# Glossary

## A

**accuracy:** A measure of the degree to which a measured value or the average of a number of measured values agrees with the “true” value for a given parameter; accuracy includes elements of both bias and precision.

**actinides:** The elements of the periodic table from actinium to lawrencium, including the naturally occurring radionuclides thorium and uranium and the human-made radionuclides plutonium and americium.

**alpha radiation:** The emission of alpha particles during radioactive decay. Alpha particles are identical in makeup to the nucleus of a helium atom and have a positive charge. Alpha radiation is easily stopped by materials as thin as a sheet of paper and has a range in air of approximately an inch. Despite its low penetration ability, alpha radiation is densely ionizing and, therefore, very damaging when ingested or inhaled.

**ambient dose equivalent:** Since the effective dose cannot be measured directly with a typical survey instrument or a dosimeter, approved simulation quantities are used to approximate the effective dose (see **dose, effective**). The ambient dose equivalent is the quantity recommended by the International Commission on Radiation Units and Measurements to approximate the effective dose received by a human from external exposure to ambient ionizing radiation.

**anthropogenic radionuclide:** Radionuclide produced as a result of human activity (human-made).

**aquifer:** A geologic formation, group of formations, or part of a formation capable of yielding a significant amount of groundwater to wells or springs.

**aquifer well:** A well that obtains its water from below the water table.

## B

**background radiation:** 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. It does not include radiation from source, byproduct, or special nuclear materials regulated by the United States (U.S.) Nuclear Regulatory Commission. The typically quoted average individual exposure from background radiation in southeastern Idaho is 360 millirems per year.

**basalt:** The most common type of solidified lava; a dense, dark gray, fine-grained, igneous rock that is composed chiefly of plagioclase, pyroxene, and olivine, often displaying a columnar structure.

**becquerel (Bq):** A quantitative measure of radioactivity. This is an alternate measure of activity used internationally. One Bq of activity is equal to one nuclear decay per second. There are $3.7 \times 10^{10}$ Bq in 1 Curie (Ci).

**beta radiation:** Radiation comprised of charged particles emitted from a nucleus during radioactive decay. A negatively charged beta particle is identical to an electron. A positively charged beta particle is called a positron. Beta radiation is slightly more penetrating than alpha radiation, and it may be stopped by materials such as aluminum or Lucite panels.

**bias:** The tendency for an estimate to deviate from an actual or real event. Bias may be the tendency for a model to over- or under-predict.

**bioremediation:** The process of using various natural or introduced microbes or both to degrade, destroy, or otherwise permanently bond contaminants contained in soil or water or both.

**biota concentration guide:** The limiting concentration of a radionuclide in soil, sediment, or water that would not cause dose limits for the protection of populations of aquatic and terrestrial biota to be exceeded.

**blank:** The primary purpose of blanks (e.g., a sample of analyte-free media) is to trace sources of artificially introduced contamination. Laboratory blanks assess the potential of contamination being introduced during the analytical laboratory process whereas field blanks are used to identify potential contamination that occurred during sample collection. See **field blank**, **laboratory blank**, **equipment blank,** and **reagent blank**.

**blind sample:** Contains a known quantity of some of the analytes of interest added to a sample media being collected. A blind sample is used to test for the presence of compounds in the sample media that interfere with the analysis of certain analytes.

**butte:** A steep-sided and flat-topped hill.

## C

**calibration:** The adjustment of a system and the determination of system accuracy using known sources and instrument measurements of higher accuracy.

**calibration verification:** This is used to check that an instrument is within the original calibration of the instrumentation being used for analyses of the samples sent to the laboratory for the requested method and analytes requested on the chain of custody.

**chain of custody:** A method for documenting the history and possession of a sample from the time of collection, through analysis and data reporting, to its final disposition. An item is considered to be in a person's custody if the item is (1) in the physical possession of that person, (2) within direct view of that person, or (3) placed in a secured area or container by that person.

**comparability:** A measure of the confidence with which one dataset or method can be compared to another.

**composite sample:** A sample of environmental media that contains a certain number of sample portions collected over a time period. The samples may be collected from the same location or different locations. They may or may not be collected at equal intervals over a predefined period (e.g., quarterly).

**completeness:** A measure of the amount of valid data obtained from a measurement system compared to the amount that was expected under optimum conditions.

**confidence interval:** A statistical range with a specified probability a given parameter lies within that range.

**contaminant:** Any physical, chemical, biological, radiological substance, matter, or concentration that is in an unwanted location.

**contaminant of concern:** A contaminant in a given media (usually soil or water) above a risk level that may result in harm to the public or the environment. At the Idaho National Laboratory (INL) Site, this term refers to a contaminant that is above a $10^{-6}$ (i.e., 1 in 1 million) risk value.

