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**SM-40.408, RADIOLOGICAL CONTROLS MANUAL: RADIOLOGICAL GLOSSARY,
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DOCUMENT CHANGE SUMMARY – This document replaces issue dated April 3, 2003. This version incorporates changes to SOP C-401. Changes are indicated with change bars.

APPLICABILITY

This procedure applies to radiological activities conducted at the Boeing Santa Susana Field Laboratory (SSFL) campus (“Boeing - SSFL”).

The terms “shall,” “should,” “may,” etc. indicate procedural requirements or suggestions for good practices. These terms are intended to convey meanings typically used in quality assurance or standards documents (e.g., ANSI).

- “Shall” in this procedure denotes a mandatory requirement.
- “Should” denotes a recommended practice, but which is not required. “Should” is used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required.
- “May” denotes an option. “May” indicates a course of action permissible within the limits of the procedure.

This procedure implements the requirements of SOP C-401, *Radiation Safety Program*. This procedure is intended to provide additional guidance to the requirements of the SOP. Stipulations of this procedure are to be interpreted in light of the SOP C-401 requirements.

Note that DOE dosimetry terminology has been changed. This procedure incorporates the revised terminology as well as the former descriptions. SOP C-401, Table 8 describes terminology equivalency.

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GLOSSARY

As they apply to DOE operations and activities, terms defined in the Atomic Energy Act of 1954 or in 10 CFR part 820 and not defined in this Glossary are used consistent with their meanings given in the Atomic Energy Act of 1954 or in 10 CFR Part 820.

Abnormal Situation - Unplanned event or condition that adversely affects, potentially affects or indicates degradation in the safety, security, environmental or health protection performance or operation of a facility.

Accountable sealed radioactive source - [DOE activities] a sealed radioactive source having a half-life equal to or greater than 30 days and an isotopic activity equal to or greater than the corresponding value provided in Appendix E of 10 CFR 835.

Activation - Process of producing a radioactive material by bombardment with neutrons, protons or other nuclear particles. Activation can also occur when materials are subjected to extremely high energy gamma or beta particle fluxes.

Activity Median Aerodynamic Diameter (AMAD) means a particle size in an aerosol where fifty percent of the activity in the aerosol is associated with particles of aerodynamic diameter greater than the AMAD.

Administrative Control Level - Level of radiation exposure established well below regulatory limits by management to help reduce individual and collective radiation dose.

Airborne radioactive material or airborne radioactivity - radioactive material dispersed in the air in the form of dusts, fumes, particulates, mists, vapors, or gases.

ALARA - See "As Low As is Reasonably Achievable,"

Alpha Particles - High-energy helium atom nuclei (the atom stripped of all electrons) produced in radioactive decay. Alpha particles have relatively great energy but are easily stopped or shielded. They will not penetrate the outermost layer of a person's skin and so pose a hazard only if the radioactive material is taken internally, by inhaling it, eating it, or by a wound or absorption through the skin.

Annual limit on intake (ALI) - the derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide in a year by the reference man (ICRP Publication 23) that would result in a committed effective dose of 5 rems (0.05 sievert) or a committed equivalent dose of 50 rems (0.5 sievert) to any individual organ or tissue. Prior to 8 July 2010, ALI values for intake by ingestion and inhalation of selected radionuclides were based on Table 1 of the U.S. Environmental Protection Agency's Federal Guidance Report No. 11, *Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion*, published September 1988. After 8 July 2010, ALI values are based on International Commission on Radiological Protection Publication 68, *Dose Coefficients for Intakes of Radionuclides by Workers*, published July, 1994 (ISBN 0 08 042651 4). This document is available from Elsevier Science Inc., Tarrytown, NY.

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Approval Authority - The Division Director of an operation or function and who is responsible for its planning and operation. The Approval Authority is generally considered to be the individual with ultimate budgetary approval authority for a Department.

As Low As Reasonably Achievable (ALARA) - The approach to radiation protection to manage and control exposures (both individual and collective) to the work force and to the general public to levels as low as is reasonable, taking into account social, technical, economic, practical, and public policy considerations. As used in this document, ALARA is not a dose limit but a process which has the objective of attaining doses as far below the applicable limits of this part as is reasonably achievable.

ALARA Committee – Multi-disciplined forum that reviews and advises management on improving progress toward minimizing radiation exposure and radiological releases.

Assessment - Evaluation or appraisal of a process, program or activity to estimate its acceptability.

Authorized limit – A limit on the concentration of residual radioactive material on the surfaces or within the property that has been derived consistent with DOE directives including the as low as is reasonably achievable (ALARA) process requirements, given the anticipated use of the property and has been authorized by DOE to permit the release of the property from DOE radiological control.

Background - radiation from:

- (I) Naturally occurring radioactive materials which have not been technologically enhanced;
- (ii) Cosmic sources;
- (iii) Global fallout as it exists in the environment (such as from the testing of nuclear explosive devices);
- (iv) Radon and its progeny in concentrations or levels existing in buildings or the environment which have not been elevated as a result of current or prior activities; and
- (v) Consumer products containing nominal amounts of radioactive material or producing nominal amounts of radiation.

