APPENDIX 2

TERMS USED

abnormal situation: an 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

accelerator: a device employing electrostatic or electromagnetic fields to impart kinetic energy to molecular, atomic or sub-atomic particles and capable of creating a radiological area

accelerator safety envelope: a set of verifiable physical and administrative credited controls that define the bounding conditions for safe operation and address the accelerator facility hazards and risks

access control system: engineered and/or administrative systems that limit radiation dose to personnel by managing and limiting entry to an area

accidental exposure: unintended contact with a substance or change in the physical environment (e.g., radiation) resulting from an accident

accountable sealed radioactive source: 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 835.2(a)

activated material: material that has been exposed to a radiation field capable of causing radio-activation and has been determined through process knowledge and/or survey/analysis (per approved procedures) to have radioactivity distinguishable from background

administrative control: procedures and activities which involve human actions that are designed to minimize or control personnel radiation exposure (examples include radiological work permits and sweep procedures)

administrative control level: a numerical dose constraint established at a level below regulatory limits that administratively controls and helps reduce individual and collective dose; this level helps ensure that no person exceeds the Department of Energy limit. No one at Jefferson Lab may exceed this dose level without prior permission from the Radiation Control Department Manager and the Lab Director.

airborne radioactivity: radioactive material in any chemical or physical form that is present in ambient air, above natural background

airborne radioactivity area: an area where the measured airborne activity levels exceed the levels specified in 10 CFR 835

APPENDIX 2

TERMS USED

alert level (design goal): the cumulative annual exposure used for facility design purposes, and, when such a level is approached or exceeded, triggers a review of ALARA efforts in place for the affected individual(s) or population

as low as reasonably achievable (ALARA): making every reasonable effort to maintain exposures to radiation as far below the dose limits as is practical, taking into account the state of technology and other societal and economic considerations, including the benefit of the radiation producing activity

assigned radiation monitor (ARM): a person who has received training beyond the Radiation Worker I course in the use of radiation protection instrumentation and administrative procedures for controlling exposure to radiation and handling of radioactive material

background: radiation from
- naturally occurring radioactive materials which have not been technologically enhanced;
- cosmic sources;
- global fallout as it exists in the environment (such as from the testing of nuclear explosive devices);
- 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
- consumer products containing nominal amounts of radioactive material or producing nominal amounts of radiation.

becquerel (Bq): the Standard International (SI) unit of radioactivity; one Bq is the quantity of radioactive material in which one atom is transformed per second or undergoes one disintegration per second

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: adjusting and/or determining either 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
- strength of a radiation source relative to a standard (e.g., primary, secondary, or tertiary) or conventionally true value

APPENDIX 2

TERMS USED

clearance: removal of property that contains or may contain residual radioactive material from DOE radiological control under 10 CFR Part 835 and DOE Order 458.1

collective dose: the sum of the individual doses received in a given period of time by a specific group of people

combustible: able to catch fire or burn easily

committed effective dose (E_{50}): 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, $E_{50} = \Sigma w_T H_{T,50} + w_{Remainder} H_{Remainder,50}$. Where $w_{Remainder}$ is the tissue weighting factor assigned to the remainder organs and tissues and $H_{Remainder,50}$ is the committed equivalent dose to the remainder organs and tissues. Committed effective dose is expressed in units of rem (or Sv).

committed equivalent dose ($H_{T,50}$): 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 (expressed in units of rem [or Sv]). It does not include contributions from radiation sources external to the body.

confined space: any area that *meets all three* of the following criteria
- is large enough and so configured that an employee can bodily enter and perform assigned work
- has limited or restricted means for entry or exit
- is not designed for continuous employee occupancy

contamination: radioactive material in a form that makes it susceptible to uncontrolled distribution to surfaces or areas. It can be (a) loose surface contamination that can be removed by incidental contact; or (b) fixed contamination that cannot be easily removed, but requires more aggressive actions to spread the radioactivity.

contamination 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 2B, Contamination Control Levels

controlled area: an area to which access is managed in order to protect individuals from exposure to radiation and/or radioactive material. Individuals who enter only the controlled area without entering radiological areas or radioactive material areas are not expected to receive a total effective dose of more than 0.1 rem (0.001 sievert) in one year.