**continuing calibration verification (CCV) (also known as initial calibration verification [ICV]):** The primary purpose of the CCV/ICV is to check the original calibration of the instrumentation being used to analyze samples for that method and targeted analytes. The CCV/ICV is from an external source that is different than that used in the calibration.

**control sample:** A sample collected from an uncontaminated area that is used to compare INL Site analytical results to those in areas that could not have been impacted by INL Site operations.

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**cosmic radiation:** Penetrating ionizing radiation, both particulate and electromagnetic, that originates in outer space. Secondary cosmic rays, formed by interactions in the earth's atmosphere, account for about 45 to 50 millirem of the 300 millirem of natural background radiation that an average U.S. citizen receives in a year.

**curie (Ci):** The original unit used to express the decay rate of a sample of radioactive material. The curie is a unit of activity of radioactive substances equivalent to $3.70 \times 10^{10}$ disintegrations per second; it is approximately the amount of activity produced by 1 gram of radium-226. It is named for Marie and Pierre Curie who discovered radium in 1898. The curie is the basic unit of radioactivity used in the system of radiation units in the U.S., which is referred to as a "traditional" unit. See **becquerel (Bq)**.

## D

**data gap:** A lack or inability to obtain information despite good faith efforts to gather desired information.

**data quality assessment:** A data quality assessment includes reviewing data for accuracy, representativeness, and, if available, consistency with historical measurements to ensure that the data support their intended uses. A preliminary data assessment is also performed to determine the structure of the data (i.e., distribution of data [normal, lognormal, exponential, or nonparametric]); identify relationships/associations, trends, or patterns between sample points/variables or over time; identify anomalies; and select the appropriate statistical tests for decision-making.

**data validation:** A systematic review of a data set to identify outliers or suspect values. More specifically, data validation refers to the systematic process of independently reviewing a body of analytical data against established criteria to provide assurance that the data are acceptable for their intended use. This process may use appropriate statistical techniques to screen out impossible or highly unlikely values.

**data verification:** The act of reviewing, inspecting, testing, checking, auditing, or otherwise determining and documenting whether items, processes, services, or documents conform to specified requirements. The data verification process involves checking for common errors associated with analytical data. A review is first conducted to ensure all data and sample documentation are present and complete. In addition, the following also may be reviewed: sample preservation and temperature, defensible chain of custody documentation and sample integrity, analytical hold-time compliance, correct test method application, adequate analytical recovery, correct minimum detection limit, possible cross-contamination, and matrix interference (i.e., analyses affected by dissolved inorganic/organic materials in the matrix).

**decay products:** Decay products are also called "daughter products." They are radionuclides that are formed by the radioactive decay of parent radionuclides. In the case of radium-226, for example, nine successive different radioactive decay products are formed in what is called a "decay chain." The chain ends with the formation of lead-206, which is a stable nuclide.

**derived concentration standard (DCS):** The concentration of a radionuclide in air or water that, under conditions of continuous exposure for one year by a single pathway (e.g., air inhalation or immersion, water ingestion), would result in an effective dose of 100 mrem (1 mSv). DOE O 458.1, "Radiation Protection of the Public and the Environment," establishes this limit, and Department of Energy (DOE) Standard DOE-STD-1196-2022, "Derived Concentration Technical Standard," provides the numerical values of DCSs.

**deterministic effect:** A health effect, the severity of which varies with the dose and for which a threshold is believed to exist. Deterministic effects generally result from the receipt of a relatively high dose over a short time period. Skin erythema (reddening) and radiation-induced cataract formation is an example of a deterministic effect (formerly called a nonstochastic effect).

**diffuse source:** A source or potential source of pollutants that is not constrained to a single stack or pipe. A pollutant source with a large areal dimension.

**diffusion:** The process of molecular movement from an area of high concentration to one of lower concentration.

**direct radiation:** External radiation from radioactive plumes or from radionuclides deposited on the ground or other surfaces.

**dispersion:** The process of molecular movement by physical processes.

**dispersion coefficient:** An empirical concentration, normalized to a unit release rate, used to estimate the concentration of radionuclides in a plume at some distance downwind of the source. The National Oceanic and Atmospheric Administration prepared the dispersion coefficients for this report, using data gathered continuously at meteorological stations on and around the INL Site and the HYSPLIT transport and dispersion model.

**dose:** A general term used to refer to the effect on a material that is exposed to radiation. It is used to refer either to the amount of energy absorbed by a material exposed to radiation (see **dose, absorbed**) or to the potential biological effect in tissue exposed to radiation. See **dose, equivalent** and **dose, effective;** see also **dose, population**.

**dose, absorbed:** The amount of energy deposited in any substance by ionizing radiation per unit mass of the substance. It is expressed in units of rad or gray (Gy) (1 rad = 0.01 gray).

