its radiological hazard. The classes include Class A, B, and C, with Class A being the least hazardous and accounting for 96 percent of LLW in the United States. As the waste class and hazard increase, the regulations established by the NRC require progressively greater controls to protect the health and safety of the public and the environment.

**Waste, radioactive**

Radioactive materials at the end of their useful life or in a product that is no longer useful and requires proper disposal. See High-level radioactive waste [/reading-rm/basic-ref/glossary/high-level-radioactive-waste-hlw.html] , Low-level radioactive waste [/reading-rm/basic-ref/glossary/low-level-radioactive-waste-llw.html] , and Spent (depleted or used) nuclear fuel [/reading-rm/basic-ref/glossary/spent-depleted-or-used-nuclear-fuel.html] .

**Watt**

A unit of power (in the international system of units) defined as the consumption or conversion of one joule of energy per second. In electricity, a watt is equal to current (in amperes) multiplied by voltage (in volts).

**Watthour**

An unit of energy equal to one watt [/reading-rm/basic-ref/glossary/watt.html] of power steadily supplied to, or taken from, an electrical circuit for one hour (or exactly $3.6x10^3$J).

**Weighting factor (WT)**

Multipliers of the equivalent dose to an organ or tissue used for radiation protection purposes to account for different sensitivities of different organs and tissues to the induction of stochastic effects of radiation (see 10 CFR 20.1003 [/reading-rm/doc-collections/cfr/part020/part020-1003.html] for complete information).

**Well-logging**

All operations involving the lowering and raising of measuring devices or tools that contain licensed nuclear material [/reading-rm/basic-ref/glossary/licensed-material.html] or are used to detect licensed nuclear materials in wells for the purpose of obtaining information about the well or adjacent formations that may be used in oil, gas, mineral, groundwater, or geological exploration. For related information, see Well Logging [/materials/miau/industrial.html#well] and the Well-Logging Licensee Toolkit [/materials/miau/industrial-uses/well-toolkit.html] .

**Wheeling service**

The movement of electricity from one system to another over transmission facilities of intervening systems. Wheeling service contracts can be established between two or more systems.

**Whole-body counter**

A device used to identify and measure the radioactive material in the body of human beings and animals. It uses heavy shielding to keep out naturally existing background radiation and ultrasensitive radiation detectors and electronic counting equipment.

**Whole-body exposure**

Whole body exposure includes at least the external exposure, head, trunk, arms above the elbow, or legs above the knee. Where a radioisotope is uniformly distributed throughout the body tissues, rather than being concentrated in certain parts, the irradiation can be considered as whole-body exposure (see also 10 CFR 20.1003 [/reading-rm/doc-collections/cfr/part020/part020-1003.html] ).

**Wipe sample**

A sample made for the purpose of determining the presence of removable radioactive contamination on a surface. It is done by wiping, with slight pressure, a piece of soft filter paper over a representative type of surface area. It is also known as a "swipe" or "smear" sample.

**X-rays**

Penetrating electromagnetic radiation (photon) having a wavelength that is much shorter than that of visible light. These rays are usually produced by excitation of the electron field around certain nuclei. In nuclear reactions, it is customary to refer to photons originating in the nucleus as x-rays.

**Yellowcake**

The solid form of mixed uranium oxide, which is produced from uranium [/reading-rm/basic-ref/glossary/uranium.html] ore in the uranium recovery [/materials/uranium-recovery.html] (milling) process. The material is a mixture of uranium oxides, which can vary in proportion and color from yellow to orange to dark green (blackish) depending on the temperature at which the material is dried (which affects the level of hydration and impurities), with higher drying temperatures producing a darker and less soluble material. Yellowcake was commonly referred to as $U_3O_8$, because that chemical compound historically comprised the majority of the yellowcake produced by uranium recovery facilities utilizing conventional milling methods. Most modern uranium recovery facilities utilize in situ recovery methods and produce a yellowish compound comprised mostly of uranyl peroxide dihydrate. This material is then transported to a uranium conversion [/materials/fuel-cycle-fac/ur-conversion.html] facility, where it is transformed into uranium hexafluoride ($UF_6$), in preparation for fabricating fuel [/reading-rm/basic-ref/glossary/nuclear-fuel.html] for nuclear reactors [/reading-rm/basic-ref/glossary/nuclear-reactor.html] .

**Zirconium**

A chemical element used (in the form of "Zircaloy" metals) in cladding [/reading-rm/basic-ref/glossary/cladding.html] for nuclear fuel rods [/reading-rm/basic-ref/glossary/fuel-rod.html] . The thin zirconium tubes contain pellets of nuclear fuel [/reading-rm/basic-ref/glossary/nuclear-fuel.html] and are bundled together into assemblies [/reading-rm/basic-ref/glossary/fuel-assembly-fuel-bundle-fuel-element.html] for use in a reactor [/reading-rm/basic-ref/glossary/nuclear-reactor.html] .

*Page Last Reviewed/Updated Wednesday, February 07, 2024*