APPENDIX 2

TERMS USED

controlled area radiation monitor (CARM): a radiation detection system which is interlocked to the Personnel Safety System and designed to turn off the electron beam if radiation levels exceed pre-established set points

corrective action: an activity that restores a service, item, component, or process to a state of acceptable compliance with specifications, procedures, or regulatory requirements

critique (or assessment): a detailed analysis by personnel involved in or knowledgeable of a functional area, i.e., radiological control

curie: unit of radioactivity equivalent to 37 billion 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 § 835.206; the declaration may be revoked, in writing, at any time

decontamination: process of removing radioactive contamination and materials from personnel, equipment or areas

derived air concentration (DAC):

- for the radionuclides listed in 10 CFR 835, Appendix A to 10 CFR 835 -- the airborne concentration that equals the annual limit intake (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 m^3)
- for the radionuclides listed in 10 CFR 835, Appendix C -- the air immersion DACs calculated for continuous, non-shielded exposure via immersion in a semi-infinite atmospheric cloud

discharge: the action of releasing a liquid, gas, or other substance from where it was confined

documentation: material that provides official information or evidence or that serves as a record

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

dose limit: maximum allowed radiation dose specified by statute or DOE Order to which an individual or group (see collective dose) may be exposed

APPENDIX 2

TERMS USED

dose tracking: the use of supplemental, direct reading dosimeters (or other equivalent means) for purposes of assessing, tracking and managing radiation exposures associated with a particular work activity

dosimeter: a device, normally including OSL elements, track-etch devices or other radiation sensing elements, used to determine the cumulative dose during the period used

effective dose (E): the summation of the products of the equivalent dose received by specified tissues of the body (H_T) and the appropriate tissue weighting factor (W_T) that is $E = \Sigma W_T H_T$. It includes the dose from radiation sources internal and/or external to the body as is expressed in units of rem (or Sv). For purposes of compliance with 10 CFR 835, equivalent dose to the whole body may be used as effective dose for external exposures.

effluent: any treated or untreated air emission or liquid discharge, including stormwater runoff, at a site or facility

embryo/fetus: a developing human organism from conception until birth

emergency exposure: radiation exposure received as a result of responding to a fire, injury or other accident/emergency event

engineered controls: equipment, structures, and devices which limit or prevent radiation exposure to personnel with little or no human intervention; these controls may be passive (e.g., shielding) or active (e.g., interlocks) in nature

entry controls: any administrative or engineered action, device, process, procedure or item that is intended to increase assurance that only authorized individuals enter an area

equivalent dose (H_T): the product of the average absorbed dose ($D_{T,R}$) in rad (or Gy) in a tissue or organ (T) and a radiation weighting factor (W_R). 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 an extremity and the skin is assessed at a depth of 0.007 cm in tissue. Equivalent dose is expressed in units of rem (or Sv).

excavation: digging, grading, tunneling, trenching, or drilling below grade, and installing stakes, rods, etc. to a depth greater than 12 inches; it includes penetrations of slabs on grade such as sidewalks and roads

APPENDIX 2

TERMS USED

exclusion area: an area (normally only applicable to an accelerator enclosure) that is locked and interlocked to prevent personnel access while the accelerator is operating/operational. Fully enclosed accelerator Exclusion Areas with credited access control systems are not considered accessible.

exposure: term used generally to describe receiving radiation dose; AND, a measure of the ionization produced in air by x or gamma radiation. The traditional unit for exposure is the Roentgen (R). 1 Roentgen refers to the amount of photon radiation required to produce ions carrying 1 electrostatic unit of electrical charge (2.08 billion electrons) in 1 cubic centimeter of air at standard temperature and pressure. Whole body exposure to 1R of x or gamma radiation results in an equivalent dose of approximately 1 rem.

exposure rate: the rate of exposure to external sources of ionizing radiation, usually measured in sub-units of Roentgen per hour

external dose or exposure: that portion of the equivalent dose received from radiation sources (e.g., external sources) outside the body

general employee radiological training (GERT): the radiation safety awareness course required of individuals needing unescorted access to a controlled area, but not to any higher designated level of radiologically controlled area

gestation period: the time from conception to birth, usually 40 weeks approximately 9 months

gray (Gy): system international (SI) unit of absorbed dose; one gray is equal to an absorbed dose of 1 joule per kilogram (100 rad)

groundwater: water found underground in the cracks and spaces in soil, sand and rock; it is stored in and moves slowly through geologic formations of rocks, sand and soil called aquifers

hazard: an event or physical condition that has the potential to cause fatalities, injuries, illness, property damage, infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm or loss

hazardous material: a material that has been determined to be capable of posing risk to health, safety, and/or property and requires special care in handling. The term includes hazardous substances, hazardous wastes, marine pollutants, and elevated temperature materials; see 49 CFR 172

