NUREG-0770

Glossary of Terms

Nuclear Power and Radiation

U.S. Nuclear Regulatory Commission

Office of Public Affairs
Office of Inspection and Enforcement
Office of Administration

Compilers: J. G. Hanchett, OPA, F. W. Hasselberg, OIE
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ABSTRACT

This "Glossary of Terms: Nuclear Power and Radiation" is a compilation of words and concepts commonly used in the nuclear power field defined to assist the news media and members of the public in understanding this often complex technology. The glossary was compiled by the NRC Office of Inspection and Enforcement and the Office of Public Affairs from a variety of internal and external sources. It is a part of the agency's response to a recommendation by the President's Commission on the Accident at Three Mile Island that government agencies, utility companies and the news media better prepare themselves to disseminate information to the public, in a form that is understandable.

CONTENTS

Introduction

The President's Commission on the Accident at Three Mile Island (the Kemeny Commission) made several recommendations under the general heading of "The Public's Right to Information." These recommendations were mainly concerned with the responsibility held by government agencies, utility companies and the news media to do a better job of disseminating information to the public.

Among the recommendations, the President's Commission stated that "Federal and state agencies, as well as the utility, should make adequate preparation for a systematic public information program so that in time of a radiation-related emergency, they can provide timely and accurate information to the news media and the public in a form that is understandable" [emphasis added].

The President's Commission also recommended that major media outlets and those other media, regardless of size, located near nuclear power plants, "hire and train specialists who have more than a passing familiarity with reactors and the language of radiation." Furthermore, the Commission added, reporters should discipline themselves "to place complex information in a context that is understandable to the public [emphasis added] and that allows members of the public to make decisions regarding their health and safety."

As part of the U.S. Nuclear Regulatory Commission response to those recommendations, the Office of Inspection and Enforcement and the Office of Public Affairs have developed this "Glossary of Terms: Nuclear Power and Radiation" as part of the course material for an introductory seminar on nuclear power plants and radiation to be presented to the news media. It is our first attempt to define in readily understandable language, a wide variety of terms and concepts commonly used in the disciplines related to nuclear power.

There is certainly no shortage of excellent scientific and technical dictionaries. However, most of them are compiled for scientists and engineers and are not sufficiently broad to cover the range of topics--nuclear physics, radiation, nuclear reactor components and operations, fuel cycle, and health physics, to name a few--involved in a nuclear power plant.

We have therefore developed our own glossary, borrowing liberally from a variety of internal and external sources. We have attempted to redefine many of the terms and concepts in a way that will be understandable to the news reporter and the layman. In some instances, we suspect that our simplification--and, perhaps, oversimplification--of certain terms may offend some of our technical colleagues. In other

cases, the definitions may still be too technical. When the definitions include terms that are also defined elsewhere in the text, they are identified by underlining.

Our goal is to provide a useful start toward defining terms that are, at times, both complex and mystifying. The editors will welcome, from any source, comments and suggestions for additions, deletions, corrections and further clarification and simplification of the terms defined in this glossary.

Definitions — A

absorber	Any material that absorbs or lessens the intensity of ionizing radiation. Neutron absorbers (like boron, hafnium, and cadmium) are used in control rods for reactors. Concrete and steel absorb gamma rays and neutrons in reactor shields. A thin sheet of paper or metal will absorb or weaken alpha particles and all except the most energetic beta particles. (See control rod; shielding.)
absorption	The process by which the number of particles or photons entering a body of matter is reduced or attenuated by interaction with the matter. (See neutron capture.)
access hatch (air lock)	An airtight door system that preserves the pressure integrity of a reactor containment building while allowing access to personnel and equipment.
activation	The process of making a material radioactive by bombardment with neutrons, protons, or other nuclear radiation. (See induced radioactivity.)
activation products	See induced radioactivity.
activity	See radioactivity.
acute exposure	See exposure.
acute radiation sickness (syndrome)	See radiation sickness (syndrome).
air lock	See access hatch.
air sampling	The collection and analysis of samples of air to measure its radioactivity or to detect the presence of radioactive substances, particulate matter or chemical pollutants.
ALARA	Acronym for "As Low as Reasonably Achievable," a basic concept of radiation protection that specifies that radioactive discharges from nuclear plants and radiation exposure to personnel be kept as far below regulation limits as feasible. The term was originally "As Low as Practicable."

A

A

alpha particle	A positively charged particle ejected spontaneously from the nuclei of some radioactive elements. 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 short range. The most energetic alpha particle will generally fail to penetrate the skin. Alphas are hazardous when an alpha-emitting isotope is introduced into the body.
anion	Negatively charged ion. (See ionization.)
atom	The smallest particle of an element that cannot be divided or broken up by chemical means. It consists of a central core called the nucleus, which contains protons and neutrons. Electrons revolve in orbits in the region surrounding the nucleus.
atomic energy	Energy released in nuclear reactions. Of particular interest is the energy released when a neutron initiates the breaking up or fissioning of an atom's nucleus into smaller pieces (fission), or when two nuclei are joined together under millions of degrees of heat (fusion). It is more correctly called "nuclear energy."
Atomic Energy Commission (AEC)	Federal agency created in 1946 to manage the development, use and control of nuclear energy for military and civilian application. Abolished by the Energy Reorganization Act of 1974 and succeeded by the Energy Research and Development Administration (now part of the U. S. Department of Energy) and the U.S. Nuclear Regulatory Commission.
atomic number	The number of positively charged protons in the nucleus of an atom.
atomic weight	See mass number.
attenuation	See absorption.
auxiliary building	Building at a nuclear power plant, frequently located adjacent to the reactor containment building, that houses most of the reactor

A

	auxiliary and safety systems, such as radioactive waste systems, chemical and volume control systems and emergency cooling water systems.
auxiliary feedwater	Backup feedwater supply used during nuclear plant startup and shutdown; also known as emergency feedwater. (See feedwater.)

