9 GLOSSARY

accident: An unplanned sequence of events resulting in undesirable consequences, such as the release of radioactive or hazardous material to the environment.

accident consequence assessment: An assessment of the impacts following the occurrence of an accident, independent of the probability of that accident. The PEIS provides estimates of the consequences of a large number of possible accidents, ranging from those with low probability (rare) to those with relatively high probability (frequent).

accident frequency: The likelihood that a specific accident will occur, that is, the probability of occurrence. If an accident is estimated to happen once every 50 years, the accident frequency is generally reported as 0.02 per year (1 occurrence divided by 50 years = 0.02 occurrences per year). For the PEIS, accident frequencies were grouped as follows:

- I, likely (L) — The average frequency of occurrence is estimated to be greater than or equal to 1 in 100 years.
- II, unlikely (U) — The average frequency of occurrence is estimated to be 1 in 100 to 1 in 10,000 years.
- III, extremely unlikely (EU) — The average frequency of occurrence is estimated to be 1 in 10,000 to 1 in 1 million years.
- IV, incredible (I) — The average frequency of occurrence is estimated to be less than 1 in 1 million years.

accident risk: Risk based on both the severity of an accident (consequence) and the probability that the accident will occur. High-consequence accidents that are unlikely to occur (low probability) may pose a low overall risk. For purposes of comparison, accident risk is typically calculated by multiplying the accident consequence (e.g., dose or expected fatalities) by the accident probability.

accident risk assessment: An assessment that considers the probabilities and consequences of a range of possible accidents, including low-probability accidents that have high consequences and high-probability accidents that have low consequences. The overall *risk* associated with an accident is generally estimated by multiplying the accident consequence by the probability of occurrence.

accident source term: The amount of radioactive or hazardous material released to the environment in dispersible form following an accident.

adsorption: Process in which solid surfaces attract and retain a layer of ions from a water solution.

advection: The process by which material is transported by the bulk motion of flowing water.

air quality: Measure of the health-related and visual characteristics of the air, often derived from quantitative measurements of the concentrations of specific injurious or contaminating substances. Air quality standards are the prescribed level of constituents in the outside air that cannot be exceeded during a specific time in a specified area.

Air Quality Control Region (AQCR): An interstate or intrastate area designated by the U.S. Environmental Protection Agency for the attainment and maintenance of National Ambient Air Quality Standards.

ALARA: see *as low as reasonably achievable*.

alpha particle (α): A positively charged particle consisting of two protons and two neutrons that is emitted during radioactive decay from the nucleus of certain nuclides. It is the least penetrating of the three common types of radiation (alpha, beta, and gamma).

ambient air: The surrounding atmosphere as it exists around people, plants, and structures.

***American Indian Religious Freedom Act* of 1978:** The Act that established national policy to protect and preserve for Native Americans their inherent right of freedom to believe, express, and exercise their traditional religions, including the rights of access to religious sites, use and possession of sacred objects, and freedom to worship through traditional ceremonies and rites.

AQCR: see *Air Quality Control Region*.

aquifer: A saturated subsurface geologic formation that can transmit significant quantities of water.

***Archaeological and Historic Preservation Act*:** Act directed at the preservation of historic and archaeological data that would otherwise be lost as a result of federal construction. It authorizes the U.S. Department of the Interior to undertake recovery, protection, and preservation of archaeological and historic data.

as low as reasonably achievable (ALARA): An approach to control or manage radiation exposures (both individual and collective to the workforce and the public) and releases of radioactive material to the environment as low as social, technical, economic, practical, and public policy considerations permit. ALARA is not a dose limit; it is a practice that has as its objective the attainment of dose levels as far below applicable limits as possible.

***Atomic Energy Act* of 1954:** The Act that, along with other related legislation, provided the Atomic Energy Commission (a predecessor of the U.S. Department of Energy) with authority to develop generally applicable standards for protecting the environment from radioactive materials.

attainment area: An area considered to have air quality as good as or better than the National Ambient Air Quality standards as defined in the *Clean Air Act*. An area may be an attainment area for one pollutant and a nonattainment area for others (see also *nonattainment area*).

***Bald and Golden Eagle Protection Act*, as amended:** The Act making it unlawful to take, pursue, molest, or disturb bald (American) and golden eagles, their nests, or their eggs anywhere in the United States.

beta particle (β): An elementary particle emitted from a nucleus during radioactive decay; it is negatively or positively charged, identical in mass to an electron, and in most cases easily stopped, as by a thin sheet of metal or plastic.

biota: The plant and animal life of a region.

blending: The mixing of two quantities of uranium with different levels of enrichment to produce uranium enriched to a level suitable for manufacture into a fuel. Depleted uranium can be blended with highly enriched uranium to produce nuclear reactor fuel.

bounding: In the case of accident analysis, bounding is a condition, consequence, or risk that provides an upper limit that is not exceeded by other conditions, consequences, or risks. This term is also used to identify conservative assumptions that will likely overestimate actual risks or consequences.

breach: A general term referring to a hole in a cylinder or container. A breach may be caused by corrosion or by mechanical forces, such as those caused by a drop or contact with handling equipment.

cancer: A group of diseases characterized by uncontrolled cellular growth. Increased incidence of cancer can be caused by exposure to radiation.

candidate species: Plant or animal species that are not yet officially listed as threatened or endangered but are undergoing status review by the U.S. Fish and Wildlife Service. These species are candidates for possible addition to the list of threatened and endangered species.

carbon monoxide (CO): A colorless, odorless gas that is toxic if breathed in high concentration over a period of time. Carbon monoxide is one of six criteria air pollutants specified under Title I of the *Clean Air Act*.

cascade: The process system that is used to separate the isotopic streams of uranium-235 and uranium-238 in gaseous diffusion plants.

cask: A heavily shielded, typically robust container for shipping or storing spent nuclear fuel. Spent nuclear fuel casks are usually cylindrical containers with radiation shielding provided by steel, lead, concrete, or depleted uranium.

census tract: An area usually containing between 2,500 and 8,000 persons that is used for organizing and monitoring census data. The geographic dimensions of census tracts vary widely, depending on population settlement density. Census tracts do not cross county borders.