**dose, effective (*E*):** The summation of the products of the equivalent dose received by specified tissues and organs of the body, and tissue-weighting factors for the specified tissues and organs, and is given by the expression:

$$E=\sum_T w_T \sum_R w_R D_{T,R} \quad or \quad E=\sum_T w_T H_T$$

where $H_T$ or $W_R D_{T,R}$ is the equivalent dose in a tissue or organ, T, and $w_T$ is the tissue-weighting factor. The effective dose is expressed in the SI unit sievert (Sv) or conventional unit rem (1 rem = 0.01 Sv). See **dose, equivalent** and **weighting factor**.

**dose, equivalent ($H_T$):** The product of absorbed dose in tissue multiplied by a quality factor, and then sometimes multiplied by other necessary modifying factors, to account for the potential for a biological effect resulting from the absorbed dose. For external dose, the equivalent dose to the whole body is assessed at a depth of 1 cm in tissue; the equivalent dose to the lens of the eye is assessed at a depth of 0.3 cm in tissue, and the equivalent dose to the extremity and skin is assessed at a depth of 0.007 cm in tissue. Equivalent dose is expressed in units of rems (or sieverts). It is expressed numerically in rems (traditional units) or sieverts (SI units). See **dose, absorbed** and **quality factor**.

**dose, population or collective:** The sum of the individual effective doses received in a given time period by a specified population from exposure to a specified source of radiation. Population dose is expressed in the SI unit person-sievert (person-Sv) or conventional unit person-rem (1 person-Sv = 100 person-rem). See **dose, effective**.

**dosimeter:** Portable detection device for measuring the total accumulated exposure to ionizing radiation.

**dosimetry:** The theory and application of the principles and techniques involved in the measurement and recording of radiation doses.

**double-blind performance evaluation (PE) samples:** The value of a double-blind PE sample is unknown to both the laboratory receiving the sample and the INL Site contractor. While the program

specifies PE sample matrix and boundaries of the value's range (i.e., the known value must fall between a predetermined minimum and maximum value that corresponds to the specific project or program), the actual value is unknown to both the INL Site contractor and the laboratory.

**drinking water:** Water for the primary purpose of consumption by humans.

**duplicate sample:** A sample collected from the same sampling location using the same equipment and sampling technique and placed into an identically prepared and preserved container. Duplicate samples are analyzed independently as an indication of gross errors in sampling techniques. See **replicate sample**.

## E

**Eastern Snake River Plain Aquifer:** One of the largest groundwater "sole source" resources in the U.S. It lies beneath a rolling topography extending some 308 km (191 mi) from Ashton to King Hill, Idaho, and ranges in width from 64 to 130 km (40 to 80 mi). The plain and aquifer were formed by repeated volcanic eruptions that were the result of a geologic hot spot beneath the earth's crust.

**ecosystem:** The interacting system of a biologic community and its nonliving environment.

**effluent:** Any gaseous or liquid discharge released to the environment, including storm water runoff at a site or facility.

**electrometallurgical treatment:** The process of treating spent nuclear fuel using metallurgical techniques.

**environment:** Includes water, air, and land and the interrelationship that exists among and between water, air, and land and all living things.

**environmental indicators:** Animal and plant species that are particularly susceptible to decline related to changes, either physical or chemical, in their environment.

**environmental media:** Includes air, groundwater, surface water, soil, flora, and fauna.

**environmental monitoring:** Sampling for contaminants in air, water, sediments, soils, agricultural products, plants, and animals, either by direct measurement or by collection and analysis of samples. It is a combination of two distinct activities (effluent monitoring and environmental surveillance) that together provide information on the health of an environment.

**equipment blank:** Sample prepared by collecting uncontaminated water passed over or through the sampling equipment. This type of blank sample is normally collected after the sampling equipment has been used and subsequently cleaned. An equipment blank is used to detect contamination introduced by the sampling equipment either directly or through improper cleaning.

**exposure:** The interaction of an organism with a physical or chemical agent of interest. Examples of such agents are radiation (physical) and carbon tetrachloride (chemical).

**exposure pathway:** The mechanism through which an organism may be exposed to a contaminant. An example is the surface water pathway, whereby an organism may be exposed to a contaminant through the consumption of surface water containing that contaminant.

**external dose or exposure:** That portion of the dose received from radiation sources outside the body (i.e., external sources).

**extremely hazardous substance:** A substance listed in the appendices to 40 CFR 355, "Emergency Planning and Notification."

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## F

**fallout:** Radioactive material made airborne as a result of aboveground nuclear weapons testing and deposited on the earth's surface.