B

background radiation — The radiation in man's natural environment, including cosmic rays and radiation from the naturally radioactive elements, both outside, and inside the bodies of humans and animals. It is also called natural radiation. The usually quoted average individual exposure from background radiation is 125 millirem per year.

beta particle — A charged particle emitted from a nucleus during radioactive decay, with a mass equal to 1/1837 that of a proton. A negatively charged beta particle is identical to an electron. A positively charged beta particle is called a positron. Large amounts of beta radiation may cause skin burns, and beta emitters are harmful if they enter the body. Beta particles are easily stopped by a thin sheet of metal or plastic.

binding energy — The minimum energy required to separate a nucleus into its component neutrons and protons.

bioassay — The collection and analysis of human hair, tissue, nasal smears, urine or fecal samples to determine the amount of radioactive material that might have been ingested by the body.

biological halflife — The time required for a biological system, such as that of a human, to eliminate by natural processes half 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 or radioactive source to reduce the radiation to a level safe for humans.

body burden — The amount of radioactive material present in the body of a human or an animal.

boiling water reactor (BWR) — A reactor in which water, used as both coolant and moderator, is allowed to boil in the core. The resulting steam can be used directly to drive a turbine and electrical generator.

bone seeker — A radioisotope that tends to accumulate in the bones when it is introduced into the body. An example is strontium-90, which behaves chemically like calcium.

B

breeder	A reactor that produces more nuclear fuel than it consumes. A fertile material, such as uranium-238, when bombarded by neutrons, is transformed into a fissile material, such as plutonium-239, which can be used as fuel. (See fissile, fissionable and fertile material.)
Btu	A British thermal unit. The amount of heat required to change the temperature of one pound of water one degree Fahrenheit at sea level.
BWR	A boiling water reactor.

C

calibration	The check or correction of the accuracy of a measuring instrument to assure proper operational characteristics. (See counter.)
cask	A heavily shielded container used to store and/or ship radioactive materials. Lead and steel are common materials used in the manufacture of casks.
cation	A positively charged ion. (See ionization.)
chain reaction	A reaction that stimulates its own repetition. In a fission chain reaction, a fissionable nucleus absorbs a neutron and fissions, 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. An elementary particle carrying a positive or negative electric charge.
chemical compound	See compound.
chemical recombination	Following an ionization event, the positive and negatively charged ion 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 radiation.
China syndrome	The hypothetical result of a power reactor core melt accident in which molten fuel melts through the reactor pressure vessel and the bottom of the containment building and into the earth "all the way to China."
chronic exposure	See exposure.
cladding	The thin-walled metal tube that forms the outer jacket of a nuclear fuel rod. It prevents corrosion of the fuel by the coolant and the release of fission products into the coolant. Aluminum, stainless steel and zirconium alloys are common cladding materials.

C

cleanup system	A system used for continuously filtering and demineralizing the reactor coolant system to reduce contamination levels and minimize corrosion.
coastdown	An action that permits the reactor power level to decrease gradually as the fuel in the core is depleted.
cold shutdown	The term used to define a reactor coolant system at atmospheric pressure and at a temperature below 212°F following a reactor cooldown. (See control rod.)
compound	A chemical combination of two or more elements combined in a fixed and definite proportion by weight.
condensate	Water that has been produced by the cooling of steam in a condenser.
condenser	A large heat exchanger designed to cool exhaust steam from a turbine below the boiling point so that it can be returned to the heat source as water. In a pressurized water reactor, the water is returned to the steam generator. In a boiling water reactor, it returns to the reactor core. 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 or directly into a body of water. (See cooling tower.)
contamination	The deposition of unwanted radioactive material on the surfaces of structures, areas, objects, or personnel.
containment	The provision of a gastight shell or other enclosure around a reactor to confine fission products that otherwise might be released to the atmosphere in the event of an accident.
control rod	A rod, plate or tube containing a material such as hafnium, boron, etc., used to control the power of a nuclear reactor. By absorbing neutrons, a control rod prevents the neutrons from causing further fission. (See poison.)

C

controlled area	A defined area in which the occupational exposure of personnel to radiation or radioactive material is under the supervision of an individual in charge of radiation protection.
control room (building)	The area in a nuclear power plant from which most of the plant power production and emergency safety equipment can be operated by remote control.
coolant	A substance circulated through a nuclear reactor to remove or transfer heat. The most commonly used coolant in the United States is water. Other coolants include heavy water, air, carbon dioxide, helium, liquid sodium and sodium-potassium alloy.
cooldown	The gradual decrease in reactor fuel rod temperature caused by the removal of heat from the reactor coolant system.
cooling tower	A heat exchanger designed to aid in the cooling of water that was used to cool exhaust steam exiting the turbines of a power plant. Cooling towers transfer exhaust heat into the air instead of into a body of water.
core	The central portion of a nuclear reactor containing the fuel elements, moderator, neutron poisons and support structures.
core melt accident	See China syndrome
cosmic radiation	Penetrating ionizing radiation, both particulate and electromagnetic, originating in outer space. Secondary cosmic rays, formed by interactions in the earth's atmosphere, account for about 45 to 50 millirem of the 125 millirem background radiation that an average individual receives in a year.
counter	A general designation applied to radiation detection instruments or survey meters that detect and measure radiation. The signal that announces an ionization event is called a count. (See Geiger-Mueller counter.)
critical mass	The smallest mass of fissionable material that will support a self-sustaining chain reaction.

C

critical organ	The body organ receiving a radionuclide or radiation dose that results in the greatest overall damage to the body.
criticality	A term used in reactor physics to describe the state when the number of neutrons released by fission is exactly balanced by the neutrons being absorbed (by the fuel and poisons) and escaping the reactor core. A reactor is said to be "critical" when it achieves a self-sustaining nuclear chain reaction.
crud	A colloquial term for corrosion and wear products (rust particles, etc.) that become radioactive under a radiation flux. (See induced radioactivity.)
cumulative dose	The total dose resulting from repeated exposures of radiation to the same region, or to the whole body, over a period of time.
curie (Ci)	The basic unit used to describe the intensity of radioactivity in a sample of material. The curie is equal to 37 billion disintegrations per second, which is approximately the rate of decay of 1 gram of radium. A curie is also a quantity of any radionuclide that decays at a rate of 37 billion disintegrations per second. Named for Marie and Pierre Curie, who discovered radium in 1898.