***Clean Air Act*:** The Act that mandates the issuance and enforcement of air pollution control standards for stationary sources and motor vehicles.

***Clean Air Act Amendments* of 1990:** An Act that expanded the enforcement powers of the U.S. Environmental Protection Agency and added restrictions on air toxins, ozone-depleting chemicals, stationary and mobile emissions sources, and emissions implicated in acid rain and global warming.

***Clean Water Act* of 1972, 1987:** The Act that regulates the discharge of pollutants from a point source into navigable waters of the United States in compliance with a National Pollution Discharge Elimination System permit. Also regulates discharges to or dredging of wetlands.

***Code of Federal Regulations* (CFR):** The codified form in which all federal regulations in force are published.

collective dose: Summation of individual radiation doses received by all those exposed to the source or event being considered. The collective radiation dose received by a population group is usually measured in units of person-rem.

collective population risk: A measure of possible loss in a group of people that takes into account the probability that the hazard will cause harm and the consequences of that event. The collective population risk does not express the risk to specific individual members of the population.

committed effective dose equivalent: The sum of the committed dose equivalents to various

tissues of the body, each multiplied by its weighting factor. It does not include contributions from external doses. Committed effective dose equivalent is expressed in units of rem and provides an estimate of the lifetime radiation dose to an individual from radioactive material taken into the body through either inhalation or ingestion.

convection: Process by which heat is transferred between a surface and a moving fluid when they are at different temperatures.

cost analysis: The life-cycle cost estimates, including estimates of labor and capital, for each of the strategy alternatives considered in the PEIS.

criteria pollutants: Six air pollutants for which national ambient air quality standards are established by the U.S. Environmental Protection Agency under Title I of the *Clean Air Act*. The six pollutants are sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), ozone (O_3), particulate matter (PM_{10}, particles with a mean diameter of less than 10 microns [µm]), and lead (Pb).

critical habitat: Air, land, or water area and constituent elements, the loss of which would appreciably decrease the likelihood of survival and recovery of a species listed as threatened or endangered or a distinct segment of the population of that species.

cultural resources: Archaeological sites, architectural structures or features, traditional use areas, and Native American sacred sites or special use areas.

cumulative impacts: The impacts assessed in an environmental impact statement that could potentially result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal), private industry, or individual undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

curie (Ci): A measure of the radioactivity of a material, equal to 3.7×10^{10} disintegrations per second.

cylinder: As defined for this PEIS, a large steel container used to store depleted UF_6. Cylinders are typically about 12 ft long by 4 ft in diameter and weigh about 10 to 14 tons when full of depleted UF_6.

cylinder preparation: The activities required to prepare depleted UF_6 cylinders for transportation. Cylinder preparation would be required for alternatives that involve transport of cylinders to a conversion facility or a long-term storage site.

decay: Natural process by which a radioactive atom is physically transformed into another form by the release of energy in the form of subatomic particles such as alpha or beta particles, or electromagnetic radiation such as gamma rays.

decay products, radioactive: The isotopes produced when another isotope undergoes radioactive decay. The decay products are also typically radioactive.

decommissioning: The process of removing a facility from operation, followed by decontamination, entombment, dismantlement, or conversion to another use.

defluorination: The conversion of uranium hexafluoride to U_3O_8 accomplished by using steam. UF_6 is chemically decomposed with steam and heat to produce U_3O_8 and HF, with concentrated HF as the direct by-product.

depleted UF_6: see *depleted uranium hexafluoride*.

depleted uranium hexafluoride (depleted UF_6): A compound of uranium and fluorine from which most of the uranium-235 isotope has been removed. Isotope separation results in two product "streams." The stream containing the additional uranium-235 is said to be enriched and is collected for further processing into other forms of enriched uranium. The remaining UF_6 stream is said to be "depleted" and is now stored at the Paducah, Portsmouth, and K-25 sites.

disposal: The emplacement of material in a manner designed to ensure isolation for the foreseeable future. Disposal is considered to be permanent, with no intent to retrieve the material for future use.

disposal facility: A facility or part of a facility into which hazardous, radioactive, or solid waste is intentionally placed and at which waste is intended to permanently remain after closure of the facility.

disproportionately high and adverse environmental impact: An adverse environmental impact determined to be unacceptable or above generally accepted norms. A disproportionately high impact refers to an environmental hazard with a risk or rate of exposure for a low-income or minority population that exceeds the risk or rate of exposure for the general population.

disproportionately high and adverse human health effect: Any effect on human health from exposure to environmental hazards that exceeds generally accepted levels of risk and affects low-income and minority populations at a rate that appreciably exceeds the rate for the general population. Adverse health effects are measured in risks and rates that could result in latent cancer fatalities, as well as other fatal or nonfatal adverse impacts to human health.

dose: The amount of energy deposited in body tissue due to radiation exposure. Various technical terms — such as dose equivalent, effective dose equivalent, and collective dose — are used to evaluate the amount of radiation received by an exposed individual or population.

dose rate: Radiation dose delivered per unit of time and measured in rem per hour.

drain: A device (e.g., a channel or pipe) used to carry away or to empty liquid from a liquid source.

drifts: Lateral extensions of belowground tunnels that are used for storage or disposal of material.

DUCRETE™: A composite material produced by combining dense UO_2 and concrete.

effective dose equivalent: The sum of the products of the dose equivalent to various organs or tissues and the weighting factors applicable to each of the body organs or tissues that are irradiated. The effective dose equivalent includes the dose from radiation sources internal and/or external to the body and is expressed in units of rem.

EIS: see *environmental impact statement*.

***Emergency Planning and Community Right-to-Know Act* of 1986:** The Act that established programs to provide the public with important information on the hazardous and toxic chemicals in their communities and established emergency planning and notification requirements to protect the public in the event of a release of hazardous substances.