"Background radiation" does not include radiation from source, byproduct or special nuclear materials. Such radioactivity is present at low levels all around and is part of the natural environment.

Becquerel (Bq) - The International System (SI) unit for activity of radioactive material. One becquerel is that quantity of radioactive material in which one atom is transformed per second or undergoes one disintegration per second (1 Bq = 1 dis/sec).

Beta Particles - High-energy electrons produced in radioactive decay. Beta particles have moderate energy and may be stopped or shielded by relatively small thickness of material, such as 1/8 in. aluminum or 1/2 in. wood. When beta particles are stopped, they lose energy and become normal electrons, eventually becoming attached to atoms.

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Bioassay - the determination of kinds, quantities, or concentrations, and, in some cases, locations of radioactive material in the human body, whether by direct measurement or by analysis and evaluation of radioactive materials excreted or removed from the human body.

Calibration - to adjust and/or determine either:

- A. The response or reading of an instrument relative to a standard (e.g., primary, secondary, or tertiary) or to a series of conventionally true values; or
- B. The strength of a radiation source relative to a standard (e.g., primary, secondary, or tertiary) or conventionally true value. This is also referred to in the Boeing-SSFL program as "validation" of sources.

Company-issued Clothing - Clothing provided by the company, such as work coveralls and shoes, for non-radiological work. For radiological control purposes, company-issued clothing shall be considered the same as personal clothing.

Containment Device - Barrier such as a glovebag, glovebox or tent for inhibiting the release of radioactive material from a specific location.

Contractor Senior Site Executive - The person at a DOE contractor-operated facility or site who has final on-site corporate authority and is often called President, General Manager, Site Manager or Director.

Critical Mass - The smallest mass of fissionable material that will support a self-sustaining chain reaction under specified conditions.

Contamination - Radioactive material, usually in small amounts, where it is not wanted. This may be dust or a coating on a surface or radioactivity absorbed into material such as concrete, wood, or plaster. Removal of contamination is called decontamination or "decon."

Contamination Reduction Corridor - A defined pathway through a hazardous waste site Contamination Reduction Zone where decontamination occurs.

Contamination Survey - Use of swipes or direct instrument surveys to identify and quantify radioactive material on personnel, on equipment or in areas.

Continuing Training - Training scheduled over a specified time such as over a two-year period for the purpose of maintaining and improving technical knowledge and skills.

Continuous Air Monitor (CAM) - Instrument that continuously samples and measures the levels of airborne radioactive materials on a "real-time" basis and has alarm capabilities at preset levels.

Contractor - any entity under contract with Boeing-SSFL with the responsibility to perform activities at a Boeing-SSFL site or facility.

Controlled Area - Any area to which access is managed by or for DOE in order to protect personnel from exposure to radiation and/or radioactive materials. This is equivalent to a Restricted Area in NRC and State of California terminology.

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Controlled Work Permit (CWP) - Permit that identifies radiological conditions, establishes worker protection and monitoring requirements, and contains specific approvals for radiological work activities. The Controlled Work Permit serves as an administrative process for planning and controlling radiological work and informing the worker of the radiological conditions.

Counseling - Advice, information exchange and guidance provided to employees on radiologically related topics, such as dose perspectives; potential health effects from radiation exposure; skin contaminations; contaminated wounds; internally deposited radioactivity; pregnancy; and radiation exposure. This advice and guidance is normally provided by knowledgeable, senior professionals from the Radiological Control Organization and other organizations, such as Medical, as appropriate.

Critique - Meetings of personnel involved in or knowledgeable about an event (either a success or an abnormal event) to document a chronological listing of the facts.

Curie - A unit of radioactivity. A curie is that amount of radioactive material that disintegrates at the rate of 3.7×10^{10} nuclear transformations ("disintegrations") per second.

Declared pregnant worker - a woman who has voluntarily declared to her employer, in writing, her pregnancy for the purpose of being subject to the occupational dose limits to the embryo/fetus as provided in regulations (e.g. § 835.206). This declaration may be revoked, in writing, at any time by the declared pregnant worker.

Decontamination - Process of removing radioactive contamination and materials from personnel, equipment or areas.

Deep Dose - The dose equivalent from external radiation determined at a tissue depth of 1 cm.