D

daughter products	Isotopes that are formed by the radioactive decay of some other isotope. In the case of radium-226, for example, there are 10 successive daughter products, ending in the stable isotope lead-206.
decay heat	The heat produced by the decay of radioactive fission products after the reactor has been shut down. (See residual heat.)
decay, radioactive	The decrease in the amount of any radioactive material with the passage of time, due to the spontaneous emission from the atomic nuclei of either alpha or beta particles, often accompanied by gamma radiation. (See halflife; radioactive.)
decontamination	The reduction or removal of contaminating radioactive material from a structure, area, object, or person. Decontamination may be accomplished by (1) treating the surface to remove or decrease the contamination; (2) letting the material stand so that the radioactivity is decreased as a result of natural decay; and (3) covering the contamination to shield or attenuate the radiation emitted.
depleted uranium	Uranium having a percentage of uranium-235 smaller than the 0.7% found in natural uranium. It is obtained from spent (used) fuel elements or as by-product tails, or residues, from uranium isotope separation. (See mill tailings.)
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 assure 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 to the systems, structures, and components necessary to assure public health and safety. (See seismic Category I.)
detector	A material or device that is sensitive to radiation and can produce a response signal suitable for measurement or analysis. A radiation detection instrument. (See counter.)
deuterium	An isotope of hydrogen with one proton and one neutron in the nucleus. (See heavy water.)

D

deuteron	The nucleus of deuterium. It contains one proton and one neutron.
differential pressure (DP)	The difference in pressure between two points of a system, such as between the inlet and outlet of a pump.
disintegration	See decay, radioactive.
Doppler coefficient	See fuel temperature coefficient of reactivity.
dose	A quantity (total or accumulated) of ionizing radiation received. The term "dose" is often used in the sense of the exposure dose, expressed in roentgens, which is a measure of the total amount of ionization that the quantity of radiation could produce in air. This should be distinguished from the absorbed dose, given in rads, that represents the energy absorbed from the radiation in a gram of any material. Furthermore, the biological dose, given in rem, is a measure of the biological damage to living tissue from the radiation exposure.
dose equivalent	A term used to express the amount of effective radiation when modifying factors have been considered. The product of absorbed dose multiplied by a quality factor multiplied by a distribution factor. It is expressed numerically in rem.
dosimeter	A portable instrument for measuring and registering the total accumulated exposure to ionizing radiation. (See dosimetry.)
dosimetry	The theory and application of the principles and techniques involved in the measurement and recording of radiation doses. Its practical aspect is concerned with the use of various types of radiation instruments with which measurements are made. (See film badge; survey meter.)
dose rate	The radiation dose delivered per unit of time. Measured, for example, in rem per hour.
drywell	The containment structure enclosing a boiling water reactor vessel and its recirculation system. The drywell provides both a pressure suppression system and a fission product barrier under accident conditions.

E

effective halflife	The time required for the amount of a radioactive element deposited in a living organism to be diminished 50 percent as a result of the combined action of radioactive decay and biological elimination. (See biological halflife.)
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.
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 radiations range from X-rays (and gamma rays) of short wavelength, through the ultraviolet, visible, and infrared regions, to radar and radio waves of relatively long wavelength. All electromagnetic radiations travel in a vacuum with the velocity of light. (See photon.)
electron	An elementary particle with a unit negative charge and a mass 1/1837 that of the proton. Electrons surround the positively charged nucleus and determine the chemical properties of the atom. (See beta particle.)
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.
emergency core cooling system [ECC(S)]	Reactor system components (pumps, valves, heat exchangers, tanks and piping) that are specifically designed to remove residual heat from the reactor fuel rods should the normal core cooling system (reactor coolant system) fail.
emergency feedwater	See auxiliary feedwater.
enrichment	See isotopic enrichment.
excursion	A sudden, very rapid rise in the power level of a reactor caused by supercriticality. Excursions

are usually quickly suppressed by the negative temperature coefficient, the fuel temperature coefficient or the void coefficient (depending on reactor design), and by rapid insertion of control rods.

exposure — The absorption of radiation or ingestion of a radionuclide. Acute exposure is generally accepted to be a large exposure received over a short period of time. Chronic exposure is exposure received during a lifetime. (See dose.)

external radiation — Exposure to ionizing radiation when the radiation source is located outside the body.

extremities — The hands and forearms and, with restrictions, the head, feet, and ankles. (Permissible radiation exposures in these regions are generally greater than in the whole body because they contain less blood-forming material and have smaller volumes for energy absorption.)

F

fast fission	Fission of a heavy atom (such as uranium-238) when it absorbs a high-energy (fast) neutron. Most fissionable materials need thermal (slow) neutrons in order to fission.
fast neutron	A neutron with kinetic energy greater than its surroundings released during fission.
fast reactor	A reactor in which the fission chain reaction is sustained primarily by fast neutrons rather than by slow-moving neutrons. Fast reactors contain little or no moderator to slow down the neutrons from the speeds at which they are ejected from fissioning nuclei.
feedwater	Water supplied to the reactor pressure vessel (in a BWR) or the steam generator (in a PWR) that removes heat from the reactor fuel rods by boiling and becoming steam. The steam becomes the driving force for the plant turbine generator.
fertile material	A material, which is not itself fissile (fissionable by thermal neutrons), that can be converted into a fissile material by irradiation in a reactor. There are two basic fertile materials, uranium-238 and thorium-232. When these fertile materials capture neutrons, they are converted into fissile plutonium-239 and uranium-233, respectively.
film badge	A pack of photographic film used for approximate measurement of radiation exposure for personnel monitoring purposes. The badge may contain two or three films of differing sensitivity, and it may contain a filter that shields part of the film from certain types of radiation.
fissile material	Although sometimes used as a synonym for fissionable material, this term has acquired a more restricted meaning; namely, any material fissionable by thermal (slow) neutrons. The three primarily fissile materials are uranium-233, uranium-235 and plutonium-239.
fission	The splitting of a nucleus into at least two other nuclei and the release of a relatively large amount of energy. Two or three neutrons are usually released during this type of transformation.

F

fission gases	Those fission products that exist in the gaseous state. Primarily the noble gases (krypton, xenon, radon, etc.).
fission products	The nuclei (fission fragments) formed by the fission of heavy elements, plus the nuclides formed by the fission fragments' radioactive decay.
fissionable material	Commonly used as a synonym for fissile material, the meaning of this term has been extended to include material that can be fissioned by fast neutrons, such as uranium-238.
flux	A term applied to the amount of some type of radiation crossing a certain area per unit time. The unit of flux is the number of particles, energy, etc., per square centimeter per second.
fuel assembly	A cluster of fuel rods (or plates). Also called a fuel element. Many fuel assemblies make up a reactor core.
fuel cycle	The series of steps involved in supplying fuel for nuclear power reactors. It can include mining, milling, isotopic enrichment, fabrication of fuel elements, use in a reactor, chemical reprocessing to recover the fissionable material remaining in the spent fuel, reenrichment of the fuel material, refabrication into new fuel elements, and waste disposal.
fuel element	See fuel assembly.
fuel reprocessing	The processing of reactor fuel to separate the unused fissionable material from waste material.
fuel rod	A long, slender tube that holds fissionable material (fuel) for nuclear reactor use. Fuel rods are assembled into bundles called fuel elements or fuel assemblies, which are loaded individually into the reactor core.
fuel temperature coefficient of reactivity	The physical property of fuel pellet material (uranium-238) that causes the uranium to absorb more neutrons away from the fission process as fuel pellet temperature increases. This acts to stabilize power reactor operations. Also known as the Doppler coefficient.