Emergency Response Planning Guideline (ERPG): A hazardous-material personnel exposure level or range which, when exceeded by a short-term or acute exposure, will cause adverse reproductive, developmental, or carcinogenic effects in humans. ERPGs are approved by a committee of the American Industrial Hygiene Association.

endangered species: Any species that is in danger of extinction throughout all or a significant portion of its geographic range.

***Endangered Species Act,* as amended:** The Act intended to prevent the further decline of endangered and threatened species and to restore these species and their habitats. Consultation with the U.S. Fish and Wildlife Service is necessary to determine whether endangered and threatened species or their critical habitats are known to be in the vicinity of the proposed action.

engineering analysis: A comprehensive technical analysis of depleted UF_6 technology options, including conversion, use, transportation, storage, and disposal.

enrichment: An isotopic separation process that increases the portion of the uranium-235 isotope in relation to uranium-238 in natural uranium. In addition to the enriched uranium, this process also produces uranium depleted in uranium-235. Enrichment is accomplished in the United States through a process called gaseous diffusion.

environmental impact statement (EIS): A document prepared in accordance with the requirements of the *National Environmental Policy Act*. A programmatic EIS (PEIS) is a broad-scope EIS that identifies and assesses the environmental impacts of a program or policy.

environmental justice: The fair treatment of people of all races, cultures, incomes, and educational levels with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment implies that no population of people should be forced to shoulder a disproportionate share of the negative environmental impacts of pollution or environmental hazards due to a lack of political or economic strength.

ERPG: see *Emergency Response Planning Guideline*.

evapotranspiration: Loss of water from the soil by both evaporation and transpiration from plants growing in the soil.

exposure: The condition of being made subject to the action of radiation, chemicals, or physical hazards. Exposure is sometimes used as a generic term to refer to the dose of radiation or chemicals absorbed by an individual or population.

external exposure: Exposure to radiation, principally gamma radiation, that originates from sources outside of the body.

failure: For this PEIS, defined as the release of disposed uranium material from the bottom of the disposal facility to the surrounding soil. Failure of a disposal facility would generally occur hundreds to thousands of years after facility closure due to the ultimate penetration of water and natural degradation of engineered barriers.

***Farmland Protection Policy Act* of 1981:** An Act that requires federal agencies to take steps to ensure that federal actions do not contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses in cases in

which other national interests do not override the importance of protecting the farmland resources.

fault: A fracture in the earth's crust accompanied by displacement of one side of the fracture with respect to the other and in a direction parallel to the fracture.

***Federal Facilities Compliance Act* of 1992:** An Act that amended the *Resource Conservation and Recovery Act*, with the objectives of bringing all federal facilities into compliance with applicable federal and state hazardous waste laws, of waiving federal sovereign immunity under those laws, and of allowing the imposition of fines and penalties. The law also requires the U.S. Department of Energy to submit an inventory of all its mixed waste and to develop a treatment plan for mixed waste.

federal-listed species: see *threatened, endangered,* and *candidate* species.

fission: The splitting of a heavy atomic nucleus into two nuclei of lighter elements, accompanied by the release of energy and generally one or more neutrons. Fission can occur spontaneously or be induced by neutron bombardment.

floodplain: The lowlands adjoining inland and coastal waters and relatively flat areas, including at a minimum that area inundated by a 1% or greater chance flood in any given year. The base floodplain is defined as the 100-year (1%) floodplain. The critical action floodplain is defined as the 500-year (0.2%) floodplain.

food chain: The scheme of feeding relationships between trophic levels that unites the member species of a biological community.

fugitive dust: The dust released from activities associated with construction, manufacturing, or transportation.

fugitive emissions: Uncontrolled emissions to the atmosphere from pumps, valves, flanges, seals, and other process points not vented through a stack. Also includes emissions from area sources such as ponds, lagoons, landfills, and piles of stored material.

gamma radiation (γ): High-energy, short-wavelength electromagnetic radiation (a packet of energy) emitted from a radioactive nucleus during decay. 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.

gaseous diffusion: The uranium enrichment process first developed in the 1940s as part of the Manhattan Project. In gaseous diffusion, gaseous UF_6 is allowed to flow irreversibly through a membrane or diffusion barrier. With holes just large enough to allow the passage of individual molecules without passage of the bulk gas through the membrane or diffusion barrier, more of the lighter molecules (i.e., those containing uranium-235 atoms) will flow through the barrier than the heavier molecules (i.e., those containing uranium-238 atoms), thus effecting partial separation. Gaseous diffusion results in two streams of UF_6: one enriched in the uranium-235 isotope and one depleted in the uranium-235 isotope.

gelation: A process for conversion of UF_6 to UO_2, where the solid uranium is separated from an aqueous solution through chemical reaction.

general public: For purposes of analyses in this PEIS, anyone outside the boundary of a site at the time of an accident or during normal facility operations, as well as people along transportation

routes used to ship hazardous chemicals or radioactive materials.

generic sites: For this PEIS, sites broadly defined with very generalized environmental characteristics for the purpose of evaluating the impacts of manufacturing, disposal, and long-term storage in mines. For example, disposal of uranium oxide was analyzed for a wet (or eastern) location and a dry (or western) location. Such a broad characterization is useful for evaluating an activity that is very generalized in nature and for which one environmental variable (such as groundwater) is of most importance.

geologic repository (mined geologic repository): An underground facility for the disposal of nuclear waste. The waste is isolated by placing it in mined cavities in a continuous, stable geologic formation at depths typically greater than 300 meters. A surface facility is used to prepare the waste material for placement in the underground portions of the repository.

glove box: An airtight box used to work with hazardous material, vented to a closed filtering system, having gloves attached inside the box to protect the worker.

greater-than-Class-C waste: Low-level radioactive waste generated by the commercial sector that exceeds U.S. Nuclear Regulatory Commission concentration limits for Class-C low-level waste, as specified in 10 CFR Part 61.

