

AMERICAN NUCLEAR SOCIETY

Standards Committee

GLOSSARY OF DEFINITIONS AND TERMINOLOGY

May 19, 2016

Foreword

This Glossary is an edited compilation of the "Definitions" provided in standards issued by the American Nuclear Society (ANS) Standards Committee. This version includes definitions in standards issued prior to September 1, 2015. The specific standards that were reviewed for this update are listed in Appendix A. This review included new standards from all ANS consensus committees. Older definitions focused on NFSC standards. Over time, as standards are revised, the glossary will be updated so that it fully reflects the definitions used in all ANS standards.

Each ANS standard shall include a definitions section that provides clarity for terms used in the standard that may not be commonly understood in the nuclear industry. The Glossary definitions shall be used to provide a consistent set of definitions and to minimize the time-consuming task of developing unique definitions for each document. Terms not contained in the Glossary may be defined by the Working Group and included in the definitions section of the standard.

The Glossary is intended to be a living document subject to revision. The Glossary will be provided as a part of the ANS Standards Toolkit available at:

- On the ANS website at: <http://www.ans.org/standards/resources/>
- On ANS Standards Committee Workspace at: https://workspace.ans.org/kws/groups/scmembers/documents?folder_id=915

A definition followed by a (G) means the definition was in the original Glossary, a (C) or (ANS 3.2-[no date]) means the definition came from the 1983 Glossary and that no later version was available for review.

In general, this document provides the preferred definition in the Glossary followed by non-preferred alternate definition variations that have been used in other standards. The source document for each definition is identified at the end of each definition (e.g., ANS 3.2-1989). Standards with exact duplicate definitions are also identified, as well as those documents which contain a variant form.

The goal of identifying preferred and alternate definitions is to assist the standards working groups (WG) in selection of definitions and to eventually standardize all definitions used in ANS standards.

The WG shall:

1. Use the preferred definition unless it is not applicable to the subject of the standard or confusion would be created,
2. If the preferred definition is not applicable, use one of the alternate definitions,
3. If none-of the included definitions are applicable, an alternate term or alternate definition may be substituted with a footnote stating the reason for use of a new definition.

The formats for preferred and alternate definitions are shown in the following **Format Sample**.

The alternate definitions have a lead in "*non-preferred variation (x)*" where x is 1 for the first alternate definition, 2 for the second, etc. The alternate definitions are indented.

The preferred definitions have been selected based on general applicability, the number of standards, the hierarchy and age of the standards using the definition. For example, a new issue of ANS-50.1 would be preferred over a definition used for a detailed specific subject standard. A definition used in ten standards would be preferred over a definition used in only one. A definition of general applicability would be preferred over one unique to a particular application.

Where similar, but not identical, terms are identified, the glossary identifies terms that should be subordinate and its definition replaced by reference in whole or part to the preferred term.

When issuing a new or revised standard for ballot review, the WG shall highlight 1) any changes to the definitions in the standard, 2) any definitions that are not currently in the glossary, and 3) any uses of alternate definitions.

Suggested Definition Changes

Questions, suggestions for changes or additions to the Glossary should be addressed to ANS Standards Manager at:

standards@ans.org

Format Sample

core damage. Any physical disruption of the nuclear core including fuel, fission products, and containing geometry consisting of cladding, structure, and flow alignment that could release significant amounts of radioactivity from fission products by being undercooled or overreactive. (ANS-53.1-2011)

non-preferred variation (1) - Uncovery and heatup of the reactor core to the point at which prolonged oxidation and severe fuel damage are anticipated and involving enough of the core, if released, to result in offsite public health effects. (ASME/ANS RA-Sb–2013)

For information only - For additional definitions, refer to:

Nuclear Regulatory Commission Glossary at
<http://www.nrc.gov/reading-rm/basic-ref/glossary.html#N>

IAEA Nuclear Safety Glossary at:
http://www-pub.iaea.org/MTCD/publications/PDF/Pub1290_web.pdf

European Nuclear Society Glossary of Nuclear Terms at
<http://www.euronuclear.org/info/encyclopedia/pdf/Nuclear%20Glossary,2008-04-04.pdf>

The Language of the Nucleus at:
: <http://www.nuclearglossary.com/index.html>

A.