F

fusion (thermo-nuclear reaction)	A nuclear reaction characterized by joining together of light nuclei to form heavier nuclei, the energy for the reactions being provided by violent thermal agitation of particles at very high temperatures. If the colliding particles are properly chosen and the agitation is violent enough, there will be a release of energy from the reaction. The energy of the stars is derived from such reactions.

G

gap	The space inside a reactor fuel rod that exists between the fuel pellet and the fuel rod cladding.
gamma ray (gamma radiation)	High-energy, short wavelength electromagnetic radiation (a packet of energy) emitted from the nucleus. Gamma radiation frequently accompanies alpha and beta emissions and always accompanies fission. Gamma rays are very penetrating and are best stopped or shielded against by dense materials, such as lead or uranium. Gamma rays are similar to X-rays, but are usually more energetic.
gas-cooled reactor	A nuclear reactor in which a gas is the coolant.
gases	Normally formless fluids that completely fill the space and take the shape of their container.
gaseous diffusion (plant)	A method of isotopic separation based on the fact that gas atoms or molecules with different masses will diffuse through a porous barrier (or membrane) at different rates. This method is used to separate uranium-235 from uranium-238; it requires large gaseous diffusion plants and enormous amounts of electric power.
Geiger-Mueller counter	A radiation detection and measuring instrument. It consists of a gas-filled tube containing electrodes, between which there is an electrical voltage but no current flowing. When ionizing radiation 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 radiation. 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.
graphite	A form of carbon, similar to the lead used in pencils, used as a moderator in some nuclear reactors.

H

halflife	The time in which half the atoms of a particular radioactive substance disintegrate to another nuclear form. Measured halflives vary from millionths of a second to billions of years. Also called physical halflife.
halflife, biological	The time required for the body to eliminate half of the material taken in by natural biological means.
halflife, effective	The time required for a radionuclide contained in a biological system, such as a human or an animal, to reduce its activity by half as a combined result of radioactive decay and biological elimination.
half-thickness	The thickness of any given absorber that will reduce the intensity of a beam of radiation to one-half its initial value. (See attenuation; shielding.)
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 recognition, evaluation and control of health hazards from ionizing radiation.
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; usually part of the environment, such as the air, a river or outer space.
heatup	The rise in temperature of the reactor fuel rods resulting from an increase in the rate of fission in the core.
heavy water (D_2O)	Water containing significantly more than the natural proportions (one in 6500) of heavy hydrogen (deuterium) 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 for absorption of neutrons.

H

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 inexpensive (unenriched) uranium as a fuel.
high radiation area	Any area in which a major portion of the body could receive a radiation dose of 100 millirem (0.1 rem) in one hour. These areas must be posted as "high radiation areas" and access into these areas is maintained under strict control.
hot	A colloquial term meaning highly radioactive.
hot spot	The region in a radiation/contamination area in which the level of radiation/contamination is noticeably greater than in neighboring regions in the area.

I

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.

internal radiation — Nuclear radiation resulting from radioactive substances in the body. Some examples are iodine-131 found in the thyroid gland, and strontium-90 and plutonium-239 found in bone.

ion — An atom that has too many or too few electrons, causing it to be chemically active; an electron that is not associated (in orbit) with a nucleus. (See ionization.)

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. (See counter.)

ionizing radiation — Any radiation capable of displacing electrons from atoms or molecules, thereby producing ions. Examples: alpha, beta, gamma, X-rays, neutrons and ultraviolet light. High doses of ionizing radiation may produce severe skin or tissue damage.

irradiation — Exposure to radiation.

isotone — One of several different nuclides having the same number of neutrons in their nuclei.

isotope — One of two or more atoms with the same number of protons, but different numbers of neutrons in their nuclei. Thus, carbon-12, carbon-13 and carbon-14 are isotopes of the element carbon, the numbers denoting the approximate atomic weights. Isotopes have very nearly the same chemical properties, but often different physical properties (for example, carbon-12 and -13 are stable, carbon-14 is radioactive.

I

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 abundances 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.

J

K

kilo-	A prefix that multiplies a basic unit by 1000. Example: 1 kilometer = 1000 meters.
kilovolt (kV)	The unit of electrical potential equal to 1000 volts.
kinetic energy	The energy that a body possesses by virtue of its mass and velocity; the energy of motion.

L

LD 50/30	The dose of radiation expected to cause death within 30 days to 50 percent of those exposed. Generally accepted to range from 400 to 450 rem received over a short period of time [also known as lethal dose (LD)].
light water	Ordinary water (H_2O) as distinguished from heavy water (D_2O).
light-water reactor	A term used to designate reactors using ordinary water as coolant, including boiling water reactors (BWRs) and pressurized water reactors (PWRs), the most common types used in the United States.
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.
low population zone (LPZ)	An area of low population density often required around a nuclear installation. 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.

M

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^2, the square of the speed of light in a vacuum, 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.
mass number	The number of nucleons (neutrons and protons) in the nucleus of an atom. Also known as the atomic weight of an atom.
mega-	A prefix that multiplies a basic unit by 1,000,000.
megacurie	One million curies. (See curie.)
micro-	A prefix that divides a basic unit into one million parts.
microcurie	A one-millionth part of a curie. (See curie.)
microsecond	A one-millionth part of a second.
mill tailings	Naturally radioactive residue from the processing of uranium ore into yellowcake in a mill. Although the milling process recovers about 93 percent of the uranium, the residues, or tailings, contain several radioactive elements, including uranium, thorium, radium, polonium and radon.
milli-	A prefix that divides a basic unit by 1000.
millirem	A one-thousandth part of a rem. (See rem.)
milliroentgen	A one-thousandth part of a roentgen. (See roentgen.)
moderator	A material, such as ordinary water, heavy water, or graphite, used in a reactor to slow down high-velocity neutrons, thus increasing the likelihood of fission.
moderator temperature coefficient of reactivity	The property of a reactor moderator to slow down fewer neutrons as its temperature increases. This acts to stabilize power reactor operations.