Derived air concentration (DAC) -- For the radionuclides listed in appendix A of 10 CFR 835 or appendix B of 10 CFR 20, the airborne concentration that equals the ALI divided by the volume of air breathed by an average worker for a working year of 2000 hours (assuming a breathing volume of 2400 m³). For the radionuclides listed in appendix C of 10 CFR 835 and appendix B of 10 CFR 20, the air immersion DACs were calculated for a continuous, non-shielded exposure via immersion in a semi-infinite atmospheric cloud of radioactive material. Prior to 8 July 2010, the DAC values were based upon the derived airborne concentrations found in Table 1 of the U.S. Environmental Protection Agency's Federal Guidance Report No. 11, *Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion*, published September 1988. After 8 July 2010, except as noted in the footnotes to appendix A of this part, the values are based on dose coefficients from International Commission on Radiological Protection Publication 68, *Dose Coefficients for Intakes of Radionuclides by Workers*, published July, 1994 (ISBN 0 08 042651 4) and the associated ICRP computer program, *The ICRP Database of Dose Coefficients: Workers and Members of the Public*, (ISBN 0 08 043 8768). These materials are available from Elsevier Science Inc., Tarrytown, NY.

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Derived air concentration-hour (DAC-hour) - the product of the concentration of radioactive material in air (expressed as a fraction or multiple of the DAC for each radionuclide) and the time of exposure to that radionuclide, in hours. [The quantity of material in 2,000 DAC hours is equivalent to 1 ALI. 2000 DAC-hours will result in a CEDE / Committed Effective Dose of 5,000 millirem.]

Deterministic effects - Effects due to radiation exposure for which the severity varies with the dose and for which a threshold normally exists (e.g., radiation-induced opacities within the lens of the eye).

Disintegration Per Minute (dpm) - The rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

Distinguishable from background means that the detectable concentration of a radionuclide is statistically different from the background concentration of that radionuclide in the vicinity of the site or, in the case of structures, in similar materials using adequate measurement technology, survey, and statistical techniques. (Source: 10 CFR 20.1003) Boeing Boeing-SSFL generally uses the Lower Limit of Detection (LLD) as the comparison value for determining if a measured level is distinguishable from background (See TPD RS-00012, Appendix A for discussion).

DOE - The United States Department of Energy.

DOE activity - an activity taken for or by DOE in a DOE operation or facility that has the potential to result in the occupational exposure of an individual to radiation or radioactive material. The activity may be, but is not limited to, design, construction, operation, or decommissioning. To the extent appropriate, the activity may involve a single DOE facility or operation or a combination of facilities and operations, possibly including an entire site or multiple DOE sites.

DOELAP - Department of Energy Laboratory Accreditation Program for personnel dosimetry under DOE 5480.15.

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 an exposed worker receives. These terms are used to describe the differing interactions of radiation with tissue as well as to assist in the management of personnel exposure to radiation. The commonly used unit of dose is the millirem (mrem), one-thousandth of a rem. Rem stands for roentgen-equivalent-man, a term developed to express the effect of radiation of different types.

Dose is a general term for absorbed dose, equivalent dose, effective dose, committed equivalent dose, committed effective dose, or total effective dose as defined in 10 CFR 835.

- Absorbed dose (D) - the average energy imparted by ionizing radiation to the matter in a volume element per unit mass of irradiated material. The absorbed dose is expressed in units of rad (or gray) (1 rad = 0.01 gray).

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- [Before 8 July 2010] Committed Dose Equivalent (CDE) ($H_{T,50}$) - the dose equivalent calculated to be received by a tissue or organ over a 50-year period after the intake of a radionuclide into the body. It does not include contributions from radiation sources external to the body. Committed dose equivalent is expressed in units of rem (or sievert) (1 rem = 0.01 sievert).
- [After 8 July 2010] Committed equivalent dose (HT,50) - The equivalent dose calculated to be received by a tissue or organ over a 50-year period after the intake of a radionuclide into the body. It does not include contributions from radiation sources external to the body. Committed equivalent dose is expressed in units of rems (or Sv). (see CDE, which this term replaces),
- [Before 8 July 2010] Committed Effective Dose Equivalent (CEDE) ($H_{E,50}$) - the sum of the committed dose equivalents to various tissues in the body ($H_{T,50}$), each multiplied by the appropriate weighting factor (w_T)--that is, $H_{E,50} = \sum w_T H_{T,50}$. Committed effective dose equivalent is expressed in units of rem (or sievert).
- [After 8 July 2010] Committed effective dose (E50) - The sum of the committed equivalent doses to various tissues or organs in the body ($H_{T,50}$), each multiplied by the appropriate tissue weighting factor (w_T)--that is, $E50 = \sum w_T H_{T,50} + w_{\text{Remainder}} H_{\text{Remainder},50}$. Where $w_{\text{Remainder}}$ is the tissue weighting factor assigned to the remainder organs and tissues and $H_{\text{Remainder},50}$ is the committed equivalent dose to the remainder organs and tissues. Committed effective dose is expressed in units of rems (or Sv). (see CEDE, which this term replaces).
- [Before 8 July 2010] Cumulative Total Effective Dose Equivalent - the sum of all total effective dose equivalent values recorded for an individual, where available, for each year occupational dose was received, beginning January 1, 1989.
- [After 8 July 2010] Cumulative total effective dose means the sum of all total effective dose values recorded for an individual plus, for occupational exposures received before the implementation date of this amendment, the cumulative total effective dose equivalent (as defined in the November 4, 1998 amendment to this rule) values recorded for an individual, where available, for each year occupational dose was received, beginning January 1, 1989 (See CTEDE, which this definition replaces).
- Deep dose equivalent - the dose equivalent derived from external radiation at a depth of 1 cm in tissue.
- [Before 8 July 2010] Dose equivalent (H) - the product of absorbed dose (D) in rad (or gray) in tissue, a quality factor (Q), and other modifying factors (N). Dose equivalent is expressed in units of rem (or sievert) (1 rem = 0.01 sievert).
- [After 8 July 2010] Equivalent dose (HT) - The product of average absorbed dose (DT,R) in rad (or gray) in a tissue or organ (T) and a radiation (R) weighting factor (wR). 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 Sv).