green salt: see *uranium tetrafluoride*.

groundshine: Gamma radiation emitted from radioactive materials deposited on the ground.

groundwater: Generally, all water contained in the ground; water held below the water table available to freely enter wells.

grout: A cementing or sealing mixture of cement and water to which sand, sawdust, or other fillers (additives — e.g., waste) may be added.

grouted waste: Refers to the solid material obtained by mixing waste material with cement and repackaging it in drums. Grouting is intended to reduce the mobility of the waste material.

habitat: Area where a plant or animal lives.

hazard index: A summation of the hazard quotients for all chemicals to which an individual is exposed. A hazard index value of 1.0 or less than 1.0 indicates that no adverse human health effects (noncancer) are expected to occur.

hazard quotient: A comparison of an estimated chemical intake (dose) with a reference dose level below which adverse health effects are unlikely. The hazard quotient is expressed as the ratio of the estimated intake to the reference dose. The value is used to evaluate the potential for noncancer health effects, such as organ damage, from chemical exposures.

hazardous air pollutants: The 189 chemicals and chemical classes — such as asbestos, beryllium, mercury, benzene, and radionuclides — whose emissions are specially regulated by the *Clean Air Act*.

hazardous material: A material that poses a potential risk to health, safety, and property when transported or handled.

hazardous waste: Under the *Resource Conservation and Recovery Act*, a solid waste, or combination of solid waste, which — because of its quantity, concentration, or physical, chemical or infectious characteristics — may (a) cause or significantly contribute to an increase in mortality

or an increase in serious irreversible, or incapacitating reversible, illness; or (b) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported or disposed of, or otherwise managed. Source material (including UF_6), special nuclear material, and by-product material, as defined by the *Atomic Energy Act*, are specifically excluded from the definition of solid waste.

health risk conversion factors: Estimates of the expected number of health effects (i.e., cancer cases, cancer fatalities, or genetic effects) caused by exposure to a given amount of radiation. Health risk conversion factors are multiplied by the estimated radiation dose received by a given population (such as workers or members of the public) in order to estimate the number of health effects expected to occur as a result of the exposure. Health risk conversion factors are derived from data collected from Japanese atomic bomb survivors, historical medical and industrial exposures, and animal experimentation.

heels: Residual amounts of nonvolatile material left in a cylinder following the removal of the depleted UF_6.

HEU: see *highly enriched uranium*.

HF: see *hydrogen fluoride*.

high-efficiency particulate air (HEPA) filter: A filter with an efficiency of at least 99.95% used to separate particles from air exhaust streams prior to releasing that air into the atmosphere.

high-level radioactive waste (HLW): The highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid. High-level waste contains a combination of transuranic waste and fission products in concentrations requiring permanent isolation. High-level waste may include other highly radioactive material that the U.S. Nuclear Regulatory Commission, consistent with existing law, determines by rule requires permanent isolation.

highly enriched uranium (HEU): Uranium that contains the isotope uranium-235 in concentration of 20% or more. Naturally occurring uranium has a uranium-235 content of about 0.7%.

hydrocarbons (HC): Chemical compounds containing carbon and hydrogen as the principal elements.

hydrogen fluoride (HF): A colorless, toxic, fuming, corrosive liquid or gas; miscible with cold water and very soluble in hot water. HF is produced when UF_6 comes in contact with water, such as humidity in the air, and is often a by-product produced when UF_6 is converted to another chemical form.

hygroscopic: A chemical substance with an affinity for water; one that will absorb moisture, usually from the air.

Inconel: A metal alloy containing nickel, chromium, and iron, which exhibits good resistance to corrosion in aqueous environments.

internal exposure: The ingestion or inhalation of radioactive contaminants in air, water, food, or soil, and the subsequent radiation dose to internal organs and tissues of the body.

involved worker: A worker directly involved in the handling or processing of radioactive or hazardous materials.

ion: An atom, molecule, or molecular fragment carrying a positive or negative electrical charge.

ionizing radiation: Radiation that has enough energy to remove electrons from substances that it passes through, forming ions.

isotope: One of two or more species of an element that have the same atomic number but different masses. The difference in mass is due to the presence of one or more extra neutrons in the nucleus. The number of protons for different isotopes of the same element is the same. Uranium-235 and uranium-238 are examples of isotopes of the element uranium.

land disposal restrictions: Restrictions on the disposal of waste that is hazardous under the *Resource Conservation and Recovery Act*. The land disposal restrictions include technology-based or performance-based treatment standards that must be met before hazardous waste can be disposed of on land.

latent cancer fatality (LCF): Term used to indicate the estimated number of cancer fatalities that may result from exposure to a cancer-causing element. Latent cancer fatalities are similar to naturally occurring cancers and may be expressed at any time after the initial exposure.

lead (Pb): A toxic metal in air, food, water, and soil. Overexposure to this metal can cause damage to the circulatory, digestive, and central nervous systems. Lead is one of six criteria air pollutants specified under Title I of the *Clean Air Act*.

LEU: see *low-enriched uranium*.

long-term storage: The containment of material on a temporary basis or for a period of years, in such a manner as not to constitute disposal of such material. Long-term storage would preserve access to the material until a future use is identified or until a decision is made to dispose of the material.

low-enriched uranium (LEU): Uranium that contains the isotope uranium-235 in a concentration of less than 20% and greater than 0.7%. Most commercial reactor fuel is enriched to 5% or less uranium-235.

low-income population: Persons of low-income status. This status is based on U.S. Bureau of the Census definitions of individuals living below the poverty line, as defined by a statistical threshold that considers family size and income. For 1990, the poverty line threshold for a family unit of four individuals was $12,674 (based on 1989 income). In this PEIS, low-income population was defined as consisting of any census tract located within a 50-mile (80-km) radius of a storage site that has a proportion of low-income population that is greater than the respective state average.

low-level mixed waste (LLMW): Waste that contains both hazardous waste under the *Resource Conservation and Recovery Act* and radioactive material, including source, special nuclear, or by-product material subject to the *Atomic Energy Act* of 1954. Such waste has to be handled, processed, and disposed of in a manner that considers its chemical as well as its radioactive components.

low-level radioactive waste (LLW): Waste that contains radioactivity but is not classified as high-level waste, transuranic waste, spent nuclear fuel, or "11e(2) by-product material" as defined by U.S. Department of Energy Order 5820.2A. Low-level waste is typically disposed of using shallow land burial.

