

APPENDIX A
GLOSSARY OF TERMS

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absorbed dose - Energy from ionizing radiation absorbed per unit mass of tissue. For this report, the energy is assumed to be averaged over the organs or tissues being irradiated.

accident environment - Resulting conditions from an accident scenario, such as blast overpressures, fragments, and fire.

accident scenario - Launch vehicle and/or spacecraft condition resulting from failure model(s) at the component and/or subsystem level(s). Different failure modes can result in the same accident scenario.

air quality - A measure of the levels of constituents in the air.

air quality standards - The legally prescribed level of constituents in the outside air that cannot be exceeded during a specified time in a specified area. The National Ambient Air Quality Standards (NAAQS) establish minimum concentration levels set on a scientific basis for specific pollutants or group of pollutants, such as particulates.

alpha particle - Ionizing radiation produced from the spontaneous decay of certain radioactive materials, including Pu-238. An alpha particle consists of the nucleus of a helium atom. Alpha particles are easily stopped by tissue or other material; therefore, damage occurs only to tissues close to the radiation source.

ambient air - The surrounding atmosphere, usually the outside air, as it exists around people, plants, and structures. (It is not the air in the immediate proximity of the emission source.)

aquifer - A water-bearing subsurface formation capable of producing significant quantities of water under ordinary hydraulic gradients; the water can be pumped to the surface through a well or emerge naturally as a spring.

archaeological sites - Sites where material remains (e.g., fossils, relics, artifacts, and monuments) of past human life and activities and cultural remains exist.

astronomical unit (AU) - The distance from the Earth to the Sun. It is equal to 149,599,000 km (92,960,818 mi).

background radiation - Ionizing radiation present in the environment from cosmic rays and natural sources in the Earth; background radiation varies considerable with location.

Becquerel (Bq) - Unit of activity equal to 1 disintegration per second.

Biological Opinion - A formal opinion from the Fish and Wildlife Service regarding impact or potential consequences to endangered or threatened species from a proposed action.

biological resources - A group of plants, animals, and other living organisms located in a specific region.

cancer - A group of diseases characterized by uncontrolled cellular growth.

carbon dioxide (CO₂) - A heavy colorless, odorless, nonpoisonous gas that is a normal component of the ambient air; it does not support combustion; it dissolves in water to form carbonic acid; it can be formed by the combustion or decomposition of organic substances and can be absorbed from the air by plants during photosynthesis.

carbon monoxide (CO) - A colorless, odorless gas that is toxic if breathed in high concentrations over a certain period of time; it is a normal component of most automotive exhaust systems and is a product of incomplete fossil-fuel combustion.

clad - Thin-walled metal enclosure that forms the outer shell of nuclear fuel and prevents the release of plutonium dioxide and alpha particles into the environment.

committed effective dose equivalent - The sum of the committed dose equivalents to various tissues of the body, expressed in Sieverts (rem).

complementary cumulative distribution function (CCDF) - The consequence-probability distribution curves used to represent the conditional probabilities for the various health effects due to accidents.

conditional probability - The probability that a release of radioactive material could occur given an initiating accident (i.e., the accident has occurred).

cumulative density function - Alternate form by which to describe the probability distribution of an accident.

cumulative impacts - Additive environmental, health, safety, and significant socioeconomic impacts that result from a number of similar activities in an area.

Curie (Ci) - A measure of the radioactivity level of a substance (i.e., the number of unstable nuclei that are undergoing transformation in the process of radioactivity decay); one curie equals the disintegration of 3.7×10^{10} (37 billion) nuclei per second and is equal to the radioactivity of one gram of radium-226.

decay heat - The heat produced by the energy of decay of radionuclides.

decay, radioactive - The decrease in the amount of any radioactive material with the passage of time due to the transformation of one nuclide into a different nuclide or into a different energy state of the same nuclide. The decay process results in the emission of nuclear radiation (alpha, beta, or gamma radiation) and heat.

decontamination (radioactive) - The reduction or removal of radioactive contaminants from surfaces of equipment by cleaning or washing with chemicals, by wet abrasive blasting, or by chemical processing.

de minimis - This is a concept to indicate a collective dose level at which the risks to human health are considered negligible.

deposition - In atmospheric transport terms, the settling out on ground and building surfaces of atmospheric aerosols and particles (dry deposition) or their removal from the air to the ground by precipitation (wet deposition or rainout).

dose - The amount of energy deposited in the body by ionizing radiation per unit body mass.

dose commitment - The dose that an organ or tissue would receive during a specified period of time (e.g., usually 50 years) as a result of intake (as by ingestion or inhalation), frequently over 1 year, of one or more radionuclides from a defined release.

dose equivalent - The product of the absorbed dose from ionizing radiation and such factors that account for the difference in biological effectiveness due to the type of radiation and its distribution in the body (measured in Sieverts [rem]). The weighting factor for beta and gamma radiation is 1 and for alpha radiation it is approximately 20; thus, 1 Gy (100 rad) gamma radiation is equivalent to 1 Sv (100 rem), and 1 Gy (100 rad) alpha radiation is equivalent to 1 Sv (2,000 rem).

effective dose equivalent - The dose to the whole body that would have the same biological effect as a given dose equivalent to a particular organ or tissue.

endangered species - Plant and animal species that are threatened with either extinction or serious depletion in an area and are formally listed by the U.S. Fish and Wildlife Service.