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- [Before 8 July 2010] Effective Dose Equivalent (EDE) (H_E) - the summation of the products of the dose equivalent received by specified tissues of the body (H_T) and the appropriate weighting factor (w_T)--that is, $H_E = \sum w_T H_T$. It includes the dose from radiation sources internal and/or external to the body. For purposes of compliance with this part, deep dose equivalent to the whole body may be used as effective dose equivalent for external exposures. The effective dose equivalent is expressed in units of rem (or sievert).
- [After 8 July 2010] Effective dose (E) - the summation of the products of the equivalent dose received by specified tissues or organs of the body (H_T) and the appropriate tissue weighting factor (w_T)--that is, $E = \sum w_T H_T$. It includes the dose from radiation sources internal and/or external to the body. For purposes of compliance with this part, equivalent dose to the whole body may be used as effective dose for external exposures. The effective dose is expressed in units of rems (or Sv).
- External dose or exposure - that portion of the dose equivalent (now "equivalent dose") received from radiation sources outside the body (i.e., "external sources").
- Internal dose or exposure - that portion of the dose equivalent (now "equivalent dose") received from radioactive material taken into the body (i.e., "internal sources").
- Lens of the eye dose equivalent - the external exposure of the lens of the eye and is taken as the dose equivalent at a tissue depth of 0.3 cm.
- Quality factor (Q) - the modifying factor used to calculate the dose equivalent from the absorbed dose; the absorbed dose (expressed in rad or gray) is multiplied by the appropriate quality factor.
- Shallow dose equivalent - the dose equivalent deriving from external radiation at a depth of 0.007 cm in tissue.
- [Before 8 July 2010] Total effective dose equivalent (TEDE) - the sum of the effective dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures).
- [After 8 July 2010] Total Effective Dose (TED) means the sum of the effective dose (for external exposures) and the committed effective dose.
- Weighting factor (w_T) - the fraction of the overall health risk, resulting from uniform, whole body irradiation, attributable to specific tissue (T). The dose equivalent to tissue, (H_T), is multiplied by the appropriate weighting factor to obtain the effective dose equivalent contribution from that tissue. The weighting factors are listed in GUIDE C-401.002, Appendix 1B.

Dose Assessment - Process of determining radiological dose and uncertainty included in the dose estimate, through the use of exposure scenarios, bioassay results, monitoring data, source term information and pathway analysis.

Dosimetry - Methods have been developed for measuring the dose received by a person due to exposure to radiation, both outside the body (external) and inside the body (internal). These involve the use of film badges, TLDs, or pocket dosimeters for external radiation, and bioassay procedures for internal radiation determinations.

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Electromagnetic Radiation - A type of energy that can exist in many different forms ranging in intensity of energy from very low-frequency radiowaves to FM and TV broadcast waves, microwaves and radar, infrared radiation, visible light (increasing in energy from red to blue colors), ultraviolet radiation, to X and gamma rays. Depending on the energy (or frequency or wavelength), this radiation interacts differently with matter. Only electromagnetic radiation in the X-ray region or above is considered to be "ionizing" radiation subject to this procedure.

Embryo/fetus - Developing human organism from conception until birth. Same as unborn child.

Engineering Controls - Use of components and systems to reduce airborne radioactivity and the spread of contamination by using piping, containments, ventilation, filtration or shielding.

Entrance or access point - any location through which an individual could gain access to areas controlled for the purpose of radiation protection. This includes entry or exit portals of sufficient size to permit human entry, irrespective of their intended use.

Exposure - Exposure is a measure of the amount of radiation to which a person is or might be subjected. Exposure can be measured by a variety of radiation instruments. The commonly used unit of exposure is the milliroentgen (mR), one-thousandth of a roentgen. This is a historically based unit, derived during the early days of research with radioactive materials, almost a century ago.

Extremities - Includes hands and arms below the elbow, or feet and legs below the knees.

Filter Integrity Test - Test performed on High-Efficiency Particulate Air (HEPA) filters to identify any damage to the filter or leakage around the filter. Techniques used to conduct the test are described in ANSI/UL 586-1990, "High Efficiency Particulate Air Units."