M

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 its chemical properties.

monitoring — Periodic or continuous determination of the amount of ionizing radiation or radioactive contamination present in an occupied region, as a safety measure, for purposes of health protection. (See radiological survey.)

N

nano-	A prefix that divides a basic unit by one billion.
nanocurie	One billionth part of a curie.
natural radiation	See background radiation.
natural uranium	Uranium as found in nature. It contains 0.7 percent uranium-235, 99.3 percent uranium-238 and a trace of uranium-234.
negative temperature coefficient	See moderator temperature coefficent.
neutron	An uncharged elementary particle with a mass slightly greater than that of the proton, and found in the nucleus of every atom heavier than hydrogen.
neutron capture	The process in which an atomic nucleus absorbs or captures a neutron.
neutron chain reaction	A process in which some of the neutrons released in one fission event cause other fissions to occur. There are three types of chain reactions: (1) Nonsustaining chain reaction--An average of less than one fission is produced by the neutrons released by each previous fission (reactor subcriticality.) (2) Sustaining chain reaction--An average of exactly one fission is produced by the neutrons released by each previous fission (reactor criticality.) (3) Multiplying chain reaction--An average of more than one fission is produced by the neutrons released by previous fission (reactor supercricitality.)
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 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

N

	available to cause fission and must be absorbed by shielding placed around the reactor pressure vessel for that purpose.
neutron, slow	See neutron, thermal.
neutron source	A radioactive material (decays by neutron emission) that can be inserted into a reactor to ensure that a sufficient quantity of neutrons is available to start a chain reaction and 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. (See thermalization.)
noble gas	A gaseous chemical element that does not readily enter into chemical combination with other elements. An inert gas. (See fission gases.)
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.
nozzle	As used in PWRs and BWRs, the interface for fluid (inlet or outlet) between reactor plant components (pressure vessel, coolant pumps, steam generators, etc.) and their associated piping systems.
nuclear disintegration	See decay, radioactive.
nuclear energy	The energy liberated by a nuclear reaction (fission or fusion) or by radioactive decay.
nuclear fission	See fission.
nuclear force	A powerful short-ranged attractive force that holds together the particles inside an atomic nucleus.
nuclear fusion	See fusion.

N

nuclear power plant	An electrical generating facility using a nuclear reactor as its power (heat) source.
nuclear radiation	See radiation, nuclear.
nuclear reaction	See reaction, nuclear.
nuclear reactor	See reactor, nuclear.
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 (or atomic nucleus); nuclei (plural)	The small, central, positively charged region of an atom that carries essentially all the mass. Except for the nucleus of ordinary (light) hydrogen, which has a single proton, all atomic nuclei contain both protons and neutrons. The number of protons determines the total positive charge, or atomic number; this 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. (See isotope.)
nuclide	A general term referring to all known isotopes, both stable (279) and unstable (about 5000), of the chemical elements.

O

operating basis earthquake	An earthquake that could be expected to affect the plant site, but for which the plant power production equipment is designed to remain functional without undue risk to public health and safety. (See design-basis phenomenon.)
oralloy	Uranium enriched in the isotope uranium-235. This material is an excellent fission fuel and is capable of sustaining a chain reaction.

P

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 air (or water) by volume.
pellet, fuel	As used in PWRs and BWRs, a pellet is a small cylinder approximately 3/8-inch in diameter and 5/8-inch in length consisting of uranium fuel in a ceramic form--uranium dioxide, UO_2. Typical fuel pellet enrichments range from 2 to 3.5 percent uranium-235.
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.
personnel monitoring	The determination of the degree of radioactive contamination on individuals using survey meters, or the determination of radiation dosage received by means of dosimetry devices.
photodosimetry	The determination of the cumulative dose of ionizing radiation by use of photographic film.
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.
picocurie	One trillionth part of a curie.
pig	A container (usually lead) used to ship or store radioactive materials. The thick walls protect the person handling the container from radiation. Large containers are commonly called casks.
pile	A nuclear reactor; called a pile because the earliest reactors were "piles" of graphite and uranium blocks.

P

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.
pocket dosimeter	A small ionization detection instrument that indicates radiation exposure directly. An auxiliary charging device is usually necessary.
poison	In reactor physics, a material other than fissionable material in the vicinity of the reactor core that will absorb neutrons. The addition of poisons, such as control rods or boron, into the reactor is said to be an addition of negative reactivity.
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.
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.
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 power reactor in which heat is transferred from the core to a heat exchanger by high-temperature water kept under high pressure in the primary system. Steam is generated in a secondary circuit. Many reactors producing electric power are pressurized water reactors.
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	See reactor coolant system.

P

proportional counter	An 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.
proton	An elementary nuclear particle with a positive electric charge located in the nucleus of an atom. (See atomic number.)
PWR	A pressurized water reactor.

Q

quality factor	The factor by which the absorbed dose is to be multiplied to obtain a quantity that expresses, on a common scale for all ionizing radiations, the biological damage to exposed persons. It is used because some types of radiation, such as alpha particles, are more biologically damaging 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. (See photon.)

R

rad	Acronym for radiation absorbed dose. The basic unit of absorbed dose of radiation. A dose of one rad means the absorption of 100 ergs (a small but measurable amount of energy) per gram of absorbing material.
radiac	An acronym derived from "radioactivity detection indication and computation," a generic term applying to radiological instruments or equipment.
radiation, nuclear	Particles (alpha, beta, neutrons) or photons (gamma) emitted from the nucleus of an unstable (radioactive) atom as a result of radioactive decay.
radiation area	Any accessible area in which the level of radiation is such that a major portion of an individual's body could receive in any one hour a dose in excess of 5 millirem, or in any five consecutive days a dose in excess of 100 millirem.
radiation detection instrument	A device that detects and records the characteristics of ionizing radiation. (See counter.)
radiation monitoring	See monitoring.
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 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, inflamation of the mouth and throat, and general loss of energy. In severe cases, where the radiation exposure has been relatively large, death may occur within two to four weeks. Those who survive 6 weeks after the receipt of a single large dose of radiation may generally be expected to recover.
radiation source	Usually a manmade sealed source of radiation used in teletherapy, radiography, as a power source for batteries, or in various types of