**field blank:** A field blank is collected to assess the potential introduction of contaminants and the adequacy of field and laboratory protocols during sampling and laboratory analysis. In air sampling, a field blank is a clean, analyte-free filter that is carried to the sampling site, exposed to sampling conditions, returned to the laboratory, and treated as an environmental sample. In water sampling, field blanks are prepared at the field site where environmental water samples are collected. A sample of analyte-free water is poured into the container in the field where environmental water samples are collected, preserved, and shipped to the laboratory with field samples. Results include relevant ambient conditions during sampling and laboratory sources of contamination. See **reagent blank**.

**field replicates:** Two samples collected from a single location at the same time, stored in separate containers, and analyzed independently. In the case of air sampling, two air samplers are placed side by side, and each filter is analyzed separately. Duplicates are useful in estimating the precision resulting from the sampling process. See **sample duplicate (collocated samples)**.

**fissile material:** Although sometimes used as a synonym for fissionable material, this term has acquired a more restricted meaning. Namely, any material that is fissionable by thermal (slow) neutrons. The three primary fissile materials are uranium-233, uranium-235, and plutonium-239.

**fission:** The splitting of the nucleus of an atom (generally of a heavy element) 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.

**fission products:** The nuclei (fission fragments) formed by the fission of heavy elements plus the nuclides formed by the subsequent decay products of the radioactive fission fragments.

**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.

**follow-up:** Contact with an analytical laboratory to perform a review of an initial non-agreement.

**for-cause-review:** A for-cause-review is performed by an analytical laboratory after a follow-up identifies a cause of a non-agreement for a particular method/analyte/media. The for-cause-review may result in a corrective action. See **follow-up**.

**floodplain:** Lowlands that border a river and are subject to flooding. A floodplain is comprised of sediments carried by rivers and deposited on land during flooding.

## G

**gamma radiation:** A form of electromagnetic radiation, such as radio waves or visible light but with a much shorter wavelength. It is more penetrating than alpha or beta radiation and capable of passing through dense materials, such as concrete.

**gamma spectroscopy:** An analysis technique that identifies specific radionuclides that emit gamma radiation. It measures the particular energy of a radionuclide's gamma radiation emissions. The energy of these emissions is unique for each radionuclide, acting as a fingerprint to identify a specific radionuclide.

**gross alpha activity:** The total radioactivity due to alpha particle emission as inferred from measurements on a dry sample. See **alpha radiation**.

**gross beta activity:** The total radioactivity due to beta particle emission as inferred from measurements on a dry sample. See **beta radiation**.

**groundwater:** Water located beneath the surface of the ground (subsurface water). Groundwater usually refers to a zone of complete saturation containing no air.

## H

**half-life:** The time in which one-half of the activity of a particular radioactive substance is lost due to radioactive decay. Measured half-lives vary from millionths of a second to billions of years. Also called physical or radiological half-life.

**hazardous air pollutant:** Any hazardous chemical as defined under 29 CFR 1910.1200, “Hazard Communication,” and 40 CFR 370.2, “Definitions.” See **hazardous substance**.

**hazardous material:** Material considered dangerous to people or the environment.

**hazardous substance:** Any substance, including any isomers and hydrates, as well as any solutions and mixtures containing these substances, designated as such under Section 311 (b) (2)(A) of the Clean Water Act (CWA); any toxic pollutant listed under Section 307 (a) of the CWA; any element, compound, mixture, solution, or substance designated pursuant to Section 102 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA); any hazardous waste having the characteristics identified under or listed pursuant to Section 3001 of the Solid Waste Disposal Act; any hazardous air pollutant listed under Section 112 of the Clean Air Act; and any imminently hazardous chemical substance or mixture to which the U.S. Environmental Protection Agency (EPA) administrator has taken action pursuant to Section 7 of the Toxic Substances Control Act. The term does not include petroleum, including crude oil or any fraction thereof that is not otherwise specifically listed or designated in the first paragraph, and it does not include natural gas, natural gas liquids, liquefied natural gas, or synthetic gas usable for fuel (or mixtures of natural gas and such synthetic gas).

**hazardous waste:** A waste that is listed in the tables of 40 CFR 261, “Identification and Listing Hazardous Waste,” or that exhibits one or more of four characteristics (e.g., corrosivity, reactivity, ignitability, toxicity) above a predefined value.

**high-level radioactive waste:** Waste material resulting from the reprocessing of spent nuclear fuel, including both liquid and solid materials containing enough radioactivity to require permanent isolation from the environment.

**hot spot:** (1) In environmental surveillance, a localized area of contamination or higher contamination in an otherwise uncontaminated area. (2) In geology, a stationary, long-lived source of magma coming up through the mantle to the earth’s surface. The hot spot does not move but remains in a fixed position. As the crust of the earth moves over a hot spot, volcanic eruptions occur on the surface.

