Radiation
Terms and Definitions

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Division of Environmental Health
Office of Radiation Protection

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Sometimes trying to understand the information presented to you can be difficult due to the field specific terms commonly used. This list is provided to help the general public better understand this information.

Absorbed Dose
Absorbed dose is the amount of energy deposited in any material by ionizing radiation. The unit of absorbed dose, the rad, is a measure of energy absorbed per gram of material. The unit used in countries other than the United States is the gray. One gray equals 100 rad.

Accident
An unplanned event that has the potential for a release of radioactive materials or for an increase in radiation levels in excess of the limits specified by a facility's operating license or regulatory limits.

Activity
The number of radioactive atoms decaying per unit time. This term characterizes the strength of a radioactive source and is expressed in terms of the number of decays per unit time or the Curie (Ci).

Acute Health Effects

(Also called Nonstochastic, or deterministic effects) Radiation health effects which can be directly related to the absorbed dose. These effects occur at “high radiation” levels, and begin at a threshold level of radiation. Above the threshold, the severity of the effect is linearly related to the dose. “Acute” refers to a dose received within one month or less.

Acute Release

A short-period release (period short compared wi th a year) of radioactive materials into the environment associated either with one event or with a short series of events.

Advisory

A simple ingestion pathway recommendation issued to the public. The primary purpose of an Advisory is to minimize the eco nomic impacts of a nuclear accident by preventing possible contamination of food. Advisories are made prior to confirmation of contamination, and can be made before any release of radiation from the plant. Because they involve small economic cost and need not be based on actual but only possible contamination, Advisories may be issued for broad geographic area, up to and including the entire ingestion pathway planning zone. Advisories do not require lab results.

Airborne Radioactive Material

Radioactive material dispersed in the air in the form of dust, fumes, mist, vapor or gases.

Air Sampling

The collection and analysis of samples of air to measure its radioactivity or to detect the presence of airborne radioactive substances, particulate matter, vapors, or chemical pollutants.

ALARA

The guiding principle behind radiation protection is that ionizing radiation exposures should be kept "As Low As Reasonably Achievable (ALARA)," economic and social factors being taken into account. This common-sense approach means that radiation doses for both workers and the public are typically kept lower than their regulatory limits.

Alpha Particle

A charged particle, composed of two protons and two neutrons, emitted from the nucleus of an atom. Alpha particles can be stopped by thin layers of light materials, such as a sheet of paper, and pose no direct or external radiation threat.

Atom

The smallest part of any material that cannot be broken up by chemical means. Each atom has a core (the nucleus), which contains protons and neutrons. Electrons orbit around the nucleus. In an uncharged atom the number of electrons orbiting the nucleus equals the number of protons in the nucleus.

Background Radiation

The amount of radiation to which a member of the population is exposed from natural sources, such as terrestrial radiation due to naturally occurring radionuclides in the soil, cosmic radiation, originating in outer space, and naturally occurring radionuclides in the human body.

Beta Particle

A charged particle emitted from the nucleus of an atom and having a mass and charge equal in magnitude to those of the electron. Beta particles can be stopped by aluminum.

Biological Half-Life

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

Committed Effective Dose Equivalent

The radiation dose committed over a “lifetime” (50 years for adult, 70 years for infa nt) to person via radiation of organs from inhalation or ingestion of radioactive material.

Contamination

Deposition of radioactive material in any place where it is not desired, particularly where its presence may be harmful. The harm may be in vitiating an experiment or a procedure, or in actually being a source of danger to personnel.

Corrective Actions

Those emergency measures taken to lessen or terminate an emergency situation by stopping an uncontrolled release of radioactive material or by reducing the magnitude of the release (e.g., shutting down equipment, fire fighting, repair and damage control).

Curie (Ci)

The unit of radioactivity that quantifies the number of radioactive atoms that decays per unit time. The unit used in countries other than the United States is the becquerel (Bq). One Bq equals 2.7×10^{-11} Ci; One Ci equals 3.7×10^{10} Bq.

Decay (Radioactive Decay)
Radioactive decay describes the process where an energetically unstable atom transforms itself to a more energetically favora ble, or stable, state. The unstable atom can emit ionizing radiation in order to become more stable. This atom is said to be "radioactive" and the process of change is called "(radioactive) decay."

Decontamination
The removal of radioactive contaminants from surfaces (e.g., skin) by cleaning and washing.