***Low-Level Radioactive Waste Policy Act*:** The Act, as amended, that established procedures for

the implementation of compacts providing for the establishment and operation of regional disposal facilities for low-level radioactive waste and that made the federal government responsible for ultimate disposal of commercially generated waste with a classification of greater-than-Class-C (see also *greater-than-Class-C waste*).

maximally exposed individual (MEI): A hypothetical individual who — because of proximity, activities, or living habits — could potentially receive the maximum possible dose of radiation or of a hazardous chemical from a given event or process.

***Migratory Bird Treaty Act*, as amended:** Act intended to protect birds that have common migration patterns between the United States and Canada, Mexico, Japan, and Russia.

millirem: A unit of radiation exposure equal to one-thousandth of a rem.

minority population: Persons classified by the U.S. Bureau of the Census as Negro/Black/ African-American, Hispanic, Asian and Pacific Islander, American Indian, Eskimo, Aleut, or other nonwhite; based on self-classification by individuals according to the race with which they most closely identify. For this PEIS, a minority population was defined as any census tract located within a 50-mile (80-km) radius of a storage site that has a proportion of minority population that is greater than the respective state average.

mixed waste: see *low-level mixed waste*.

model: A conceptual, mathematical, or physical system obeying certain specified conditions, whose behavior is used to understand the physical system to which it is analogous. Models are often used to predict the behavior or outcome of future events.

Modified Mercalli Intensity: A level on the modified Mercalli scale. A measure of the perceived intensity of earthquake ground-shaking with 12 divisions, from I (not felt by people) to XII (damage nearly total).

Monel: Trade name for a white copper-nickel alloy that is acid- and corrosion-resistant.

multi-purpose unit: A heavily shielded cask that can be used for storage, transportation, and disposal of spent nuclear fuel.

National Ambient Air Quality Standards (NAAQS): Air quality standards established by the *Clean Air Act*, as amended. The primary NAAQS are intended to protect the public health with an adequate margin of safety, and the secondary NAAQS are intended to protect the public welfare from any known or anticipated adverse effects of a pollutant.

National Emission Standards for Hazardous Air Pollutants (NESHAPS): A set of national emission standards for listed hazardous pollutants emitted from specific classes or categories of new and existing sources. These standards were implemented in the *Clean Air Act Amendments* of 1977.

***National Environmental Policy Act* (NEPA) of 1969:** The Act that established the national policy to protect humans and the environment, requiring environmental reviews of federal actions that have the potential for significant impact on the environment. Also established the Council on Environmental Quality.

***National Historic Preservation Act* of 1966, as amended:** The Act directing federal agencies to consider the effects of their programs and projects on properties listed on or eligible for the *National Register of Historic Places*. It does not require any permits, but pursuant to federal code,

if a proposed action might impact any archaeological, historical, or architectural resource, it mandates consultation with the proper agencies.

National Pollutant Discharge Elimination System (NPDES): Federal permitting system required for hazardous effluents regulated through the *Clean Water Act*, as amended.

***National Register of Historic Places*:** A list maintained by the Secretary of the Interior as the official list of historic properties (districts, sites, buildings, structures, and objects) deserving preservation because of their local, state, or national significance in American history, architecture, archaeology, engineering, and culture. Properties listed on or eligible for the *National Register* are protected by the *National Historic Preservation Act* of 1966, as amended.

NEPA document: A document prepared pursuant to requirements of the *National Environmental Policy Act* or the Council on Environmental Quality regulations, including the following: environmental assessment, environmental impact statement, Notice of Intent, Record of Decision, and Finding of No Significant Impact.

nitrogen oxides (NO_x): The oxides of nitrogen, primarily nitrogen oxide (NO) and nitrogen dioxide (NO_2), that are produced in the combustion of fossil fuels and can constitute an air pollution problem. When NO_2 combines with volatile organic compounds in sunlight, ozone is produced. Nitrogen oxides are one of six criteria air pollutants specified under Title I of the *Clean Air Act*.

nonattainment area: An Air Quality Control Region (or a portion thereof) for which the U.S. Environmental Protection Agency has determined that ambient air concentrations exceed National Ambient Air Quality Standards for one or more criteria pollutants (see also *attainment area* and *criteria pollutants*).

nonhazardous waste: Routinely generated waste, including general facility refuse such as paper, cardboard, glass, wood, plastics, scrap, metal containers, dirt, and rubble. Nonhazardous waste is segregated and recycled whenever possible.

noninvolved worker: A worker employed at a site who is not directly involved in the handling of radioactive or hazardous materials.

normal operations: Conditions during which facilities and processes operate as expected or designed. In general, the evaluation of normal operations includes the occurrence of some infrequent events that, although not considered routine, are not classified as accidents. For example, the identification and repair of breached cylinders, expected to occur infrequently, was considered to be normal operations.

***Nuclear Waste Policy Act* of 1982, as amended:** The Act that authorized federal agencies to develop a geologic repository for the permanent disposal of spent nuclear fuel and high-level radioactive waste. The Act specified the process for selecting a repository site and constructing, operating, closing, and decommissioning the repository. The Act also established programmatic guidance for these activities.

nuclear weapon: The general name given to any weapon in which the explosion results from energy released by reactions involving atomic nuclei — either fission, fusion, or both.

Occupational Safety and Health Administration (OSHA): The agency that oversees and

regulates workplace health and safety, created by the *Occupational Safety and Health Act* of 1970.