abnormal conditions and events (ACEs). Conditions and events identified as a result of system considerations or from specific software design and implementation that have the potential for incorrect execution of the software. Thus, ACEs include conditions and events internal to computer hardware or software. Examples of ACEs due to inadequate design and implementation are buffer overflows, input/output timing, initializations status, out of sequence of subroutines (ANS-10.7-2013)

abnormal radionuclide release. The unplanned or uncontrolled emission of an effluent (i.e., containing plant-related, licensed radioactive material). (ANS-2.17-2010)

absorbed dose (D). The quotient of d_e by d_m where d_e is the mean energy imparted by ionizing radiation to matter of mass d_m :

$$D = \frac{\bar{d}_e}{d_m}$$

The special name for the unit of absorbed dose in the gray (Gy);

$$1 \text{ Gy} = 1 \text{ J/kg.}$$

[based on ICRU Rpt. 33 & Publication 26]. (ANS 6.1.1-91)

Variant form: (ANS 3.7.1-D92)

academic training. Successfully completed college level work leading to a recognized degree in a discipline related to the position in question. (ANS-3.1)

acceleration sensor. An instrument capable of sensing absolute acceleration and producing a signal that could be transmitted to a recorder. (ANS-2.2-02)

accelerogram. A representation (either recorded, modified recorded, or synthetic) of the acceleration of the ground during an earthquake. The accelerogram contains acceleration-time-data pairs. (ANSI/ANS 2.27-2008)

Non-preferred variation (1) The record of acceleration varying with time for a single linear component of vibration, recorded by a time history accelerograph. (ANS 2.10-2003)

acceptable. The word "acceptable" is used when a system or component has been demonstrated to meet its design and performance criteria by test or analysis. (ANS 56.5-89)

acceptable damage. Damage resulting from an event (or appropriate combinations of events) where the safety design requirements for the appropriate category of events are met. Events (and appropriate combinations of events) are categorized by plant conditions in ANSI/ANS-51.1 and 52.1. (ANS 58.3-92) (ANS 58.3-98)

acceptable level of safety. The aggregate of an individual facility's conditions found on case-by-case basis to be adequate to assure protection of the worker and public health and safety considering the probability and consequences of adverse events including the expected response of that facility to those events. (58.3)(58.4-W90)

acceptable method. In many places, the commentary contains words such as, "Reference X provides an acceptable method for performing this aspect of the analysis." The plain meaning of this wording should be clear, namely that using the methodology or data or

approach in Reference X is one way to meet the Standard. The intent of any Requirement that uses this language is to be permissive, meaning that the analysis team can use another method without prejudice. However, it is important to understand that the intent of the Standard goes beyond the plain meaning, as follows: Whenever the phrasing “acceptable method” is used herein, the intent is that if the analysis uses another method, the other method must accomplish the stated objective with a comparable level of detail, a comparable scope, a comparable level of conservatism, etc.

It is not acceptable to use another method that does not accomplish the intent of the Requirement at least as well as the “acceptable method” would accomplish it. Whenever an alternative to the “acceptable method” is selected, it is understood that the peer-review team will pay particular attention to this topic. (ANSI/ANS-2.29—2008)

acceptance criteria. The standard, with a tolerance, against which test results are to be compared for establishing the functional acceptability. (ANS-10.8-2015)

Non-preferred variation (1) Actionable, measureable guidance for evaluating tests, inspections, and performance. (ANS-53.1-2011)

Non-preferred variation (2) The standard against which test results are to be compared for establishing the functional acceptability of the primary containment as a leakage-limiting boundary. (ANS-56.8-02)

access control station. A station established to control access between controlled and uncontrolled areas. Its function is to assure that only authorized personnel, properly equipped, may enter into controlled access areas, and that personnel leaving controlled access have been cleared by the radiation monitors.

(ANS-6.7.1-85)

Variant form: (ANS-5.6.1-85)

accessible instruments. Instruments or sensors whose locations permit ready access during plant operation without violation of applicable safety regulations such as those of the Occupational Safety and Health Administration (OSHA), or regulations that address plant security or radiation protection safety. (ANS-2.2-02) (ANS-2.10)

accident. Design Basis Accident Events and those unpostulated events that have the potential for release of significant amounts of radio-active material to the environment. (ANS-4.5-96W)

Variant form: (ANS-56.2-84)(ANS-59.1)

accident class. A grouping of severe accidents with similar characteristics (such as accidents initiated by a transient with a loss of decay heat removal, loss of coolant accidents, station blackout accidents, and containment bypass accidents). (ASME/ANS RA-Sb-2013)

