Appendix F: Glossary

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

"**Accelerator**" (particle accelerator) means any machine capable of accelerating electrons, protons, deuterons or other charged particles in a vacuum and of discharging the resultant particulate or other radiation into a medium at energies usually in excess of 1 million electron volts (MeV).

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

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

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

"**Agreement State**" means any state with which the U.S. Nuclear Regulatory Commission or the U.S. Atomic Energy Commission has entered into an effective agreement under subsection 274b of the Atomic Energy Act of 1954, as amended.

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

"**Airborne radioactivity area**" means any room, enclosure, or operating area in which airborne radioactive material, composed wholly or partly of licensed material, exists in concentrations

(1) In excess of the derived air concentrations (DAC's) specified in Appendix B to 10 CFR 20.1001 - 20.2401, effective January 1, 1998, exclusive of subsequent amendments or editions; or

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

"**ALI** or **Annual Limit on Intake**" means the derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year.

"**As Low As Is Reasonably Achievable**" (ALARA) means making every reasonable effort to maintain exposures to radiation as far below the dose limits in 32 Ill. Adm. Code: Chapter II, Subchapters b and d as is practical, consistent with the purpose for which the licensed or registered activity is undertaken, and taking into account the state of technology, the economics of improvements in relation to the state of technology, the economics of improvements in relation to benefits to the public health and safety and other societal and

socioeconomic considerations, and in relation to utilization of nuclear energy and licensed or registered sources of radiation in the public interest.

"**Background radiation**" means radiation from cosmic sources; naturally occurring radioactive materials, including radon (except as a decay product of source or special nuclear material) and global fallout as it exists in the environment from the testing of nuclear explosive devices. Background radiation does not include radiation from radioactive materials regulated by the Illinois Department of Nuclear Safety.

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

"**Bioassay**" (radio bioassay) means the determination of kinds, quantities or concentrations and, in some cases, the locations of radioactive material in the human body, whether by direct measurement (in vivo counting) or by analysis and evaluation of materials excreted or removed from the human body.

"**Byproduct material**" means

(1) any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident or to the process of producing or utilizing special nuclear material; and
(2) the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content, including discrete surface wastes resulting from underground solution extraction processes but not including underground ore bodies depleted by such solution extraction processes.

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

"**Calibration**" means the determination of

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

"**CFR**" means Code of Federal Regulations.

"**Chelating Agent**" means amine polycarboxylic acids (e.g., EDTA, DTPA), hydroxy-carboxylic acids and polycarboxylic acids (e.g., citric acid, carbolic acid and glucinic acid).

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

"**Committed effective dose equivalent**" (H[E,50]) means the sum of the products of the weighting factors applicable to each of the body organs or tissues that are irradiated and the committed dose equivalent to each of these organs or tissues (H[E,50] = SUM w[T]H[T,50]).

"**Critical Organ**" means that organ (or tissue) in which the dose equivalent would be the most significant due to a combination of the organ's radiosensitivity and a particular dose pattern throughout the body.

"**Curie**" means a unit of quantity of radioactivity. One curie (Ci) is that quantity of radioactive material which decays at the rate of 3.7×10^{10} disintegrations (transformations) per second (dps or tps).

"**Declared pregnant woman**" means any woman who has voluntarily informed her employer, in writing, of her pregnancy.

"**Deep dose equivalent**" (H[d]) means the dose equivalent at a tissue depth of 1 centimeter (1,000 milligrams per square centimeter) from external whole-body exposure.

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

"**Dose**" (radiation dose) means either absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, total organ dose equivalent, or total effective dose equivalent.

"**Dose equivalent**" (H[T]) means the product of the absorbed dose in tissue, quality factor and all other necessary modifying factors (e.g., a distribution factor for non-uniform deposition) at the location of interest. The units of dose equivalent are the sievert (Sv) and the rem.

"**Dose limits**" (limits) means the permissible upper bounds of radiation doses established by, or in accordance with, 32 Ill. Adm. Code: Chapter II, Subchapters b and d.

"**Dose rate**" means the dose per unit of time, such as rem per minute (rem/min) and millirem per hour (mrem/hr.). See also "Exposure rate"

"**Effective dose equivalent**" (H[E]) means the sum of the products of the dose equivalent to each organ or tissue (H[T]) and the weighting factor (W[T]) applicable to each of the body organs or tissues that are irradiated (H[E] = SUM w[T]H[T]).

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

"**Exposure**" means

(1) the quotient of dQ divided by dm where "dQ" is the absolute value of the total charge of the ions of one sign produced in air when all the electrons (negatrons and positrons) liberated by photons in a volume element of air having mass "dm" are completely stopped in air; or

(2) irradiation by ionizing radiation or radioactive material. NOTE: The context makes clear which is the appropriate definition.