Delayed Health Effects
Also known as stochastic effects. Radiation health effects that are based on the dose received AND the probability of those effects occurring at the given dose. Stochastic effects have no threshold and apply mainly to low levels of radiation. They can occur at any level of radiation as a function of probability.

Dose (Absorbed)
Absorbed dose is the amount of energy deposited in any material by ionizing radiation. The unit of ab sorbed dose, the rad, is a measure of energy absorbed per gram of material. The unit used in countries other than the United States is the gray. One gray equals 100 rad.

Dose Equivalent
This is the amount of biological damage to human tissue caused by radiation. Since not all types of radiation produce the same effect in humans the equivalent dose takes into account the type of radiation, using a quality factor that is based on the biological effect of the radiation type, and the absorbed dose. For example, when considering beta, X-ray, and gamma-ray radiation, the equivalent dose (expressed in rems) is equal to the absorbed dose (expressed in rads). For alpha radiation, the equivalent dose is assumed to be twenty times the absorbed dose.

Dose Rate
The radiation dose per unit of time (e.g., rad/hr, mrem/hr).

Dosimeter
Instruments to detect and measure the accumulated radiation exposure. Examples are film badges, thermoluminescent dosimeters (TLD), and pocket chambers, all used for personnel monitori ng.

Electron
Electrons are very small particles with a single negative charge. They are part of an atom and orbit around the nucleus. Electrons are much smaller than protons or neutrons. The mass of an electron is only about one two-thousandth of a proton or neutron.

Emergency Response Plan
A licensing document that describes the utility's overall emergency response functions, organization, facilities, and equipment as well as appropriate state, county, or local plans. This document is supplemented by specific implementing procedures.

Emergency Worker
Utility, federal, state, county, and other personnel who execute prescribed assessment, corrective, protective, or recovery actions, during a radiation emergency.

External Exposure
An exposure to the body from a source of ionizing radiation found outside of the body.

Exposure
An exposure is the measure of the amount of ionization produced by X-rays or gamma rays as they travel through air. The unit of radiation exposure is the roentgen (R), named for Wilhelm Roentgen, the German scientist who in 1895 discovered x-rays.

Exposure Rate
The exposure per unit of time (e.g., μR/hr, or R/hr).

Fission
A nuclear transformation characterized by splitting of a nucleus into at least two other nuclei and the release of a relatively large amount of energy.

Fission Products
Elements or compounds resulting from fission.

Food Control Measures
Protective Actions established to limit the exposure of the general public to radioactively contaminated food. Measures may include but are not limited to, delaying or restricting harvest and /or transport, or instituting an embargo.

Fusion
The act of coalescing of two or more nuclei.

Gamma Rays
Penetrating, high energy, short-wavelength electromagnetic radiation. Gamma radiation frequently accompanies alpha and beta emissions and always accompanies fission. Gamma rays are essentially similar to X-rays, but are usually more energetic, and originate in the nucleus.

Groundshine
This is gamma radiation from radioactive materials deposited on the ground.

Half-Life
The time required for a population of atoms of a given radionuclide to decrease, by radioactive decay, to exactly one-half of its original number is called the half-life. No operation, either chemical or physical, can change the decay rate. Half-lives range from much less than a microsecond to more than a billion years. The longer the half-life the more stable the nuclide. After one half -life, half the original atoms will remain; after two half-lives, one fourth (or 1/2 of 1/2) will remain; after three half-lives one eighth of the original number (1/2 of 1/2 of 1/2) will remain; and so on.

Health Physics
The science of radiation protection.

Ionizing Radiation
Radiation sufficiently energetic to dislodge electrons from an atom. Ionizing radiation includes X-rays and gamma radiations, electrons (beta radiation), alpha particles, and heavier charge atomic nuclei.

Ions
Atoms which have the same number of electrons and protons have zero charge since the number of positively charged protons equals the number of negatively charged electrons. If an atom has more electrons than protons, it has a negative charge and is called a negative ion. Atoms that have fewer electrons than protons are positively charged and are called positive ions. Some forms of radiation can strip electrons from atoms.

Internal Exposure
An exposure to the body from a source of ionizing radiation found inside of the body.

Irradiation
Exposure to ionizing radiation.

Isotopes
Nuclides that have th e same number of protons. Isotopes of a nuclide have nearly the same chemical properties, but somewhat different physical properties.

Latent Period
The period of time between exposure to ionizing radiation and the appearance of radiation effects.

Man-Made Radionuclides (Radiation)
Radionuclides that are produced by fission, fusion, particle bombardment, or electromagnetic irradiation.