Fixed Contamination - Radioactive material that cannot be readily removed from surfaces by nondestructive means, such as casual contact, wiping, brushing or washing.

Flash X-Ray Unit - Any device that is capable of generating pulsed x-rays.

Frisk or Frisking - Process of monitoring personnel for contamination. Frisking can be performed with hand-held survey instruments, automated monitoring devices or by a Radiological Control Technician.

Gamma Rays - High-energy electromagnetic radiation produced by changes in an atomic nucleus are called gamma rays. They are physically the same as X-rays but have specific energies determined by the changes in the nucleus of a radioactive atom. Gamma rays, like X-rays, can penetrate matter easily and require large amounts of material to shield them.

General Employee (DOE) - an individual who is either a DOE or DOE contractor employee; an employee of a subcontractor to a DOE contractor; or an individual who performs work for or in conjunction with DOE or utilizes DOE facilities.

Gestation Period - The time from conception to birth, approximately 9 months.

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Gray (Gy) - SI unit of absorbed dose. One gray is equal to an absorbed dose of 1 joule per kilogram (100 rads).

High-Efficiency Particulate Air (HEPA) Filter - Throwaway extended pleated medium dry-type filter with 1) a rigid casing enclosing the full depth of the pleats, 2) a minimum particle removal efficiency of 99.97 percent for thermally generated monodisperse DOP smoke particles with a diameter of 0.3 micrometer, and 3) a maximum pressure drop of 1.0 inch w.g. when clean and operated at its rated airflow capacity.

Hot Particle - Fuel, activated corrosion product, or other particles of small size that have a high specific activity as a result of nuclear fission or neutron activation.

Hot Spot - Localized source of radiation or radioactive material normally within facility piping or equipment. The radiation levels of hot spots exceed the general area radiation level by more than a factor of 5 and are greater than 100 mrem (1 mSv) per hour on contact.

Individual - any human being.

Infrequent or First-time Activities - Radiological work activities or operations that require special management attention and consideration of new or novel radiological controls. The designation of infrequent or first-time activities is specifically applicable to facilities that conduct routine and recurring process operations, and is not applicable to facilities that routinely conduct first-time activities, such as experimental or research facilities.

Ionizing Radiation - Subatomic particles (such as electrons, neutrons, alpha particles) or high energy electromagnetic radiation (x-rays and gamma rays), with sufficient energy to ionize atoms. The common forms of radiation are alpha particles (helium nucleus), beta particles (electrons), gamma rays, and X-rays.

At the energies normally encountered at Canoga Park, only those items exposed to neutrons can become radioactive. The other types of radiation do not cause material to become radioactive.

Infra-red, microwaves, radar, radio-frequencies, and other forms of radiation do not easily ionize atoms, thus are not considered to be ionizing radiation.

Irradiator - Sealed radioactive material that has the potential to create a radiation level exceeding 500 rad (5 grays) in 1 hour at 1 meter. Although not addressed in this Manual, acceptable radiological controls for irradiator use are specified in Title 10, Code of Federal Regulations, Part 20.1603.

Lifetime Dose - Total occupational exposure over a worker's lifetime, including external and committed internal dose.

Low-Level Waste - Waste that contains radioactivity and is not classified as high-level waste, transuranic waste, spent nuclear fuel or byproduct material as defined in Section 11e(2) of the Atomic Energy Act, as amended. Test specimens of fissionable material irradiated only for research and development and not for production of power or plutonium may be classified as low-level waste provided the concentration of transuranic activity is less than 100 nCi/g.

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Member of the public - an individual who is not a general employee. An individual is not a "member of the public" during any period in which the individual receives an occupational dose.

Minor - an individual less than 18 years of age.

Monitoring - the measurement of radiation levels, airborne radioactivity concentrations, radioactive contamination levels, quantities of radioactive material, or individual doses and the use of the results of these measurements to evaluate radiological hazards or potential and actual doses resulting from exposures to ionizing radiation. In the SOP and associated SM, "monitoring" and "survey" are synonymous.

Mixed Waste - Waste containing both radioactive and hazardous components as defined by the Atomic Energy Act and the Resources Conservation and Recovery Act, respectively.

Nonstochastic effects - effects due to radiation exposure for which the severity varies with the dose and for which a threshold normally exists (e.g., radiation-induced opacities within the lens of the eye).

NPDES - National Pollution Discharge Elimination System; a federal program requiring the formal permitting of effluent from sewage and other waste water systems.

NVLAP - National Voluntary Laboratory Accreditation Program. This certifies dosimetry programs for the NRC and the State of California.

Nuclear Criticality - A self-sustaining chain reaction, i.e., the state in which the effective neutron multiplication constant of system of fissionable material equals or exceeds unity.

Occupational Dose - an individual's ionizing radiation dose (external and internal) as a result of that individual's work assignment. Occupational dose does not include doses received as a medical patient or doses resulting from background radiation or participation as a subject in medical research programs.