APPENDIX 2

TERMS USED

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 2B, Contamination Control Limits

high radiation area (HRA): any area, accessible to individuals, in which radiation levels could result in an individual receiving an equivalent dose to the whole body in excess of 0.1 rems (0.001 Sv) in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates

hot particle: a small, discrete, highly radioactive particles capable of causing extremely high doses to a localized area in a short period of time

hot spot: spot where the (deep) dose rate on contact is greater than 100 mrem/h and at least five times the (deep) dose rate at 30 cm

interlock: any automatic device that causes the cessation of radiation from a radiation-producing device or prevents access to the radiation while it is present

internal dose or exposure: that portion of the equivalent dose received from radioactive material taken into the body (i.e., "internal sources")

ionizing radiation: radiation consisting of particles, X-rays, or gamma rays with sufficient energy to cause ionization in the medium through which it passes

lockout device: a device that enables a lock to be attached to an energy-isolating device, permitting the device to be secured in a safe position

material release: transfer of property to custodianship of a non-DOE entity

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

moveable shielding: a shielding configuration that can be altered using non-destructive means

natural background: the ionizing radiation in the environment that originates from natural sources such as radium in drinking water, cosmic radiation or radon

APPENDIX 2

TERMS USED

non-ionizing radiation: radiation of insufficient energy to dislodge an orbital electron, but may be capable of significant energy deposition. The transition between ionizing and non-ionizing radiation occurs at an energy level of about 12 electron volts.

notable event: an unplanned or abnormal event that affects or has the potential to affect performance, reliability, safety, or the environment. It may or may not meet DOE occurrence reporting criteria.

occupational dose: an individual's ionizing radiation dose (external and internal) as a result of that person's work assignment. Occupational dose does not include dose received as a medical patient, background radiation, or participation as a subject in medical research programs.

operational safety procedure (OSP): a work control document, with a limited effective life of up to three years, that follows the standard format specified in ES&H Manual Chapter 3310 Appendix T1 Operational Safety Procedure (OSP) and Temporary OSP Procedure. OSPs address unique or complex hazards *not* covered in the ES&H Manual, or require more specific detailed instructions. The document is signed by the appropriate authorities before work proceeds; and is read and signed by each worker before they take part in the work.

personal protective equipment (PPE): equipment that is intended to be worn or held by a person to protect that person from harm

personally identifiable information (PII): information collected or maintained about an individual, including but not limited to, education, financial transactions, medical history and criminal or employment history, and information that can be used to distinguish or trace an individual's identity, such as his/her name, social security number, date and place of birth, mother's maiden name, biometric data, and any other personal information that is linked or linkable to a specific individual

personnel dosimetry: device designed to be worn by a person for the assessment of dose, such as thermoluminescent dosimeters (TLDs), optically stimulated luminescence (OSL) dosimeters and self-reading electronic dosimeters

personnel monitoring: **s**ystematic and periodic estimate of radiation dose received by personnel during work; may also include monitoring of their excretions, skin, or any part of their clothing to determine the amount of radioactivity present

APPENDIX 2

TERMS USED

personnel safety system: an active engineered control system comprised of sensors, interlocks, and other warning devices which prevents personnel access to the beam enclosure and/or terminates accelerator operation in the event that trip points are exceeded or interlocks are triggered

planned special exposure: (see 10 CFR § 835.204)

prenatal radiation exposure: dose received by a female worker while pregnant

prompt radiation: particulate or electromagnetic radiation resulting from the accelerator beam or interaction of the beam with surrounding matter. Prompt radiation ceases immediately after shut off of the beam.

protective clothing: clothing provided to personnel to minimize the potential for skin and personal contamination

radiation absorbed dose (rad): the special unit of absorbed dose used to quantify the amount of radiation energy absorbed per unit mass of any material. One rad is equal to an absorbed dose of 100 ergs/gram or 0.01 J/kg.