Maximum Exposed Individual
The individual whose location and habits tend to maximize his radiation dose, resulting in a dose higher that that received by other individuals in the general population.

Monitoring
Periodic or continuous determinations of the amount of ionizing radiation or radioactive contamination present in an occupied region, as a safety measure, for purposes of health protection.

Naturally Occurring Radionuclides (Radiation)
Radionuclides that are occurring naturally, not caused by industrial or other human activity.

Neutron
Neutrons are part of the nucleus of an atom. Neutrons are, as the name implies, neutral in their charge. That is, they have neither a positive nor a negative charge. Neutrons are about the same size as protons.

Nucleus (Nuclei)
The small positively charged core of an atom. All nuclei contain both protons and neutrons, except the nucleus of hydrogen which contains a single proton.

Nuclide
A general term applicable to all atomic forms of an element. Nuclides are characterized by the number of protons and neutrons in the nucleus.

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.

Potassium Iodide (KI)
A chemical compound used by people who could be exposed to radioactive iodine in the atmosphere to saturate their thyroid with stable iodine in order to block any radioactive iodine uptake by the thyroid.

Protective Action
An action or policy that is designed to protect human health and safety. Protective Actions are often prescribed based on a given dose level or radioactivity.

Proton
Protons, along with neutrons, make up the nucleus of an atom. Protons have a single positive charge.

Rad (Radiation Absorbed Dose)
The unit for absorbed dose that quantifies the amount of energy absorbed per gram of material. The unit used in countries other than the United States is the gray (Gy). One Gy equals 100 rad.

Radiation
Energy in the form of waves or particles.

Radioactive Material
Any material, solid, liquid or gas, which emits radiation spontaneously.

Radioactivity
The spontaneous decay of an unstable atom, usually accompanied by the emission of ionizing radiation.

Radionuclides
Nuclides with an unstable nucleus.

REM (Roentgen Man Equivalent)
The unit for equivalent dose that quantifies the amount of energy absorbed per gram of material times a factor for the type of radiation that imparted the energy. The unit used in countries other than the United States is the sievert (Sv). One Sv equals 100 rem.

Risk
The probability of injury, disease, or death under specific circumstances.

Absolute Risk
The excess risk attributed to irradiation and usually expressed as the numeric difference between irradiated and nonirradiated populations (e.g., 1 case of cancer per million people irradiated annually for each rad). Absolute risk may be given on an annual basis or lifetime (50-year) basis.

Relative Risk
The ratio between the number of cancer cases in the irradiated population to the number of cases expected in the unexposed population. A relative risk of 1.1 indicates a 10 percent increase in cancer due to radiation, compared to the "normal" incidence.

Roentgen (R)
A Roentgen is 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.

Sheltering
The use of a structure for radiation protection from an airborne plume and/or deposited radioactive material.

Shielding
Material placed between the source of radioactive material and the body to reduce external exposure.

Sievert
The metric unit of dose equivalent (biological effect) of radiation to humans. 1 Sievert = 100 rem.

Survey Meter
An instrument used for detecting radioactive material or for measuring exposure.

Different survey meters include:

- ZnS(Ag) Scintillator – measures alpha radiation contamination
- NaI Scintillator – measures gamma radiation exposure
- Ion Chamber – measures beta/ gamma radiation exposure
- Geiger-Muller Tube – measures alpha/ beta/ gamma radiation contamination and beta/ gamma radiation exposure
- Pressurized Ion Chamber - measures gamma radiation exposure

Spent Fuel
Fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated by reprocessing.

Tracer (Radioactive)
A tracer is a radioactive material that is introduced into a system to make possible the observation of chemical, physical or biological processes in that system.

X-Rays
Penetrating, short wavelength electromagnetic radiation. X-rays are essentially similar to gamma rays, but are usually less energetic, and originate from the orbital electron cloud surrounding the nucleus.

Sources

ANSI N1.1-1976
ANSI/ ANS 3.8.1-1987
BEIR III-1980
BEIR V-1990
Environmental Protection Agency, http://www.epa.gov/radiation/enviro/html/rad/rad-term.html
ICRP 29-1978
NCRP 51-1977
NCRP 65-1980
NCRP 81-1985
NCRP 138
The Health Physics Society, http://www.hps.org/publicinformation/radterms
Radiological Emergency Response Plan and Procedures, Washington State Department of Health Office of Radiation Protection.

Links to external resources are provided as a public service and do not imply endorsement by the Washington State Department of Health.