Person - any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, Government agency, any State or political subdivision of, or any political entity within a State, any foreign government or nation or other entity, and any legal successor, representative, agent or agency of the foregoing; provided that person does not include the Department or the United States Nuclear Regulatory Commission.

Personnel Dosimetry - Devices designed to be worn by a single person for the assessment of dose equivalent such as film badges, thermoluminescent dosimeters (TLDs), and pocket ionization chambers.

Personnel Monitoring - Systematic and periodic estimate of radiation dose received by personnel during working hours. Also, the monitoring of personnel, their excretions, skin or any part of their clothing to determine the amount of radioactivity present.

Personal Protective Equipment (PPE) - Equipment such as respirators, face shields and safety glasses used to protect workers from excessive exposure to radioactive or hazardous materials.

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Planning Guide - Radiation doses can be estimated for a given activity. Based upon these estimates, a dose limit can be derived that would be reasonably anticipated to be adequate for the proposed work to be performed. This limit is called a "planning guide." All operations should be designed and planned so that actual exposures will be less than the Planning Guide. Planned operations that exceed the Planning Guide must have the approval of the Radiation Safety Officer and the designated Approval Authority.

Protective Clothing - Clothing provided to personnel to minimize the potential for skin, personal and company issued clothing contamination. Also referred to as "anticontamination clothing," "anti-Cs" and "PCs."

Planned Special Exposure - Preplanned, infrequent exposure to radiation, separate from and in addition to the annual dose limits.

Pre-filter - Filter that provides first stage air filtration to remove larger particulates and prolong the efficient use of a HEPA filter.

Prenatal radiation Exposure - The exposure of an embryo/fetus to radiation.

Primary Dosimeter - A dosimeter worn on the body used to obtain the formal record of whole body radiation dose.

Process Equipment - Large equipment or components that have been utilized in the operation of a facility, process, or other process related activity. Examples of process equipment would be tanks, building components, piping, capital equipment, etc. Small hand or power tools, personal effects, consumable supplies, trash routinely accumulated from work activities, etc. are not considered to be process equipment.

Qualification Standard - A document that states and defines the required physical attributes and the technical, academic and practical knowledge and skills developed through training, education and on-the-job performance for the successful completion of a training program. Sometimes referred to as a "Qual Card."

Quarter - Refers to a calendar quarter, for regulatory purposes defined as January 1 through March 31, April 1 through July 30, July 1 through September 30, and October 1 through December 31. Starting and ending dates of calendar quarters may be adjusted under certain conditions.

Rad - Unit of absorbed dose. One rad is equal to an absorbed dose of 100 ergs per gram or 0.01 joules per kilogram (0.01 gray).

Radiation - ionizing radiation: alpha particles, beta particles, gamma rays, X-rays, neutrons, high-speed electrons, high-speed protons, and other particles capable of producing ions. Radiation, as used in this part, does not include non-ionizing radiation, such as radio- or micro-waves, or visible, infrared, or ultraviolet light.

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Radiation-Producing Device - Equipment that accelerates electrons to high energies may produce X-rays when the electrons are stopped by components in the device. Some devices, such as X-ray machines, are purposely designed to create X-rays. Other devices, such as electron beam welders, electron microscopes, and some types of lasers, may produce radiation as a by-product. Generally any equipment that produces voltages above 25,000 volts may be radiation-producing devices.

Radiation Survey - Measurement with instrumentation to evaluate and assess the presence of radioactive materials or other sources of radiation under a specific set of conditions.

Radiation Weighting Factor (wR) - the modifying factor used to calculate the equivalent dose from the average tissue or organ absorbed dose; the absorbed dose (expressed in rad or gray) is multiplied by the appropriate radiation weighting factor. The radiation weighting factors to be used for determining equivalent dose in rems are described in the Table [RADIATION WEIGHTING FACTORS](#).

Radioactive Decay - The process of spontaneous change of atoms of one kind into atoms of another kind, usually accompanied by release of ionizing radiation. It is termed "decay" because the amount or activity decreases or decays with time.

Radioactive Material - Radioactive material is any substance that spontaneously emits ionizing radiation during the process of nuclear decay. Radioactive material includes activated material, sealed and unsealed sources, and naturally occurring radioactive isotopes. Although any such behavior of material qualifies it as radioactive, certain types or categories of materials are not subject to regulatory controls.

Radioactive Material Transportation - the movement of radioactive material by aircraft, rail, vessel, or highway vehicle. Radioactive material transportation does not include preparation of material or packagings for transportation, storage of material awaiting transportation, or application of markings and labels required for transportation.

Radioactive Waste - Solid, liquid or gaseous material that contains radionuclides regulated under the Atomic Energy Act, as amended, and is of negligible economic value considering the cost of recovery.

Radioactivity - A natural and spontaneous process by which the unstable atoms of an element emit or radiate excess energy from their nuclei and, thus, change (or decay) to atoms of a different element or to a lower energy state of the same element.

Radiography - Examination of the structure of materials by nondestructive methods, using a radioactive source or a radiation generating device.