"**Exposure rate**" means the exposure per unit of time, such as roentgen per minute (R/min) and milli-roentgen per hour (mR/hr.). See also "Dose rate".

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

"**Extremity**" means a hand, elbow, arm below the elbow, foot, knee and leg below the knee.

"**Eye dose equivalent**" or "lens dose equivalent" means the external dose equivalent to the lens of the eye at a tissue depth of 0.3 centimeter (300 milligrams per square centimeter).

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

"**Half-life, biological**" is the time required for the body to eliminate one-half of an administered dosage of any substance by regular process of elimination.

"**Half-life, effective**" is the time required for a radioactive element in a body to decrease to one half of its original value as a result of the combined action of radioactive decay and biological elimination. The effective half-life is always shorter than either the radiological or biological half-life.

"**Half-life, radiological**" is the time required for the amount of a particular radionuclide to decrease to one half of its original value.

"**Healing Arts**" means the art or science or group of arts or sciences dealing with the prevention and cure or alleviation of human ailments, diseases or infirmities, and has the same meaning as "medicine" when the latter term is used in its comprehensive sense.

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

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

"**Individual**" means any human being.
"**Individual monitoring**" means the assessment of

(1) Dose equivalent by the use of individual monitoring devices or by the use of survey data; or
(2) Committed effective dose equivalent by bioassay or by determination of the time-weighted air concentrations to which an individual has been exposed (i.e., DAC-hours). (For the definition of DAC-hours, see 32 Ill. Adm. Code 340.30.)

"**Individual monitoring devices**" (personnel dosimeter or dosimeter) means devices designed to be worn by a single individual for the assessment of dose equivalent. Examples of individual monitoring devices are film badges, thermoluminescence dosimeters (TLDs), optically stimulated luminescence dosimeters (OSLs), pocket ionization chambers, personal air sampling devices and electronic dosimeters (e.g., silicon diode dosimeters).

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

"Ionizing Radiation" (see "Radiation")

"**Isotope**" is a different form of the same chemical element distinguished by having a different number of neutrons (but the same number of protons) in the nucleus. Nearly identical chemical properties exist between isotopes of a particular element. Isotope should not be used as a synonym for nuclide. The terms "*radioisotope*" and "*radionuclide*", are commonly used to identify radioactive isotopes and radioactive nuclides, respectively.

"**License**" means any license issued by the Illinois Emergency Management Agency in accordance with 32 Ill. Adm. Code: Chapter II, Subchapters b and d.

"**Licensed material**" means radioactive material received, possessed, used, transferred or disposed of under a general or specific license issued by the Illinois Department of Nuclear Safety.

"LSC or **Liquid scintillation counting"** is a standard laboratory method for measuring radiation from low energy beta-emitting nuclides. Samples are dissolved or suspended in a "cocktail" containing an aromatic solvent and small amounts of other additives known as fluors. Beta particles emitted from the sample transfer energy to the solvent molecules, which in turn transfer their energy to the fluors; the excited fluor molecules dissipate the energy by emitting light. In this way, each beta emission (ideally) results in a pulse of light. The samples are placed in small transparent or translucent (often glass or plastic) vials that are loaded into an instrument known as a liquid scintillation counter.

"**Lost or missing source of radiation**" means any licensed or registered source of radiation whose location is unknown. This definition includes, but is not limited to, radioactive

material that has been shipped but has not reached its planned destination and whose location cannot be readily traced in the transportation system.

"**Member of the public**" means any individual, except an individual who is performing assigned duties for the licensee or registrant involving exposure to sources of radiation.

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

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

"**NORM**" **or** "**NARM**" means any naturally occurring or accelerator-produced radioactive material. It does not include byproduct, source or special nuclear material.

"**Natural radioactivity**" means radioactivity of naturally occurring nuclides.

"**Non-ionizing radiation**" means radiation that does not produce ionization. Examples are sound, radio waves, visible, infrared, and ultraviolet light.

"**Occupational dose**" means the dose received by an individual in the course of employment in which the individual's assigned duties for the licensee or registrant involve exposure to sources of radiation. Occupational dose does not include dose received from background radiation, from any medical administration the individual has received, from exposure to individuals administered radioactive material and released as authorized by the Illinois Department of Nuclear Safety, from voluntary participation in medical research programs, or as a member of the public.

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

"**Person**" means any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, agency, political subdivision of this State, any other State or political subdivision or agency thereof, and any legal successor, representative, agent, or agency of the foregoing, other than the U.S. Nuclear Regulatory Commission, or any successor thereto, and other than federal government agencies licensed by the U.S. Nuclear Regulatory Commission, or any successor thereto. "Person" also includes a federal entity (and its contractors) if the federal entity agrees to be regulated by the State or as otherwise allowed under federal law.

"**Personnel monitoring equipment**" (see "Individual monitoring devices").