## I

**infiltration:** The process by which water on the ground surface enters the soil or rock.

**influent:** Any raw or untreated gaseous or liquid stream entering a treatment system, process, or facility.

**inorganic:** Relating to or belonging to the class of compounds not having a carbon basis; hydrochloric and sulfuric acids are called inorganic substances.

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

**initial calibration verification (ICV):** The primary purpose of the CCV/ICV is to check the original calibration of the instrumentation being used to analyze samples for that method and targeted analytes. The CCV/ICV is from an external source that is different than that used in the calibration. See **continuing calibration verification (CCV).**

**inter-laboratory proficiency testing (PT) samples:** This is an external PT and inter-laboratory comparison program accredited under the International Organization for Standardization/International Electrotechnical Commission (ISO/IEC 17043:2010[E]). *The Department of Defense (DOD) Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories* (QSM 2021) requires that laboratories receiving and analyzing samples for DOE contracts successfully participate in a PT program for one year before becoming an accredited laboratory to receive samples for analyses for all analytes, matrices, and methods included in the laboratory's scope of work. The inter-laboratory program requires that participating laboratories must analyze at least two sets of samples during a calendar year.

**intra-laboratory PE:** This is an internal laboratory quality program using their own known value sample program to test their laboratory for method performance.

**intra-laboratory samples:** Intra-laboratory known value samples can be used to verify competency of the laboratory analysis method and of the analyst performing the sample preparation and analysis.

**isopleth:** A line on a map connecting points having the same numerical value of some variable.

**isotope:** Two or more forms of an element having the same number of protons in the nucleus (or the same atomic number) but having different numbers of neutrons in the nucleus (or different atomic weights). Isotopes of a single element possess almost identical chemical properties. Examples of isotopes are plutonium-238, plutomium-239, and plutonium-241; each acts chemically like plutonium but has 144, 145, and 147 neutrons, respectively.

## L

**laboratory blank:** A sample, usually deionized water, that is intended to contain none of the analytes of interest and is subjected to the same analytical or measurement process as other samples to establish a zero baseline or laboratory background value. Laboratory blanks are run before and after regular samples are analyzed to measure contamination that may have been introduced during sample handling, preparation, or analysis. A laboratory blank is sometimes used to adjust or correct routine analytical results.

**laboratory control sample:** The primary purpose of the laboratory control sample (accuracy) is to demonstrate that the laboratory can perform the overall analytical approach in a matrix free of interferences (e.g., reagent water, clean sand, or another suitable reference matrix), and its analytical system is in control but does not reflect analytical performance on analyzing real world samples.

**laboratory control sample duplicate analysis (accuracy and precision):** The laboratory control sample duplicate is used to determine the accuracy and precision as well as the bias of a method in each sample matrix.

**laboratory matrix spike:** The purpose of the matrix spike (accuracy) sample is to determine if the method is applicable to the sample matrix in question.

**laboratory replicate/duplicate:** Two aliquots from the same field sample are prepared by the laboratory and analyzed separately using identical procedures to assess the precision of a method in a given sample matrix.

**liquid effluent:** A liquid discharged from a treatment system, process, or facility.

## M

**matrices/matrix/media:** Refers to the physical form (solid, liquid, or gas) or composition (soil, filter, groundwater, or air) of a sample.

**matrix spike duplicate analysis (accuracy and precision):** The matrix spike duplicate is used to determine the accuracy and precision as well as the bias of a method in each sample matrix.

**maximally exposed individual (MEI):** A hypothetical member of the public whose location and living habits tend to maximize his or her radiation dose, resulting in a dose higher than that received by other individuals in the general population.

**method blank:** A method blank is an analyte-free matrix, such as distilled water, for liquids or cleaned sand for solids and/or soils that is processed in the same way as the INL Site contractor program samples. The main function of the method blank is to document contamination resulting from the analytical laboratory process.

**millirem (mrem):** A unit of radiation dose that is equivalent to one one-thousandth of a rem.

**millisievert (mSv):** The International System of Units (SI) for radiation dose and effective dose equivalent. The SI equivalent of the millirem (1 millisievert = 100 millirem).

**minimum detection concentration (MDC):** The lowest concentration to which an analytical parameter can be measured with certainty by the analytical laboratory performing the measurement. While results below the MDC are sometimes measurable, they represent values that have a reduced statistical confidence associated with them (less than 95 percent confidence).

**multi-media:** Covering more than one environmental media (e.g., an inspection that reviews groundwater, surface water, liquid effluent, and airborne effluent data).

## N

**natural background radiation:** Radiation from natural sources to which people are exposed throughout their lives. It does not include fallout radiation. Natural background radiation is comprised of several sources, the most important of which are as follows:

- ***cosmic radiation:*** Radiation from outer space (primarily the sun)
- ***terrestrial radiation:*** Radiation from radioactive materials in the crust of the earth
- ***inhaled radionuclides:*** Radiation from radioactive gases in the atmosphere, primarily radon-222.