R

R

	industrial gauges. Machines such as accelerators and radioisotope generators and natural radionuclides may be considered sources.
radiation standards	Exposure standards, permissible concentrations, rules for safe handling, regulations for transportation, regulations for industrial control of radiation and control of radioactive material by legislative means.
radiation syndrome	See radiation sickness (syndrome).
radiation warning symbol	An officially prescribed symbol (a magenta trefoil) on a yellow background that must be displayed where certain quantities of radioactive materials are present or where certain doses of radiation could be received.
radioactive	Exhibiting radioactivity or pertaining to radioactivity.
radioactive contamination	Deposition of radioactive material in any place where it may harm persons or equipment.
radioactive isotope	A radioisotope.
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.
radioactive waste	See waste, radioactive.
radioactivity	The spontaneous emission of radiation, generally alpha or beta particles, often accompanied by gamma rays, from the nucleus of an unstable isotope.
radiography	The making of shadow images on photographic film by the action of ionizing radiation.
radioisotope	An unstable isotope of an element that decays or disintegrates spontaneously, emitting radiation. Approximately 5000 natural and artificial radioisotopes have been identified.

R

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	A radioisotope.
radiosensitivity	The relative susceptibility of cells, tissues, organs, organisms, or other substances to the injurious action of radiation.
radium (Ra)	A radioactive metallic element with atomic number 88. As found in nature, the most common isotope has a mass number of 226. It occurs in minute quantities associated with uranium in pitchblend, carnotite and other minerals.
radon (Rn)	A radioactive element that is one of the heaviest gases known. Its atomic number is 86, and its mass number is 222. It is a daughter of radium.
reaction	Any process involving a chemical or nuclear change.
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 cooling system used to remove energy from the reactor core and transfer that energy either directly or indirectly to the steam turbine.
reactor, nuclear	A device in which nuclear fission may be sustained and controlled in a self-supporting nuclear reaction. The varieties are many, but all incorporate certain features, including fissionable material or fuel, a moderating material (unless

R

	the reactor is operated on fast neutrons), a reflector to conserve escaping neutrons, provisions for removal of heat, measuring and controlling instruments, and protective devices.
recycling	The reuse of fissionable material after it has been recovered by chemical processing from spent or depleted reactor fuel, reenriched and then refabricated into new fuel elements.
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.
rem	Acronym of roentgen equivalent man. The unit of dose of any ionizing radiation that produces the same biological effect as a unit of absorbed dose of ordinary X-rays. (See quality factor.)
reprocessing	See recycling.
restricted area	Any area to which access is controlled for the protection of individuals from exposure to radiation and radioactive materials.
roentgen (r)	A unit of exposure to ionizing radiation. It is that amount of gamma or X-rays required to produce ions carrying 1 electrostatic unit of electrical charge in 1 cubic centimeter of dry air under standard conditions. Named after Wilhelm Roentgen, German scientist who discovered X-rays in 1895.
roentgen equivalent man (or mammal)	See rem.

S

safeguards — The protection of special nuclear material (SNM) to prevent theft, loss or sabotage. (See special nuclear material.)

safe shutdown earthquake — A design-basis earthquake. (See design-basis phenomenon.)

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

safety related — The managerial controls, administrative documents, operating procedures, systems, structures and components that have been designed to mitigate the consequences of postulated accidents that could cause undue risk to public health and safety.

safety rod — See control rod; scram.

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 or counter — The combination of phosphor, photomultiplier tube, and associated electronic circuits for counting light emissions produced in the phosphor by ionizing radiation. (See counter.)

scram — Sudden shutting down of a nuclear reactor, usually by rapid insertion of control rods, either automatically or manually by the reactor operator.

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 — A term used to define structures, systems and components that are designed and built to withstand the maximum potential (earthquake) stresses for the particular region that a nuclear plant is sited.

S

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 (and heat production) in a reactor (usually by the insertion of control rods into the core). See subcriticality.)
somatic effects of radiation	Effects of radiation limited to the exposed individual, as distinguished from genetic effects, which may also affect subsequent unexposed generations.
special nuclear material	Includes plutonium, uranium-233, or uranium enriched in the isotopes uranium-233 or uranium-235.
spent (depleted) fuel	Nuclear reactor fuel that has been used to the extent that it can no longer effectively sustain a chain reaction.
spent fuel pool	An underwater storage and cooling facility for fuel elements that have been removed from a reactor.
stable isotope	An isotope that does not undergo radioactive decay.
startup	An increase in the rate of fission (and heat production) in a reactor usually by the removal of control rods from the core). (See supercriticality.)
stay time	The period during which personnel may remain in a restricted area before accumulating some permissible 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.
subcriticality	The condition of a nuclear reactor system when the rate of production of fission neutrons is lower than the rate of production in the previous generation due to increased neutron leakage and poisons.
subcritical mass	An amount of fissionable material insufficient in quantity or of improper geometry to sustain a fission chain reaction.

S

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. (See critical mass; criticality.)
supercritical reactor	A reactor in which the power level is increasing.
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.
survey	A study to (1) find the radiation or contamination level of specific objects or locations within an area of interest; (2) locate regions of higher-than-average intensity; i.e., hot spots. (See personnel monitoring.)
survey meter	Any portable radiation detection instrument especially adapted for inspecting an area to establish the existence and amount of radioactive material present. (See counter.)

T

tailings, tails	See mill tailings.
tenth thickness	The thickness of a given material that will decrease the amount (or dose) of radiation to one-tenth of the amount incident upon it. Two-tenth thicknesses will reduce the dose received by a factor of 10 x 10; i.e., 100, and so on. (See shielding.)
terrestrial radiation	The portion of natural radiation (background) that is emitted by naturally occurring radioactive materials in the earth.
thermal breeder reactor	A breeder reactor in which the fission chain reaction is sustained by thermal neutrons. (See neutron, thermal.)
thermalization	The process undergone by high-energy (fast) neutrons as they lose energy by collision. (See neutron, thermal.)
thermal neutron	See neutron, thermal.
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.
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. (See fusion.)
transient	A change in the reactor coolant system temperature and/or pressure due to a change in power output of the reactor. Transients can be caused by adding or removing neutron poisons, by increasing or decreasing the electrical load on the turbine generator, or by accident conditions.
trip, reactor	See scram.