radiation area (RA): any area, accessible to individuals, in which radiation levels could result in an individual receiving an equivalent dose to the whole body in excess of 0.005 rem (0.05 mSv) in 1 hour at 30 centimeters from the source or from any surface that the radiation penetrates

radiation deviation report (RDR): a minor, abnormal event regarding radiological controls; RDRs are investigated and tracked to and affects or has the potential to affect performance, reliability, safety, or the environment; it may or may not meet DOE occurrence reporting criteria

radiation protection program: The documented program, approved by DOE, including, but not limited to, the plans, schedules, and other measures developed and implemented to achieve and ensure continuing compliance with 10 CFR 835 and to apply the as low as is reasonably achievable (ALARA) process to occupational dose

radiation-generating device (RGD): a device which produces ionizing radiation, including certain sealed sources; small particle accelerators used for single purpose applications which produce ionizing radiation (e.g., radiography); and, electron generating devices that produce X-rays incidentally

APPENDIX 2

TERMS USED

radio frequency (RF): generally, electromagnetic energy with frequencies in the range of 10 kHz–300 GHz; sometimes the term is used to refer more narrowly to the frequency range below 300 MHz

radioactive material (RAM): for purposes here, any material, equipment or system component determined to be contaminated or suspected of being contaminated in excess of the values listed in 10 CFR 835, Appendix D; as well as activated material (defined above; including sealed and unsealed sources), and any other material that emits ionizing radiation (excluding non-regulated consumer products)

radioactive materials 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]

radioactive material transportation: the movement of radioactive material by aircraft, rail, vessel, or highway vehicle; it does not include preparation of material or packaging for transportation, storage of material awaiting transportation, or application of markings and labels required for transportation

radioactive waste: generic term for low-level radioactive components and/or contamination control scrap generated as a result of accelerator operations (material having no further use to the Lab that is suitable for disposal)

radioactivity: the spontaneous nuclear transformation of atoms, accompanied by the emission of ionizing radiation

radiography: examination of the structure of materials by nondestructive methods, using a radioactive source or a radiation-generating device

radiological area: any area within a controlled area which must be posted as a radiation area, high radiation area, very high radiation area, contamination area, high contamination area, or airborne radioactivity area

radiological barrier: ropes, chains, doors, gates or other similar physical objects used to denote and reinforce the presence of the boundary to an area controlled for radiological purposes

radiological buffer area (RBA): an intermediate area established to prevent the spread of radioactive contamination and to protect personnel from radiation exposure

APPENDIX 2

TERMS USED

radiological control hold points: 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.

radiological control operating procedure (RCOP): documents that define the scope and limitations to a task or procedure and are typically used for handling certain radioactive sources, for operating radiation producing machines, and in experimental setups for first-time activities to establish hold points

radiological control technician (RCT): Radiation Control Department support personnel who provide health physics support and oversight in the workplace. Among other things, they conduct work planning and radiological surveillance, assist in the implementation of radiological control, perform radiological analyses, and support the environmental monitoring program.

radiological posting: sign, marking, or label that indicates the presence or potential presence of radiation or radioactive materials

radiological/radiation survey: measurement of radiation or radioactive materials, usually using portable field instrumentation

radiological/ radiation worker: a general employee whose job assignment involves operation of radiation generating devices or working with radioactive materials, or who is likely to be routinely occupationally exposed above 0.1 rem per year total effective dose

radiological work: any work that requires the handling of radioactive material or access to radiation areas, high radiation areas, contamination areas, high contamination areas, or airborne radioactivity areas

radiological work permit (RWP): document that identifies radiological conditions, establishes worker protection and monitoring requirements, and contains specific approvals for radiological work activities; it serves as an administrative process for planning and controlling radiological work and informing the worker of the radiological conditions

radiologically controlled area (RCA): a posted area within a controlled area where personnel could receive a total effective dose in excess of 100 mrem in one year (unless otherwise excepted by the RCM, a whole body dose rate > 0.05 mrem/h shall define an RCA)

radionuclide: a radioactive isotope of an element which decays spontaneously, emitting radiation