**natural resources:** Land, fish, wildlife, biota, air, water, groundwater, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, otherwise controlled by the U.S., any state or local government, any foreign government, or Native American tribe.

**noble gas:** Any of the chemically inert gaseous elements of the helium group in the periodic table.

**non-community water system:** A public water system that is not a community water system. A non-community water system is either a transient non-community water system or a non-transient non-community water system.

**non-conformance report:** A non-conformance report is generated by the analytical laboratory for a more in-depth quality review of the non-agreement for a particular method/analyte/media. The non-conformance report may result in a corrective action.

**non-transient non-community water system:** A public water system that is not a community water system and that regularly serves at least 25 of the same people for more than six months per year. These systems are typically schools, offices, churches, factories, etc.

## O

**organic:** Relating or belonging to the class of chemical compounds having a carbon basis; hydrocarbons are organic compounds.

**optically stimulated luminescence dosimeter (OSLD):** Used to measure direct penetrating gamma radiation through the absorption of energy from ionizing radiation by trapping electrons that are excited to a higher energy band. The trapped electrons in the OSLD are released by exposure to green light from a laser.

## P

**perched water well:** A well that obtains its water from a water body above the water table.

**performance evaluation (PE) sample:** PE samples are prepared samples that contain known values of analyte(s) of interest to the specific project, INL Site contractor program, or laboratory. PE samples are used to assess analytical method specific laboratory performance and to check that the laboratory can be within the criteria set by the specific project or program for known value sample recovery. The samples are matched as closely as possible to the specific media, analytes of interest, and expected concentration or activity levels appropriate for the specific project, program, or use in decision-making. In some cases, the PE sample matrix may differ from the field samples (i.e., using deionized water with a known amount of analyte to simulate an atmospheric moisture sample). The PE samples are generally submitted with batches of field samples so they are processed simultaneously in the laboratory.

**person-rem:** Sum of the doses received by all individuals in a population.

**pH:** A measure of hydrogen ion activity. A low pH (0–6) indicates an acidic condition; a high pH (8–14) indicates a basic condition. A pH of 7 indicates neutrality.

**playa:** A depression that is periodically inundated with water and will retain such water over time. An intermittent or seasonal water body.

**plume:** A body of contaminated groundwater or polluted air flowing from a specific source. The movement of a groundwater plume is influenced by such factors as local groundwater flow patterns, the character of the aquifer in which groundwater is contained, and the density of contaminants. The movement of an air contaminant plume is influenced by the ambient air motion, the temperatures of the ambient air and of the plume, and the density of the contaminants.

**$PM_{10}$:** Particle with an aerodynamic diameter less than or equal to 10 microns.

**pollutant:** (1) Pollutant or contaminant as defined by Section 101(33) of the CERCLA shall include, but not be limited to, any element, substance, compound, or mixture, including disease-causing agents, which after release into the environment and upon exposure, ingesting, inhalation, or assimilation into an

organism, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction), or physical deformation in such organisms or their offspring. The term does not include petroleum, including crude oil or any fraction thereof that is not otherwise specifically listed or designated as a hazardous substance under Section 101(14) (A) through (F) of CERCLA, nor does it include natural gas, liquefied natural gas, or synthetic gas of pipeline quality (or mixtures of natural gas and such synthetic gas). For purposes of the National Oil and Hazardous Substances Pollution Contingency Plan, the term pollutant or contaminant means any pollutant or contaminant that may present an imminent and substantial danger to the U.S. public health or welfare. (2) Any hazardous or radioactive material naturally occurring or added to an environmental media such as air, soil, water, or vegetation.

**polychlorinated biphenyl:** Any chemical substance that is limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances that contain such substance.

**precision:** A measure of mutual agreement among individual measurements of the same property. Precision is most often seen as a standard deviation of a group of measurements.

**public water system:** A system for the provision to the public of water for human consumption through pipes or other constructed conveyances if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily for at least 60 days out of the year. Includes any collection, treatment, storage, and distribution facilities under control of the operator of such system and used primarily in connection with such system and any collection or pretreatment storage facilities not under such control that are used primarily in connection with such system. Does not include any special irrigation district. A public water system is either a community water system or a non-community water system.

**purgeable organic compound:** An organic compound that has a low vaporization point (volatile).

## Q

**quality assurance (QA):** Those planned and systematic actions necessary to provide adequate confidence that a facility, structure, system, or component will perform satisfactorily and safely in service. QA includes quality control. If quality is the degree to which an item or process meets or exceeds the user's requirements, then QA is the action that provides confidence that quality was in fact achieved.