Options, Continued Cylinder Storage: An option for all alternative management strategies considered in the PEIS that would involve the continued storage of depleted UF_6 cylinders at the Paducah, Portsmouth, and K-25 sites for some period of time. Continued cylinder storage was assumed to occur at these three sites through 2028 for all alternatives and to extend through 2039 for the no action alternative.

Options, Conversion: Conversion of depleted UF_6 to another chemical form. The conversion options considered in the PEIS were conversion to U_3O_8, conversion to UO_2, and conversion to metal. Several representative technologies were considered within each option.

Options, Cylinder Preparation: The activities necessary to prepare depleted UF_6 cylinders for off-site transportation. Depleted UF_6 cylinders were designed, built, tested, and certified to meet requirements of the U.S. Department of Transportation (DOT) for shipment by truck and rail. However, after several decades in storage, some cylinders no longer meet these requirements. Two options for preparing these cylinders for shipment were considered in the PEIS:

- ***Cylinder Overcontainers*** — Protective metal "overcontainers" in which cylinders not meeting DOT requirements could be placed for shipment. These reusable overcontainers would be slightly larger than a cylinder and would be designed to meet all DOT requirements.
- ***Cylinder Transfer*** — New cylinders into which the depleted UF_6 in cylinders not meeting DOT requirements would be transferred for shipment.

Options, Disposal: Options for disposal of depleted uranium material as low-level radioactive waste. The disposal options in the PEIS are defined by the chemical form of the uranium and the type of disposal facility. Two disposal options were considered in the PEIS:

- ***Disposal of U_3O_8*** — Depleted uranium could be disposed of as U_3O_8 following conversion. Disposal of both ungrouted and grouted U_3O_8 was considered. Potential disposal facilities included shallow earthen structures, belowground vaults, and an underground mine.
- ***Disposal of UO_2*** — Similarly to disposal of U_3O_8, depleted uranium could be disposed of as UO_2 following conversion, in either grouted or ungrouted form. The disposal facilities considered were the same as those considered for U_3O_8: shallow earthen structures, belowground vaults, and an underground mine.

Options, Manufacture and Use: Options that involve the manufacture and use of depleted uranium as radiation shielding material, as follows:

- ***Use as Uranium Oxide Shielding*** — The manufacture and use of uranium oxide-shielded storage casks for spent nuclear fuel.
- ***Use as Uranium Metal Shielding*** — The manufacture and use of uranium metal-shielded casks for spent nuclear fuel.

Options, Storage: Storage of depleted uranium until use at a later date. Storage options were defined by the chemical form of the uranium and the type of storage facility. Three storage options were considered in the PEIS:

- ***Storage as UF_6*** — Storage of UF_6 in cylinders similar to those currently used. Storage facilities considered included yards, buildings, and an underground mine.

- ***Storage as U_3O_8*** — Storage of depleted uranium in drums as U_3O_8 following conversion. Storage facilities considered included buildings, belowground vaults, and an underground mine.
- ***Storage as UO_2*** — Similar to options for U_3O_8, storage of depleted uranium as UO_2 in drums in buildings, belowground vaults, or an underground mine.

OSHA: see *Occupational Safety and Health Administration*.

overcontainer: Container used for transporting cylinders not meeting U.S. Department of Transportation (DOT) requirements. An overcontainer is a container into which a cylinder would be placed for shipment. The metal overcontainer would be designed, tested, and certified to meet all DOT shipping requirements and would be suitable to contain, transport, and store the cylinder contents regardless of cylinder condition. The type of overcontainer evaluated in the PEIS was a "clamshell" vessel.

ozone (O_3): The triatomic form of oxygen. In the stratosphere, ozone protects the Earth from the sun's ultraviolet rays, but in lower levels of the atmosphere, ozone is considered an air pollutant and can cause irritation of the eyes and respiratory tract. Ozone is one of six criteria air pollutants specified under Title I of the *Clean Air Act*.

palustrine: Nontidal wetlands dominated by trees, shrubs, or persistent emergent vegetation or small shallow wetlands.

particulates: Particles in an aerosol stream, the larger of which usually can be removed by filtration.

Pasquill stability categories: Classification scheme that describes the degree of atmospheric turbulence. Categories range from extremely unstable (A) to extremely stable (F). Unstable conditions promote the rapid dispersion of atmospheric contaminants and result in lower air concentrations compared with stable conditions.

pathway: A route or sequence of processes by which radioactive or hazardous material may move through the environment to humans or other organisms. For example, one potential exposure pathway involves the contamination and subsequent use of surface water or groundwater.

PCBs: see *polychlorinated biphenyls*.

PEIS: see *programmatic environmental impact statement*.

PELs: see *permissible exposure limits.*

permeability: In hydrology, the capacity of a medium (rock, sediment, or soil) to transmit groundwater. Permeability depends on the size and shape of the pores in the medium and how they are interconnected.

permissible exposure limits (PELs): Occupational exposure limits established for worker exposures to various chemicals, endorsed by the Occupational Safety and Health Administration. Permissible exposure limits are defined so as to protect worker health and may be for short-term or 8-hour duration exposure.

plume: The spatial distribution of a release of airborne or waterborne material as it disperses in the environment.

plutonium (Pu): A heavy, radioactive, metallic element with the atomic number 94. Plutonium is produced artificially in a reactor by bombardment of uranium with neutrons and is used primarily in the production of nuclear weapons.

PM_{10}: Particulate matter with a mean aerodynamic diameter equal to or less than 10 microns (µm). PM_{10} is one of six criteria air pollutants specified under Title I of the *Clean Air Act*.