T

tritium	A radioactive isotope of hydrogen (one proton, two neutrons). Because it is chemically identical to natural hydrogen, tritium can easily be taken into the body by any ingestion path. Decays by beta emission. Its radioactive halflife is about 12-1/2 years.
turbine	A rotary engine made with a series of curved vanes on a rotating shaft. Usually turned by water or steam. Turbines are considered to be the most economical means to turn large electrical generators.
turbine generator (TG)	A steam (or water) turbine directly connected to an electrical generator. The two devices are often referred to as one unit.

U

ultraviolet	Electromagnetic radiation of a wavelength between the shortest visible violet and low-energy X-rays.
unrestricted area	The area outside the owner-controlled portion of a nuclear facility (usually the site boundary).
unstable isotope	A radioisotope.
uranium (U)	A radioactive element with the atomic number 92, and as found in natural ores, an atomic weight of approximately 238. The two principal natural isotopes are uranium-235 (0.7 percent of natural uranium), which is fissile, and uranium-238 (99.3 percent of natural uranium), which is fissionable by fast neutrons and is fertile. Natural uranium also includes a minute amount of uranium-234.
uranium enrichment	See isotopic enrichment.
uranium millings (tails)	See mill tailings.

V

vapor	The gaseous form of substances that are normally in liquid or solid form.
vessel	See pressure vessel.
vital plant systems	See safety related.
void	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. (See moderator; void coefficient; neutron leakage.)
void coefficient of reactivity	Property of a reactor plant moderating system where, as temperature increases in the system, neutron leakage increases due to an increase in the number and size of voids (steam bubbles) in the moderator.

W

waste, radioactive — Solid, liquid and gaseous materials from nuclear operations that are radioactive or become radioactive and for which there is no further use. Wastes are generally classified as high level (having radioactivity concentrations of hundreds of thousands of curies per gallon or cubic foot), low level (in the range of 1 microcurie per gallon or cubic foot), or intermediate level (between these extremes).

whole-body counter — A device used to identify and measure the radiation in the body (body burden) of human beings and animals; it uses heavy shielding to keep out background radiation and ultrasensitive radiation detectors and electronic counting equipment.

whole-body exposure — An exposure of the body to radiation, in which the entire body rather than an isolated part is irradiated. Where a radioisotope is uniformly distributed throughout the body tissues, rather than being concentrated in certain parts, the irradiation can be considered as a whole-body exposure.

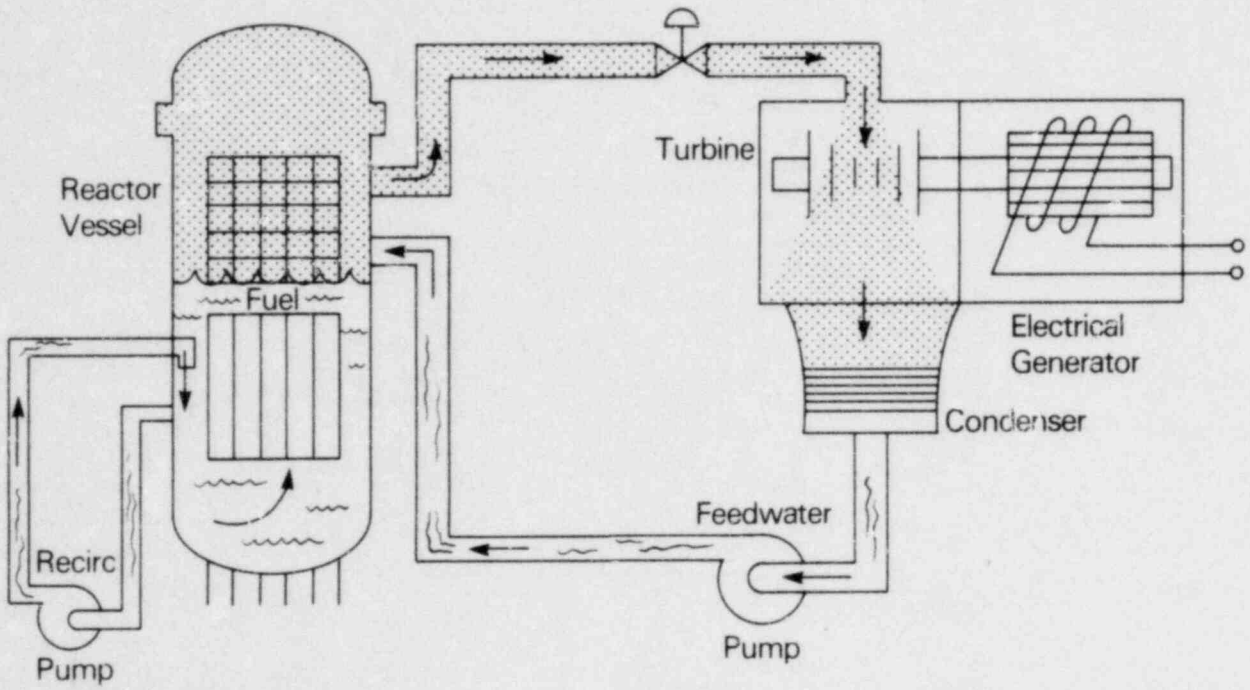
wipe sample — A sample made for the purpose of determining the presence of removable radioactive contamination on a surface. It is done by wiping, with slight pressure, a piece of soft filter paper over a representative type of surface area. It is also known as a "swipe sample."