Environmental Impact Statement - The document prepared pursuant to Section 102(2)(C) of the National Environmental Policy Act (NEPA) of 1969 for a major Federal action that could potentially significantly affect the environment.

exposure to radiation - The incidence of radiation from either external or internal sources on living or inanimate material by accident or intent:

- Background - exposure to natural background ionizing radiation
- Occupational - exposure to ionizing radiation that takes place during a person's working hours
- Population (or collective) - sum of the exposures to a number of persons who inhabit an area.

Failure Mode Effects and Analysis - A technique to identify all the events that might lead to a system breakdown or failure.

Gaussian plume - The distribution of material (a plume) in the atmosphere resulting from the release of pollutants from a stack or other source exhibiting the characteristic bellshaped (Gaussian) curve. The distribution of concentrations about the centerline of the plume, which is assumed to decrease as a function of its distance from the source and centerline, depends on the mean wind speed and atmospheric stability.

general public - Individuals who are normally at and beyond the affected boundary. For this EIS, the general public includes individuals on CCAS open-access ways (roads, rivers, creeks, railways).

global environment - The environment that includes worldwide factors, such as population distribution and density, general climatological condition characteristics, surface type (i.e., oceans, rock, soil), and global atmospheric inventory of plutonium.

gravity-assist - Using the planetary gravitational field to increase the velocity or decrease the injection energy of a spacecraft.

groundwater - Water within a subsurface formation that can supply springs and wells.

habitat - The place or type of site where a plant or animal naturally or normally lives and grows.

half-life (radiological) - The period required for the disintegration of half the atoms in a given amount of a specific radioactive substance. The half-life varies for specific radioisotopes from millionths of a second to billions of years.

health effect (for this EIS) - The impact to human health due to radiation doses. The number of excess latent cancer fatalities over and above the normal occurrence rate that could occur in the exposed population as a result of radiation from a launch accident or swingby accident.

historical resources - The sites, districts, structures, and objects considered limited and nonrenewable because of their association with historic events, persons, or social or historical movements.

hydrology - The science dealing with the properties, distribution, and circulation of natural water systems in and upon the Earth, including groundwater, surface water, and rainfall.

initiating event (failure) - An event that can begin an accident sequence if followed by systems failures or operator errors.

initiating probability - The probability that an identified accident scenario and associated adverse conditions (accident environment) will occur.

ionizing radiation - Any radiation capable of displacing electrons from atoms or molecules, thereby producing ions.

isotope - One of perhaps several different species of a given chemical element with the same number of protons, which are distinguishable by variations in the number of neutrons in the atomic nucleus but indistinguishable by chemical means.

maximally exposed individual - A hypothetical person located to receive the maximum possible dose.

maximum individual dose - The maximum individual dose commitment that an individual could receive over a 50-year commitment period.

micron (μm) - Unit of measure expressed as 10^{-6} meters or a micrometer.

NO_x - Refers to the oxides of nitrogen, primarily NO and NO₂. Gases, formed primarily by fuel combustion, that contribute to air pollution problems, such as the formation of acid rain and smog.

offsite - The area outside the property boundary of the CCAS site.

onsite - The area within the property boundary of the CCAS site.

onsite population - NASA, DOD, and contractor personnel who are on duty at CCAS or KSC and badged onsite visitors.

Orbiter - For purposes of this EIS, a spacecraft, such as Cassini, designed to orbit a planet (i.e., a celestial body) without landing on its surface.

ozone (O₃) - A triatomic form of oxygen that is a bluish irritating gas of pungent odor. Ozone is formed naturally in the upper atmosphere by a photochemical reaction with ultraviolet radiation.

particulates - Microscopic pieces of solids (usually air pollutants) that emanate from a range of sources. In this case, the particulates released from combustion are mainly composed of aluminum oxide (Al₂O₃). Under the NAAQS, particulates are measured in the ambient air as PM₁₀ (i.e., particles with an aerodynamic diameter less than or equal to a nominal 10 micrometers).