**quality control (QC):** Those actions necessary to control and verify the features and characteristics of a material, process, product, service, or activity to specified requirements. The aim of QC is to provide quality that is satisfactory, adequate, dependable, and economic.

**quality factor:** The factor by which the absorbed dose (rad or gray) must be multiplied to obtain a quantity that expresses, on a common scale for all ionizing radiation, the biological damage (rem or sievert) to the exposed tissue. It is used because some types of radiation, such as alpha particles, are more biologically damaging to live tissue than other types of radiation when the absorbed dose from both is equal. The term, "quality factor," has now been replaced by "radiation weighting factor" in the latest system of recommendations for radiation protection.

## R

**rad:** Short for radiation absorbed dose; a measure of the energy absorbed by any material.

**radioactivity:** The spontaneous transition of an atomic nucleus from a higher energy to a lower energy state. This transition is accompanied by the release of a charged particle or electromagnetic waves from the atom. Also known as activity.

**radioactive decay:** 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.

**radioecology:** The study of the behavior and the effects of radioactive materials on the environment. Also includes the use of radioisotopes to study the structure and function of ecosystems and their component parts.

**radionuclide:** A type of atom that emits energy in the form of photons or particles (radiation) during transformation.

**radiotelemetry:** The tracking of animal movements using a radio transmitter attached to the animal of interest.

**reagent blank:** A sample of any reagent used for sample preparation subjected to the same analytical or measurement process as a normal sample. A reagent blank is used to show that the reagent used in sample preparation does not contain any of the analytes of interest.

**rehabilitation:** The planting of a variety of plants to restore an area's plant community diversity after a loss (e.g., after a fire).

**relative percent difference:** A measure of variability adjusted for the size of the measured values. It is used only when the sample contains two observations, and it is calculated by the following equation:

$$RPD = \frac{|R1 - R2|}{(R1 + R2)/2} \times 100$$

where R1 and R2 are the duplicate sample measurement results.

**release:** Spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing of a hazardous substance, pollutant, or contaminant into the environment.

**rem (Roentgen Equivalent Man):** A unit in the traditional system of units that measures the effects of ionizing radiation on humans.

**replicate samples:** A sample collected from the same sampling location using the same equipment and sampling technique and placed into an identically prepared and preserved container. Duplicate samples are analyzed independently as an indication of gross errors in sampling techniques. See **duplicate samples**.

**reportable quantity:** Any hazardous substance under CERCLA, the reportable quantity for which is established in Table 302.4 of 40 CFR 302, "Designation, Reportable Quantities, and Notification." The discharge of which is a violation of federal statutes and requires notification of the regional EPA administrator.

**representativeness:** A measure of a laboratory's ability to produce data that accurately and precisely represents a characteristic of a population, a parameter variation at a sampling point, a process condition, or an environmental condition.

**reprocessing:** The process of treating spent nuclear fuel for the purpose of recovering fissile material.

**resuspension:** Windblown reintroduction to the atmosphere of material originally deposited onto surfaces from a particular source.

**rhyolite:** A usually light-colored, fine-grained, extrusive igneous rock that is compositionally similar to granite.

**risk:** In many health fields, risk means the probability of incurring injury, disease, or death. Risk can be expressed as a value that ranges from zero (e.g., no injury or harm will occur) to one (e.g., harm or injury will occur).

**risk assessment:** The identification and quantification of the risk resulting from a specific use or occurrence of a chemical, considering the possible harmful effects on individuals or society from using the chemical in the amount and manner proposed and all possible exposure routes. Quantification ideally requires the establishment of dose-effect and dose-response relationships in likely target individuals and populations.

**roentgen (R):** The amount of ionization produced by gamma radiation in air. The unit of roentgen is approximately numerically equal to the unit of rem.

## S

**sample duplicate:** Two samples collected from a single location at the same time, stored in separate containers, and analyzed independently. In the case of air sampling, two air samplers are placed side by side, and each filter is analyzed separately. Duplicates are useful in estimating the precision resulting from the sampling process. See **field replicates.**

**shielding:** The material or process used for protecting workers, the public, and the environment from exposure to radiation.

**sievert (Sv):** A unit for assessing the risk of human radiation dose, used internationally. One sievert is equal to 100 rem.

**sigma uncertainty:** The uncertainty or margin of error of a measurement is stated by giving a range of values likely to enclose the true value. These values follow from the properties of the normal distribution, and they apply only if the measurement process produces normally distributed errors; for example, the quoted standard errors are easily converted to 68.3 percent (one sigma), 95.4 percent (two sigma), or 99.7 percent (three sigma) confidence intervals, which are usually denoted by error bars on a graph or by the following notations:

- measured value ± uncertainty
- measured value (uncertainty).