Radiographer - A member of the Boeing-SSFL Quality Assurance Department who is qualified according to ASNT guidance as a Level I, Level II, or Level III radiographer; who may perform or directly supervise radiographic operations; and who is responsible for ensuring compliance with the California Code of Regulations (CCR) and Boeing-SSFL procedural requirements during conduct of operations.

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Radiological Area - any area within a controlled area defined in this section as a "radiation area," "high radiation area," "very high radiation area," "contamination area," "high contamination area," or "airborne radioactivity area." These definitions summarize primary features. Full discussions are found in SM-40.402 - 404.

- **Radioactive Material Area (RMA)** - any area within a controlled area, accessible to individuals, in which items or containers of radioactive material exist and the total activity of radioactive material exceeds the applicable values provided in [appendix E](#) of 10 CFR 835 or appendix C of 10 CFR 20. RMAs are not required for regulatory exempt articles or materials.
- **Radioactive Materials Management Area (RMMA)** - An area specified by Boeing-SSFL where a potential exists for hazardous waste to also be radioactively contaminated, thus rendering it "mixed hazardous waste." Special procedures are required to control and dispose of such wastes.
- **Controlled Work Permit Area** - Areas for which Radiation Safety requires that a Controlled Work Permit be issued for any work entry.
- **Radiation Area** - any area, accessible to individuals, in which radiation levels could result in an individual receiving an equivalent dose to the whole body (formerly referred to as a deep dose equivalent) in excess of 0.005 rem (0.05 millisievert) in 1 hour at 30 centimeters from the source or from any surface that the radiation penetrates.
- **High Radiation Area** - any area, accessible to individuals, in which radiation levels could result in an individual receiving an equivalent dose (formerly referred to as a deep dose equivalent) in excess of 0.1 rem (0.001 sievert) in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.
- **Very High Radiation Area** - An area, accessible to individuals, in which radiation levels could result in an individual receiving an absorbed dose in excess of 500 rads (5 grays) in one hour at 1 meter from a radiation source or from any surface that the radiation penetrates. Such areas are immediately dangerous to life or health and are subject to stringent access controls and alarm features.
- **Radiological Buffer Area (RBA)** - A intermediate area established to prevent the spread of radioactive contamination. The area surrounds or is contiguous with Contamination Areas, High Contamination Areas, or Airborne Radioactivity Areas.
- **Contamination (or Contaminated) Area** - any area, accessible to individuals, where removable surface contamination levels exceed or are likely to exceed the removable surface contamination values specified in Appendix D of 10 CFR 835, but do not exceed 100 times those values.
- **High Contamination Area** - any area, accessible to individuals, where removable surface contamination levels exceed or are likely to exceed 100 times the removable surface contamination values specified in Appendix D of 10 CFR 835.
- **Airborne Radioactivity Area** - Area, accessible to individuals, where the measured concentration of airborne radioactivity, above natural background, exceeds either:
 - For State of California licensed facilities:
 - 1) the derived air concentrations (DACs) specified in 10 CFR 20, Appendix B; or,

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- 2) 12 DAC-hours of intake (0.6 ALI) in one week, with no credit provided for respiratory protection..
- For Department of Energy Facilities:
 - A. The concentration of airborne radioactivity, above natural background, exceeds or is likely to exceed the derived air concentration (DAC) values listed in Appendix A or Appendix C of 10 CFR 835; or
 - B. An individual present in the area without respiratory protection could receive an intake exceeding 12 DAC-hours in a week.

Radiological Posting - Sign or label that indicates the presence or potential presence of radiation or radioactive materials.

Radiological Work - Any work that requires the handling of radioactive material or which requires access to radiation areas, high radiation areas, buffer areas, contamination areas, high contamination areas or airborne radioactivity areas.

Radiological worker - a general employee whose job assignment involves operation of radiation producing devices or working with radioactive materials, or who is likely to be routinely occupationally exposed above 0.1 rem (0.001 sievert) per year total effective dose (formerly total effective dose equivalent).

Radiological Control Hold Point - Cautionary step in a Technical Work Document requiring the Radiological Control Organization to perform some action or verification. The Radiological Control Hold Point requirements should be satisfactorily completed before the work is continued.

Real Property - land and anything permanently affixed to the land such as buildings, fences and those things attached to the buildings, such as light fixtures, plumbing and heating fixtures.

Real-time Air Monitoring - measurement of the concentrations or quantities of airborne radioactive materials on a continuous basis.

Refresher Training - Training scheduled on the alternate year when full retraining is not completed for Radiological Worker I and Radiological Worker II personnel.

Regulatory Limit - Exposure, possession, or other types of limits established by government regulatory bodies. Such limits have the force of law. Regulatory limits may not be exceeded except under certain conditions defined in the pertinent regulations. The exceeding of regulatory limits may result in citations and fines by regulatory bodies.

Release To Uncontrolled Areas - Release of material from administrative control after confirming that the residual radioactive material meets the guidelines in DOE 5400.5 or related regulatory documents.