***Pollution Prevention Act* of 1990:** The Act establishing the national policy that pollution should be prevented or reduced at the source or recycled in an environmentally safe manner and that pollution that cannot be prevented or recycled should be, as a last resort, treated and disposed of in an environmentally safe manner.

polychlorinated biphenyls (PCBs): A class of chemical substances formerly manufactured as an insulating fluid in electrical equipment. PCBs are highly toxic to aquatic life and, in the environment, exhibit many of the characteristics of dichloro diphenyl trichloroethane (DDT). PCBs persist in the environment for a long time and accumulate in animals.

polycyclic aromatic hydrocarbons (PAHs): A group of organic compounds, some of which are known to be potent human carcinogens.

population dose: see *collective dose*.

programmatic environmental impact statement (PEIS): A type of EIS that deals with broad strategies and decisions, such as those that are regional or national in scope.

proposed action: The term used in an EIS to refer to the activity planned by a federal agency that generates the need to prepare an EIS. The proposed action for this PEIS is to select a strategy for the long-term management of depleted UF_6. The PEIS considers six alternative approaches to accomplish that action.

public: see *general public*.

rad: see *radiation absorbed dose*.

radiation: The particles (alpha and beta particles) or photons (gamma rays) emitted from the nuclei of radioactive atoms. Some elements are naturally radioactive; others are induced to become radioactive by bombardment in a reactor. Naturally occurring radiation, such as that from uranium, is indistinguishable from induced radiation.

radiation absorbed dose (rad): The basic unit of absorbed dose equal to the absorption of 0.01 joule per kilogram of absorbing material.

radioactivity: The spontaneous decay or disintegration of unstable atomic nuclei, accompanied by the emission of radiation.

radionuclide: An atom that exhibits radioactive properties. Standard practice for naming a radionuclide is to use the name or atomic symbol of the element followed by its atomic weight (e.g., cobalt-60 [Co-60], a radionuclide of cobalt with an atomic weight of 60).

recharge: Replenishment of water to an aquifer.

Record of Decision (ROD): A document prepared in accordance with the requirements of 40 CFR 1505.2 that provides a concise public record of the U.S. Department of Energy's decision on a proposed action for which an EIS was prepared. A ROD identifies the alternatives considered in reaching the decision, the environmentally preferable alternative(s), and the factors balanced by the U.S. Department of Energy in making the decision. The ROD also identifies whether all practicable means to avoid

or minimize environmental harm have been adopted and, if not, why they were not.

region of influence (ROI): The physical area that bounds the environmental, sociological, economic, or cultural feature of interest for the purpose of analysis.

rem: The dosage of an ionizing radiation that will cause the same biological effect as one roentgen of X-ray or gamma-ray exposure.

repository: see *geologic repository*.

representative sites: For this PEIS, sites defined with data for actual conditions at sites that, although not proposed for that activity, might be somewhat similar to an eventual site. Representative sites were used for analysis of conversion and long-term storage in yards, buildings, and vaults. This more narrow characterization of potential future sites was used when the activity was technically better defined. Use of representative sites results in a more realistic assessment and comparison of options and alternatives than generic sites. In this PEIS, the conditions at the current storage sites were used to define the range of conditions at the representative sites.

***Resource Conservation and Recovery Act* (RCRA), as amended:** An Act that provides a "cradle-to-grave" regulatory program for hazardous waste that established, among other things, a system for managing hazardous waste from its generation until its ultimate disposal.

retardation: The process by which dissolved material moves more slowly through the soil than the velocity of the bulk fluid (i.e., water).

risk: A quantitative or qualitative expression of possible loss that considers both the probability that a hazard will cause harm and the consequences of that event.

***Safe Drinking Water Act*, as amended:** An Act that protects the quality of the public water supplies and all sources of drinking water.

sanitary waste: Waste generated by normal housekeeping activities, liquid or solid (includes sludge), that is not hazardous or radioactive.

schoepite: A yellow secondary uranium mineral that has the chemical formula $UO_3 \cdot 2H_2O$.

scope: The range of actions, alternatives, and impacts to be considered in a document prepared pursuant to the *National Environmental Policy Act* of 1969.

scoping: The process of inviting public comment on what should be considered prior to preparation of an environmental impact statement.

severe accident: An accident with a frequency of less than 1 in 1 million (10^{-6}) per year that would have more severe consequences than a design-basis accident in terms of damage to the facility, off-site consequences, or both.

shielding: Any material that is placed between a source of radiation and people, equipment, or other objects, in order to absorb the radiation and thereby reduce radiation exposure. Common shielding materials include concrete, steel, water, and lead. In general, for shielding gamma radiation sources, the denser a material is, the more effective it is as a shield.

shielding manufacturing facility: A plant where depleted uranium shielding is generated and assembled with nonradioactive shielding components to produce casks.

sinter: To form a homogenous mass by heating without melting.

socioeconomic analysis: Analysis of those parts of the human environment in a particular location that are related to existing and potential future economic and social conditions.

socioeconomic impacts: For this PEIS, impacts expressed in terms of regional economic impacts (notably changes in local employment, income, and economic output [sales]), impacts to public services and finance in local jurisdictions, and impacts to local housing markets.

***Soil and Water Conservation Act* of 1977:** An act to establish a program administered by the Secretary of Agriculture to further the conservation of soil, water, and related resources consistent with the roles and responsibilities of other federal agencies and state and local governments.

***Solid Waste Disposal Act*:** An Act that regulates the treatment, storage, or disposal of solid, both nonhazardous and hazardous, waste, as amended by the *Resource Conservation and Recovery Act* and the *Hazardous and Solid Waste Amendments* of 1984.

source: Any physical entity that may cause radiation exposure, for example, by emitting ionizing radiation or releasing radioactive material. Examples of radiation sources include X-ray machines and radionuclides such as uranium.

source term: The amount of radioactive or hazardous material released to the environment following an accident.