X

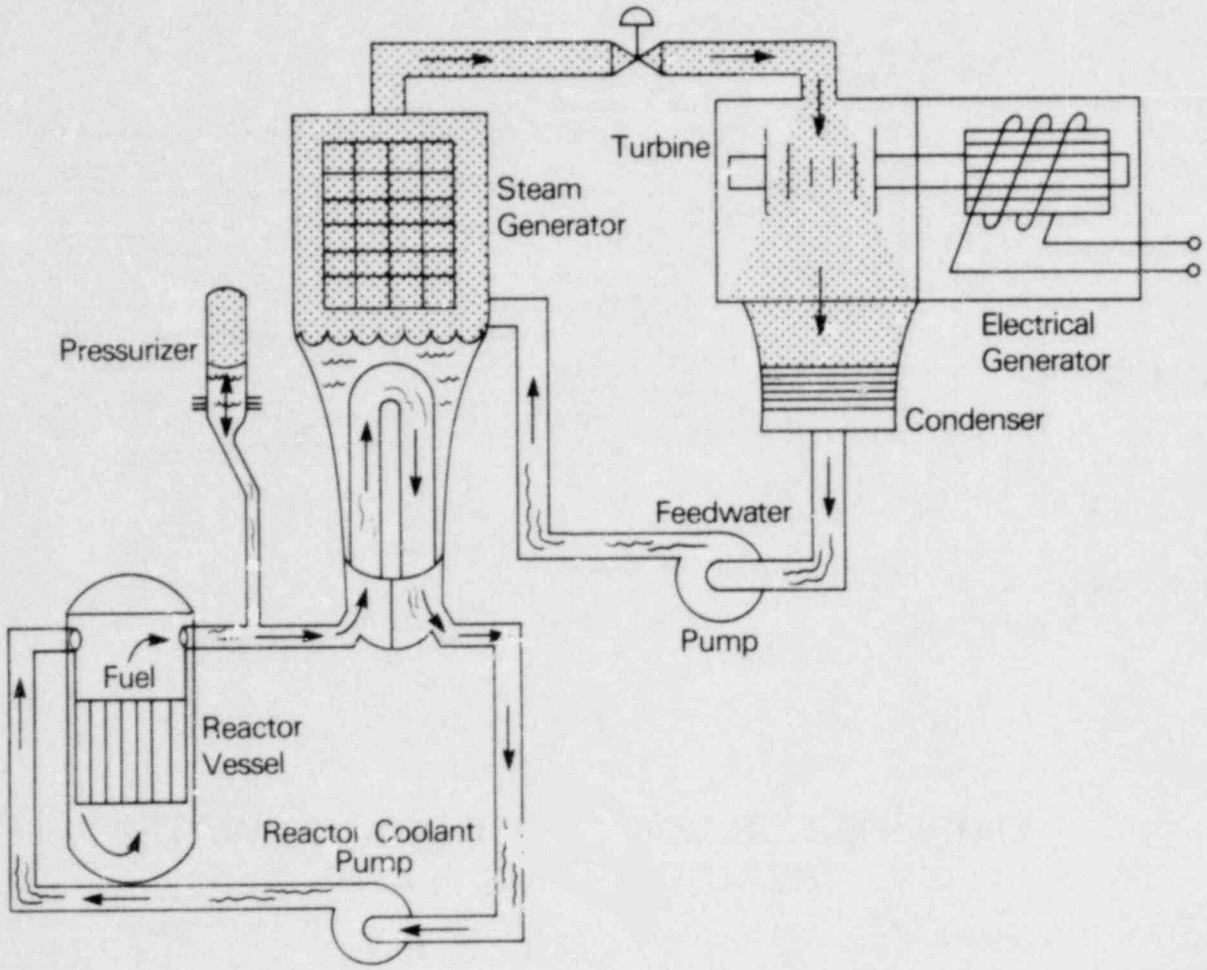
X-rays — Penetrating electromagnetic radiation (photon) having a wavelength that is much shorter than that of visible light. These rays are usually produced by excitation of the electron field around certain nuclei. In nuclear reactions, it is customary to refer to photons originating in the nucleus as gamma rays, and to those originating in the electron field of the atom as X-rays. These rays are sometimes called roentgen rays after their discoverer, W. K. Roentgen.

Y

yellowcake — A product of the uranium milling process, yellowcake is a solid uranium-oxygen compound (U_3O_8) that takes its name from its color and texture Yellowcake is the feed material used for fuel enrichment and fuel pellet fabrication.



SIMPLIFIED SCHEMATIC OF BOILING WATER REACTOR (BWR) PLANT



SIMPLIFIED SCHEMATIC OF PRESSURIZED WATER REACTOR (PWR) PLANT

ELEMENTS AND ELEMENT ABBREVIATIONS

Name	Symbol	Name	Symbol
actinium	Ac	mercury	Hg
aluminum	Al	molybdenum	Mo
americum	Am	neodymium	Nd
antimony	Sb	neon	Ne
arsenic	As	neptunium	Np
astatine	At	nickel	Ni
barium	Ba	niobium	Nb
berkelium	Bk	nitrogen	N
beryllium	Be	nobelium	No
bismuth	Bi	osmium	Os
boron	B	oxygen	O
bromine	Br	palladium	Pd
cadmium	Cd	phosphorus	P
calcium	Ca	platinum	Pt
californium	Cf	plutonium	Pu
carbon	C	polonium	Po
cerium	Ce	potassium	K
cesium	Cs	praseodymium	Pr
chlorine	Cl	promethium	Pm
chromium	Cr	protactinium	Pa
cobalt	Co	radium	Ra
copper	Cu	radon	Rn
curium	Cm	rhenium	Re
dysprosium	Dy	rhodium	Rh
einsteinium	Es	rubidium	Rb
erbium	Er	ruthenium	Ru
europium	Eu	samarium	Sm
fermium	Fm	scandium	Sc
fluorine	F	selenium	Se
francium	Fr	silicon	Si
gadolinium	Gd	silver	Ag
gallium	Ga	sodium	Na
germanium	Ge	strontium	Sr
gold	Au	sulfur	S
hafnium	Hf	tantalum	Ta
helium	He	technetium	Tc
holmium	Ho	tellurium	Te
hydrogen	H	terbium	Tb
indium	In	thallium	Tl
iodine	I	thorium	Th
iridium	Ir	thulium	Tm
iron	Fe	tin	Sn
krypton	Kr	titanium	Ti
lanthanum	La	tungsten	W
lawrencium	Lr	uranium	U
lead	Pb	vanadium	V
lithium	Li	xenon	Xe
lutetium	Lu	ytterbium	Yb
magnesium	Mg	yttrium	Y
manganese	Mn	zinc	Zn
mendelevium	Md	zirconium	Zr

PREFIXES

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

NOTES

NOTES

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This "Glossary of Terms: Nuclear Power and Radiation" is a compilation of words and concepts commonly used in the nuclear power field defined to assist the news media and members of the public in understanding this often complex technology. The glossary was compiled by the NRC Office of Inspection and Enforcement and the Office of Public Affairs from a variety of internal and external sources. It is a part of the agency's response to a recommendation by the President's Commission of the Accident at Three Mile Island that government agencies, utility companies and the news media better prepare themselves to disseminate information to the public, in a form that is understandable.

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