**single-blind PE sample:** The value of a single-blind PE sample is known to the INL contractor sending the sample but unknown to the laboratory receiving the sample.

**sink:** Similar to a playa with the exception that it rapidly infiltrates any collected water.

**spent nuclear fuel:** Uranium metal or oxide and its metal container that have been used to power a nuclear reactor. It is highly radioactive and typically contains fission products, plutonium, and residual uranium.

**split sample:** A single sample split into two separate samples. Each sample is prepared and analyzed independently as an indication of analytical variability and comparability.

**spreading areas:** At the INL Site, a series of interconnected low areas used for flood control by dispersing and evaporating or infiltrating water from the Big Lost River.

**stabilization:** The planting of rapidly growing plants for the purpose of holding bare soil in place.

**standard:** A sample containing a known quantity of various analytes. A standard may be prepared and certified by commercial vendors, but it must be traceable to the National Institute of Standards and Technology (NIST).

**standard deviation:** In statistics, the standard deviation (often abbreviated as SD), also represented by the Greek letter sigma σ, is a measure of the dispersion of a set of data from its mean. See **sigma uncertainty.**

**stochastic effect:** An effect that occurs by chance and which may occur without a threshold level of dose, whose probability is proportional to the dose and whose severity is independent of the dose. In the context of radiation protection, the main stochastic effect is cancer.

**storm water:** Water produced by the interaction of precipitation events and the physical environment (e.g., buildings, pavement, ground surface).

**surface radiation:** Surface radiation is monitored at the INL Site at or near waste management facilities and at the perimeter of Site facilities. See **direct radiation**.

**surface water:** Water exposed at the ground surface, usually constrained by a natural or human-made channel (e.g., stream, river, lake, ocean).

**surveillance:** Monitoring of parameters to observe trends but which action is not required by a permit or regulation.

## T

**thermoluminescent dosimeter:** A device used to measure radiation dose to occupational workers or radiation levels in the environment. A dosimeter is made of one or more lithium fluoride chips that measure cumulative exposure to ionizing radiation. Lithium fluoride absorbs the energy of radiation and releases it as light when heated.

**total effective dose:** The sum of the effective dose (for external exposures) and the committed effective dose.

**total organic carbon:** A measure of the total organic carbon molecules present in a sample. It will not identify a specific constituent (e.g., benzene) but will detect the presence of a carbon-bearing molecule.

**toxic chemical:** A chemical that can have toxic effects on the public or environment above the listed quantities. See also **hazardous chemical**.

**traceability:** The ability to trace history, application, or location of a sample standard and like items or activities by means of recorded identification.

**Tracer:** Tracers are added to samples to determine the overall chemical yield for the analytical preparation steps. Tracers are made of the same element with a different isotope that is chemically similar. An example would be using $^{242}Pu$ as a tracer when analyzing $^{238}Pu$ and $^{239}Pu$.

**transient non-community water system:** A water system that is not a community water system and serves an average of 25 individuals for less than six months per year. These systems are typically campgrounds or highway rest stops.

**transuranic:** Elements on the periodic table with an atomic number greater than uranium (>92). Common isotopes of transuranic elements are neptunium-239 and plutonium-238.

**transuranic waste:** Waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes (radionuclide isotopes with atomic numbers greater than uranium [92]) per gram of waste with half-lives greater than 20 years.

**trip blank*:*** The blank sample results can be used to identify and isolate the source of contamination introduced in the field or the laboratory. A trip blank is a clean sample of matrix taken from the sample preparation area to the sampling site and returned to the analytical laboratory unopened. A trip blank is used to document contamination attributable to shipping and field handling procedures.

**tritium:** A radioactive isotope of hydrogen, having three times the mass of ordinary hydrogen.

## V

**vadose zone:** That part of the subsurface between the ground surface and the water table.

## W

**water quality parameter:** Parameter commonly measured to determine the quality of a body of water or sample (i.e., specific conductivity, pH, temperature, dissolved oxygen content).

**weighting factor (wT):** A multiplier that is used for converting the equivalent dose to a specific organ or tissue (T) into what is called the effective dose. The goal of this process is to develop a method for expressing the dose to a portion of the body in terms of an equivalent dose to the whole body that would carry with it an equivalent risk in terms of the associated fatal cancer probability. The equivalent dose to tissue (HT) is multiplied by the appropriate tissue-weighting factor to obtain the effective dose (E) contribution from that tissue. See dose, equivalent and dose, effective.

**wetland:** An area inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and which under normal circumstances does support, a prevalence of vegetation typically adapted to wet conditions that cannot adapt to an absence of flooding. Wetlands generally include playa lakes, swamps, marshes, bogs, and similar areas such as sloughs, prairie potholes, wet meadows, prairie river overflows, mudflats, and natural ponds.