APPENDIX 2

TERMS USED

regulation: a set of requirements developed by an administrative agency and, having been subjected to the rulemaking process, carries the force of law

release: any spilling, leaking, pumping, pouring, emitting, emptying, discharging, or disposing into the environment of any hazardous chemical (HC), extremely hazardous substance (EHS), hazardous substance (HS), or other environmentally harmful material (EHM) outside of those discharges authorized under an existing permit or other sanctioned program

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

risk: the quantitative or qualitative expression of possible harm or loss that considers both the probability that an event will occur and the consequences of that event

Roentgen (R): the special unit for exposure; the amount of gamma- or x-rays which produce ions carrying one electrostatic unit of charge in one cubic centimeter of dry air

Roentgen equivalent man (rem): the traditional unit for quantities expressed as equivalent dose or effective dose (100 rem = 1 Sv)

sealed radioactive source: 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 means 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.

self-reading pocket dosimeter (SRPD): a personal exposure monitoring device (i.e., a dosimeter) that can be read “on the spot” by its user – unlike OSLs, which require special processing. Examples of SRPDs include: pocket ionization chambers (PICs), neutron bubble dosimeters, and digital alarming dosimeters (DADs).

shielding: material that is placed between a radiation source and potentially exposed personnel, environmental media, flora or fauna to reduce the potential for exposure to the personnel or objects of interest

APPENDIX 2

TERMS USED

credited shielding: shielding used in an accelerator to meet requirements of the Accelerator Safety Envelope. The two categories of credited shielding are:

movable – shielding that can be moved when necessary (e.g., lead bricks)

permanent – shielding that cannot be moved (e.g., concrete structures, walls, floors, labyrinths, and earth cover)

sievert (Sv): SI unit for quantities expressed as equivalent dose or effective dose (1 Sv = 100 rem)

source custodian: an individual who is trained and designated to maintain cognizance over accountability and control of assigned sealed radioactive sources

source leak test: a test to determine if a sealed radioactive source is leaking radioactive material

source user: an individual who is trained and authorized to use sealed radioactive sources

standard operating procedure (SOP): a work control document that follows a standard department format; it outlines the process steps associated with a task and identifies the authority and responsibilities assigned to personnel

standards: a set of requirements, procedures, or specifications pertaining to a particular topic

stop work order: a definitive statement made that an imminent danger is present; after which all related work is immediately stopped until a resolution can be found

subject matter experts (SME): a person or group of persons with recognized expertise or authority in a particular functional area; he/she is normally the author of procedures, TBDs, etc. written within the RCD

tag-out: a method of keeping equipment from being set in motion or preventing energy from being sent through a device, whereby a written warning – a danger tag – is attached to an energy-isolating device informing co-workers NOT to turn the power on or off, as the situation warrants. It is used in conjunction with lockout, except for *special lockout situations without tags* or alone in *special tag out situations without locks*.

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

APPENDIX 2

TERMS USED

temporary operational safety procedure (TOSP): an administrative control measure which describes hazards present and what controls are in place to mitigate or minimize the hazards. TOSPs are used during non-routine operations or temporary configurations of equipment or systems such as special tests or commissioning activities.

total effective dose (TED): the sum of the effective dose (for external exposures) and the committed effective dose

uncontrolled area: an area where there are no controls for radiation protection purposes

unrestricted (free) release: the release of property from radiological control, with no restrictions regarding subsequent use or disposition

ventilation control: air-moving devices and systems that remove contaminated air from a worker's breathing zone, or systems that control air movement, provide filtration or otherwise reduce a contaminant concentration or prevent or control emission or release to other areas. Examples of ventilation control include chemical fume hoods, HEPA filtration, and slot and canopy hoods.

very high radiation area: any area where an individual can receive an absorbed dose in excess of 500 rads in one (1) hour at a distance of 1 meter (m) from the radiation source or from any surface through which the radiation penetrates

visitor: for the purposes of this manual, anyone wishing to access a radiologically controlled area without performing any radiological work in the area (e.g., a family member on a site-seeing tour; or, a general employee who is scoping a job or conducting an inspection/assessment)

whole body: for the purposes of external exposure, head, trunk (including male gonads), arms above and including the elbow, or legs above and including the knee

whole body dose rate: radiation measurement made at a distance of 30 cm from a source or surface from which radiation is being emitted

work control document: a document used to support moderately or highly hazardous work; includes OSPs, RWPs, RCOPs, SOPs and TOSPs