"**Public dose**" means the dose received by a member of the public from sources of radiation from licensed or registered operations. Public dose does not include occupational dose, or dose received from background radiation, from any medical administration the individual has received, from exposure to individuals administered radioactive material and released as authorized by the Illinois Department of Nuclear Safety, or from voluntary participation in medical research programs.

"**Rad**" is a unit of absorbed dose. One rad is equal to an absorbed dose of 100 ergs per gram or 0.01 joule per kilogram (J/kg) (0.01 Gy).

"**Radiation**" (ionizing radiation) means gamma rays and X-rays, alpha and beta particles, high-speed electrons, neutrons, protons, and other nuclear particles, or electromagnetic radiations capable of producing ions directly or indirectly in their passage through matter; but does not include sound or radio waves, or visible, infrared or ultraviolet light.

"**Radiation area**" means an area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.05 mSv (0.005 rem) in 1 hour at 30 centimeters from the source of radiation or from any surface that the radiation penetrates.

"**Radiation emergency**" means the uncontrolled release of radioactive material from a radiation installation which poses a potential threat to the public health, welfare and safety.

"**Radiation Installation**" is any location or facility where radiation machines are used or where radioactive material is produced, transported, stored, disposed or used for any purpose, except where such radioactive materials or facility are subject to regulation by the Nuclear Regulatory Commission.

"**Radiation machine**" means any device that produces radiation when in use, except those which produce radiation only from radioactive materials.

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

"**Radioactive material**" means any solid, liquid or gaseous substance, which emits radiation spontaneously.

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

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

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

"**Roentgen**" means the special unit of exposure. One roentgen (R) equals 2.58 x 10^{-4} coulombs per kilogram (C/kg). (See "Exposure" and Section 310.140 of this Part.)
"Scintillation counter" measures ionizing radiation. The counter consists of a transparent crystal (such as NaI or Ge), usually phosphor, plastic, or organic liquid (see liquid scintillation counting) that fluoresces when struck by ionizing radiation. A sensitive photomultiplier tube (PMT) measures the light from the crystal. The PMT is attached to an electronic amplifier and other electronic equipment to count and possibly quantify the amplitude of the signals produced by the photomultiplier.

"**Sealed source**" means any device containing radioactive material to be used as a source of radiation which has been constructed in such a manner as to prevent the escape of any radioactive material.

"**Shallow dose equivalent**" (H[S]), which applies to the external exposure of the skin or an extremity, means the dose equivalent at a tissue depth of 0.007 centimeter (7 milligrams per square centimeter) averaged over an area of 1 square centimeter.

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

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

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

"**Special nuclear material**" means

(1) plutonium, uranium 233, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Illinois Emergency Management Agency declares by order to be special nuclear material after the U.S. Nuclear Regulatory Commission, or any successor thereto, has determined the material to be such, but does not include source material; or

(2) any material artificially enriched by any of the foregoing, but does not include source material.

"**Survey**" means an evaluation of the radiological conditions and potential hazards incident to the production, use, transfer, release, disposal, or presence of sources of radiation. Such an evaluation includes, but is not limited to, measurements or calculations of levels of radiation, or concentrations or quantities of radioactive material present.

"Thermoluminescent dosimeter or **TLD"** is a device that measures ionizing radiation exposure by measuring the amount of visible light emitted from a crystal in the detector when the crystal is heated. The amount of light emitted is dependent upon the radiation exposure upon the crystal.

"**Total effective dose equivalent**" (TEDE) means the sum of the deep dose equivalent for external exposures and the committed effective dose equivalent for internal exposures.

"**Total organ dose equivalent**" (TODE) means the sum of the deep dose equivalent and the committed dose equivalent to the organ receiving the highest dose as described in 32 Ill. Adm. Code 340.1160(a)(6).

"**Unrestricted area**" means any area to which access is not controlled by the licensee or registrant for purposes of protection of individuals from exposure to radiation and radioactive material, and any area used for residential quarters. NOTE: Licensees or registrants may control access to certain areas for purposes other than radiation protection, but such action does not affect whether the areas are unrestricted areas as defined in this Part.

"**Very high radiation area**" means an area, accessible to individuals, in which radiation levels from radiation sources external to the body could result in an individual receiving an absorbed dose in excess of 5 Gy (500 rad) in 1 hour at 1 meter from a source of radiation or from any surface that the radiation penetrates. NOTE: For very high doses received at high dose rates, units of absorbed dose (e.g., gray and rad) are appropriate rather than units of dose equivalent (e.g., sievert and rem).

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

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

"**Year**" means the period of time beginning in January used to determine compliance with the provisions of 32 Ill. Adm. Code: Chapter II, Subchapters b and d. The licensee or registrant may change the starting date of the year used to determine compliance by the licensee or registrant provided that the decision to make the change is made not later than December 31 of the previous year. If a licensee or registrant changes a year, the licensee or registrant shall assure that no day is omitted or duplicated in consecutive years.