Rem - Unit of dose equivalent. Dose equivalent in rem is numerically equal to the absorbed dose in rad multiplied by a quality factor, distribution factor and any other necessary modifying factor (1 rem = 0.01 sievert).

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Removable Contamination - Radioactive material that can be removed from surfaces by nondestructive means, such as casual contact, wiping, brushing or washing.

Respiratory Protective Device - an apparatus, such as a respirator, worn by an individual for the purpose of reducing the individual's intake of airborne radioactive materials.

Restricted Area - An area where access is controlled for purposes of radiation safety (same meaning as "controlled area").

Shallow Dose Equivalent - Applies to the external exposure of the skin or an extremity. It is taken as the dose equivalent at a tissue depth of 0.007 centimeter averaged over an area of 1 square centimeter.

Shielding - Material used to stop radiation is called shielding. Some radiation, such as alpha and beta particle radiation, requires small thickness of material to stop all the radiation. Others, such as gamma and X-rays, require greater thickness depending upon the intensity of the source. That is, the more powerful or intense the source of radiation, the thicker the shield must be to reduce the exposure to an acceptable level.

Sievert (Sv) - SI unit of any of the quantities expressed as dose equivalent. The dose equivalent in sieverts is equal to the absorbed dose in grays multiplied by the quality factor (1 Sv = 100 rems).

Site - An area managed by DOE where access can be limited for any reason. Controlled Areas are located within the Site Boundary.

Source Leak Test - a test to determine if a sealed radioactive source is leaking radioactive material.

Source Material - Normal and natural uranium, depleted uranium, thorium, or any other material as determined pursuant to the provisions of Section 61 of the Atomic Energy Act of 1954, as amended.

Source, Sealed Radioactive - a radioactive source manufactured, obtained, or retained for the purpose of utilizing the emitted radiation. The sealed radioactive source consists of a known or estimated quantity of radioactive material contained within a sealed capsule, sealed between layer(s) of non-radioactive material, or firmly fixed to a non-radioactive surface by electroplating or other - intended to prevent leakage or escape of the radioactive material. Sealed radioactive sources do not include reactor fuel elements, nuclear explosive devices, and radioisotope thermoelectric generators.

Source, Unsealed - A quantity of radioactive material that is contained in a container that does not meet the manufacturing criteria of a sealed source (see above). While the container may prevent dispersion of the materials, it does not meet the acceptance criteria of ANSI N542, "Sealed Radioactive Sources, Classification."

Special Nuclear Material (SNM) - Plutonium, uranium enriched in the isotope 233 or 235, and any other material as determined pursuant to the provisions of Section 61 of the Atomic Energy Act of 1954, as amended.

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Special tritium compound means any compound, except for H₂O, that contains tritium, either intentionally (e.g., by synthesis) or inadvertently (e.g., by contamination mechanisms).

Step-Off Pad - Transition area between contaminated and non-contaminated areas that is used to allow exit of personnel and removal of equipment.

Standard Radiation Symbol - Symbols designed and proportioned as illustrated in accordance with ANSI N2.1 for radiation symbols and ANSI N12.1 for fissile material.

Sticky Pad - Step-off pad provided with a tacky surface to reduce the potential for inadvertently tracking contamination out of a contaminated area.

Stochastic effects - malignant and hereditary diseases for which the probability of an effect occurring, rather than its severity, is regarded as a function of dose without a threshold, for radiation protection purposes.

Technical Work Document - A term used to generically identify formally approved documents that direct work, such as procedures, work packages, or job or research plans.

Tissue weighting factor (wT) - the fraction of the overall health risk, resulting from uniform, whole body irradiation, attributable to specific tissue (T). The equivalent dose to tissue, (HT), is multiplied by the appropriate tissue weighting factor to obtain the effective dose (E) contribution from that tissue.

Transuranic Waste - Without regard to source or form, waste that is contaminated with alpha-emitting transuranic radionuclides having half-lives greater than 20 years and concentrations greater than 100 nCi/g at the time of assay.

Thermoluminescent Dosimeter (TLD) - Radiation monitoring device used to record the radiological exposure of personnel or areas to certain types of radiation.

Unusual Occurrence - Nonemergency occurrence that has significant impact or potential for impact on safety, environment, health, security, or operations. Examples of the types of occurrences that are to be categorized as unusual occurrences are contained in DOE 5000.3A.

Visitor - Person requesting access to Controlled Areas, who has not been trained to the level required to permit unescorted access.

Week - a period of seven consecutive days.

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

X-Rays - High-energy electromagnetic radiation produced by stopping energetic electrons. They are physically the same as gamma rays but are usually produced with a broad range of energies.



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Year - the period of time beginning on or near January 1 and ending on or near December 31 of that same year used to determine compliance with the provisions of this part. The starting and ending date of the year used to determine compliance may be changed provided that the change is made at the beginning of the year and that no day is omitted or duplicated in consecutive years.