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

stability class: see *Pasquill stability categories*.

stakeholder: Any person or organization interested in or potentially affected by activities and decisions of the U.S. Department of Energy.

storage: The temporary holding of material in a controlled and monitored facility.

strategy: For this PEIS, a set of actions for handling depleted UF_6, from its current storage condition at three U.S. Department of Energy sites — Portsmouth, Ohio; Paducah, Kentucky, and Oak Ridge, Tennessee — to ultimate disposition. These broad strategies focus on material use, storage, and disposal.

sulfur dioxide (SO_2): A compound of sulfur produced by the burning of sulfur-containing compounds and considered to be a major air pollutant. Sulfur dioxide is one of six criteria air pollutants specified under Title I of the *Clean Air Act*.

sulfur oxides (SO_x): A general term used to describe the oxides of sulfur — pungent, colorless gases formed primarily by the combustion of fossil fuels. Sulfur oxides, which are considered major air pollutants, may damage the respiratory tract as well as vegetation.

technology assessment report: A document (Lawrence Livermore National Laboratory 1995) that identified and assessed the recommendations received in response to the "Request for Recommendations" for uses and management technologies for depleted UF_6.

terrestrial: Pertaining to plants or animals living on land rather than in the water.

threatened species: Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

throughput: A general term that refers to the amount of material handled or processed by a facility in a year.

tiering: The process of first addressing general (programmatic) matters in a broad PEIS, followed by more narrowly focused (project-level) environmental documentation that incorporates by reference the more general document.
For the Depleted Uranium Hexafluoride Management Program, the PEIS addresses the potential impacts of broad strategy alternatives. At the second level, documents will address specific siting issues, construction and operation decisions, and the impacts of transport between identified origins and destinations.

topography: Physical shape of the ground surface.

total effective dose equivalent: The sum of the effective dose equivalent from external exposure and the 50-year committed effective dose equivalent from internal exposure.

***Toxic Substances Control Act* of 1976 (TSCA):** The Act authorizing the U.S. Environmental Protection Agency (EPA) to secure information on all new and existing chemical substances and to control any of these substances determined to cause an unreasonable risk to public health or the environment. This law requires that the health and environmental effects of all new chemicals be reviewed by the EPA before they are manufactured for commercial purposes.

transuranic waste: Waste contaminated by alpha-emitting transuranic radionuclides (i.e., radionuclides with atomic numbers greater than 92) with half-lives of more than 20 years and concentrations higher than 100 nanocuries per gram (nCi/g) at the time of assay.

triuranium octaoxide (U_3O_8): An oxide form of uranium that is the most common chemical form found in nature. U_3O_8 is very stable and has a low solubility in water.

UF_4: see *uranium tetrafluoride*.

UF_6: see *uranium hexafluoride*.

UO_2: see *uranium dioxide*.

U_3O_8: see *triuranium octaoxide*.

ungrouted waste: For this PEIS, defined as U_3O_8 or UO_2 in the powder or pellet form produced during the conversion process.

uranium: A heavy, silvery-white, naturally radioactive, metallic element (atomic number 92). Its two principally occurring isotopes are uranium-235 and uranium-238. Uranium-235 is indispensable to the nuclear industry because it is the only isotope existing in nature to any appreciable extent that is fissionable by thermal neutrons. Uranium-238 is also important because it absorbs neutrons to produce a radioactive isotope that subsequently decays to plutonium-239, an isotope that also is fissionable by thermal neutrons.

uranium dioxide (UO_2): A black crystalline powder that is widely used in the manufacture of fuel pellets for nuclear reactors. Pressed and sintered, it is stable when exposed to water or air below 300°C.

uranium hexafluoride (UF_6): A chemical composed of one atom of uranium combined with 6 atoms of fluorine. UF_6 is a volatile white crystalline solid at ambient conditions. This form of uranium is used as feed for gaseous diffusion enrichment plants.

uranium metal: A heavy, silvery-white, malleable, ductile, softer-than-steel metallic element. One of the densest materials known, it is 1.6 times more dense than lead and slightly less toxic. Uranium metal is not as stable as U_3O_8 or UF_4 because it is subject to surface oxidation. It tarnishes in air, with the oxide film preventing further oxidation of massive metal at room temperature.

uranium tetrafluoride (UF_4): A green crystalline solid that melts at about 960°C and has an insignificant vapor pressure. It is very slightly soluble in water; generally an intermediate in the conversion of UF_6 to either uranium oxide (U_3O_8 or UO_2) or uranium metal. It is formed by the reaction of UF_6 with hydrogen gas in a vertical tube-type reactor or by the action of hydrogen fluoride on uranium dioxide. Also known as green salt.

uranyl fluoride (UO_2F_2): A yellow hygroscopic (i.e., moisture-retaining) solid that is very soluble in water. In accidental releases of UF_6, UO_2F_2 is a solid particulate compound that may deposit on the ground over a large area.

vacuum: A pressure less than atmospheric. Depleted uranium hexafluoride is stored in a vacuum in cylinders.

volatile organic compounds (VOCs): A broad range of organic compounds (such as benzene, chloroform, and methyl alcohol), often halogenated, that vaporize at ambient or relatively low temperatures.

waste management: The planning, coordination, and direction of those functions related to generation, handling, treatment, storage, transportation, and disposal of waste, as well as associated pollution prevention and surveillance and maintenance activities.

waste minimization: An action that economically avoids or reduces the generation of waste by source reduction, reducing the toxicity of hazardous waste, improving energy usage, or recycling.

wastewater: Water that typically contains less than a 1% concentration of organic hazardous waste materials.

***Water Quality Act* of 1987:** An act amending the *Federal Water Pollution Control Act* to make National Pollutant Discharge Elimination System requirements applicable to storm-water discharges.

wetlands: Lands or areas exhibiting hydric soils, saturated or inundated soil during some portion of the plant growing season, and plant species tolerant of such conditions (includes swamps, marshes, and bogs).

***Wild and Scenic Rivers Act*:** An Act providing for protection of the free-flowing, scenic, and natural values of rivers designated as components or potential components of the National Wild and Scenic Rivers System.

World Wide Web site: A collection of information — possibly including text, figures, pictures, audio, and video — that can be accessed by computer through the Internet computer network. These sites are intended to communicate and distribute information to anyone having access to the Internet.