Pascal - A metric unit of pressure; 101,000 Pascals is equal to 14.7 pounds per square inch (psi).

person-Sievert (person-rem) - The unit of collective radiation dose commitment to a given population or the sum of the individual doses received by a population segment.

pH - A measure of the hydrogen ion concentration in an aqueous solution, specifically the negative logarithm of the hydrogen ion concentration. Acidic solutions have a pH from 0 to 7; basic solutions have a pH greater than 7.

plume - The elongated pattern of contaminated air or water originating from a point-source emission, such as a smokestack, or from a waste source, such as a hazardous waste disposal site.

plutonium - A heavy artificially produced radioactive metal (atomic number 94) with 15 isotopes. The Pu-238 isotope forms the basis for the fuel in the RTG. With a decay half-life of 87.7 years, Pu-238 is produced from the neutron bombardment of neptunium-237.

probability density function - A representative of the probability distribution of a continuous random variable.

proposed action - Significant activity(ies) evaluated by an EIS for which alternatives are proposed. For this EIS, the proposed action consists of completing the preparation for and launch of the Cassini spacecraft for its 4-year science tour of Saturn.

radiation - The emitted particles (alpha, beta, neutrons) or photons (gamma) from the nuclei of unstable (radioactive) atoms as a result of radioactive decay. Some elements are naturally radioactive; others are induced to become radioactive by bombardment in a nuclear reactor or other particle accelerator. The characteristics of naturally occurring radiation are indistinguishable from those of induced radiation.

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

radioisotope heater unit (RHU) - An RHU is a radioisotope-fueled system consisting of a 1 watt pellet of plutonium-238 dioxide, a platinum-30 rhodium (Pt-30Rh) clad, an insulation system of pyrolytic graphite (PG), and an aeroshell/impact body of fine-weave pierced fabric (FWPF). RHUs help to regulate temperatures onboard the spacecraft and the Huygens Probe.

radioisotope thermoelectric generator (RTG) - An RTG is a power system consisting of a radioisotopic heat source and a thermoelectric converter that transforms thermal energy into electricity from the radioactive decay of plutonium-238.

radioisotopes - Unstable isotopes of an element that decay or disintegrate and spontaneously emit particles or electromagnetic radiation.

receiving waters - Rivers, lakes, oceans, or other water bodies that receive treated or untreated wastewaters.

reference population - A representative group of people in a specified area that would be exposed to radiation.

rem - The unit dose representing the amount of ionizing radiation needed to produce the same biological effects as one roentgen of high-penetration X-rays (about 200 kv).

risk - The accident frequency coupled with the expected consequences. For severe accidents with high consequences, the risk is balanced by the low accident frequency. Risk is defined quantitatively as the product of the frequency and the consequence. In the case of the Cassini mission, the risk is the probability (per unit dose) of producing, in an individual or a population, a radiation-induced detrimental health effect, such as cancer.

risk assessment - A process comprising the identification of the hazards, such as patterns and level of exposure, and the evaluation of the risk (i.e., accident frequency and consequences) to affected individuals or population from a known event.

Sievert (Sv) - The SI unit of dose equivalent. One Sv is equivalent to 100 rem.

socioeconomics - Relating to or involving a combination of social and economic factors.

solar energy - Energy from the Sun or heat from the Sun converted into an energy source.

solid rocket motor (SRM) - A chemical rocket propulsion system employed for launch vehicles that uses solid propellants.

source term - The quantities of materials released during an accident to air or water pathways and the characteristics of the releases (e.g., particle size distribution, release height and duration); used for determining accident consequences.

stratosphere - An upper portion of the atmosphere above the troposphere reaching a maximum height of 50 km (164,050 ft) above the Earth's surface. The temperature is relatively constant in the lower stratosphere and gradually increases with altitude. The stratosphere is Earth's main ozone producing region.

surface water - All water on the Earth's surface, as distinguished from groundwater.

swingby - Part of the trajectory when, during an interplanetary mission, a space vehicle passes by a planet to use the planetary gravitation to change course and to obtain additional velocity/momentum.

torus - The doughnut-shape region of space swept out by the Earth as it orbits the Sun.

trajectory - The flight path that a spacecraft will take during a mission.

troposphere - The portion of the atmosphere next to the Earth's surface in which the temperature rapidly decreases with altitude, clouds form, and convection is active. The troposphere begins at ground level and extends to an altitude of 10 to 12 km (32,808 to 39,370 ft) above the Earth's surface.

upper stage - The portion of the launch system that injects the spacecraft (payload) from a parking orbit into the desired orbit or interplanetary trajectory.

water quality standards - The levels of constituents or characteristics that affect the suitability of water for a given use or classification (e.g., drinking water, recreation use, propagation of fish and aquatic life, and agricultural and industrial use). Standards are legally enforceable.

wetlands - Land or areas exhibiting the following characteristics: hydric soil conditions; saturated or inundated soil during some portion of the year and plant species tolerant of such conditions; also, areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, under normal circumstances, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

wind rose - A diagram showing the relative frequency and strength of winds from different directions for a given place.

Executive Summary

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Chapter 2

Appendix B

Chapter 3

Appendix C

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Appendix D

Chapter 5

Appendix E

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