Non-preferred variation (1) accident class: a grouping of accident sequences with similar characteristics such as common POS, initiating event type, or containment challenge; e.g., accident sequences initiated by a transient with a loss of decay heat removal, loss of coolant accidents, station blackout accidents, and containment bypass accidents. (ANS/ASME-58.22-2015)

accident conditions: plant conditions such as status of fuel, reactor coolant system, radionuclide transport barriers, and harsh environments established by deleterious environ-

mental effects or degraded equipment, components, or systems, as a result of an accident. (ASME/ANS RA-S-1.4-2013)

accident duration. The period of time post accident during which the cumulative dose equals 95% of the total expected cumulative dose due to the accident. (ANS-5.6.1-D90)

accident family. The event family for an event sequence defined as an accident (see “event sequence”). (ANS-53.1-2011)

accident isolation. Establishment of isolation barriers(s) in a specific fluid system or group of fluid systems penetrating the containment to arrest or mitigate the potential consequences of an accident. (ANS-56.2-84)

accident isolation signal. A signal which automatically initiates the accident isolation function. (ANS-56.2-84)

accident phases. Phase I

That period of time extending from the initiation of the accident to the time at which the plant is in a controlled condition. Phase II

That period of time extending from the onset of a controlled condition to the time that personnel access is possible to commence activities in parts of the plant that require inspection, repair or replacement. (ANS-4.5-96W)

accident progression sequence: *It is preferred that the term (**accident sequence**) and the associated definition be used in ANS standards*

accident progression sequence: a unique combination of events, which clearly delineates the chronological and physical progression of core damage, containment response and fission product release to the environment. (ASME/ANS RA-S-1.2-2015)

accident sequence: a representation in terms of an initiating event defined for a set of initial plant conditions (characterized by a plant operating state), followed by a sequence of failures or successes of events (such as system, function, or operator performance) that can lead to undesired consequences, with a specified end state (e.g., core damage or large early release). (ANS/ASME-58.22-2015)

Non-preferred variation (1) One of the set of accident sequences, defined at the functional or systematic level, that when rank-ordered by decreasing frequency aggregate to a specified percentage of the release category core damage frequency or that individually contribute more than a specified percentage of core damage to the release category frequency. The aggregate percentage is 95%, and the individual percentage is 1%. Accident sequence significance can be measured relative to each separate release category frequency (an accident sequence may be significant to one release category and not necessarily significant to others). (ANS-53.1-2011) .

Non-preferred variation (2): A representation in terms of an initiating event followed by a sequence of failures or successes of events (such as system, function, or operator performance) that can lead to undesired consequences, with a specified end state (e.g., core damage or large early release). (ASME/ANS RA-Sb–2013)

accident sequence analysis. The process to determine the combinations of initiating events, safety functions, and system failures and successes that may lead to core damage or large early release. (ASME/ANS RA-Sb–2013)

accident sequence, significant. See significant accident sequence. (ASME/ANS RA-Sb–2013)

accuracy. (1)Conformity of an indicated value to an accepted standard value or true value. (ANS-56.8-2002) (ANS-10.8-2015)

Non-preferred variation (1) Variant form:(ANS-6.8.1-81)(ANS-6.8.2-86)

Non-preferred variation (2) A concept employed to describe the dispersion of measurements with respect to a known value. The result of a measurement is “accurate” if it is close to the true value of the quantity being measured. Inaccurate results may be caused by imprecision or bias in the measurement process.(ANS-41.5-2012)

Non-preferred variation (3)A qualitative assessment of correctness or freedom from error. (ANS-10.7-2013)

action. One or more manipulations which accomplishes a specified task. One or more actions are necessary to accomplish a function. (ANS-58.8-92)

action level. The numerical value that causes the decision maker to choose one of the alternative actions. The action level may be a derived concentration guideline level, background level, release criterion, regulatory decision limit, etc. The action level is often associated with a particular matrix/analyte combination. (Note that the action level is specified during the planning phase of a data collection activity; it is not calculated from the sampling data.) (ANS-41.5-2012)

active component. 1 A component in which mechanical movement or change of state must occur to accomplish the function of the component. (ANS-58.14-93)(ANS-51.1/52.1-83)(ANS-56.1-85)

Non-preferred variation (1) Variant form: (ANS-56.2-84)(ANS-56.5-89)(ANS-54.1-89)

active component failure. A malfunction, excluding passive failures, of an active component that would prevent completion of its intended function upon demand. (ANS-54.1-1989)

active failure. A malfunction of a component that prevents mechanical movement or change of state required to accomplish the function of the component on demand.Examples of active failures include the failure of a valve or check valve to move to its correct position, or the failure of a pump, fan, or diesel generator to start.

Spurious action of a powered component originating within its actuation or control system shall be regarded as an active failure unless specific design features or operating restrictions preclude such spurious action. An example is the unintended energization of a powered valve to open or close. (ANS-58.14-93)

Non-preferred variation (1) Variant form: (ANS-51.1/52.1-83) (ANS-51.10-87) (ANS-56.1-85) (ANS-56.2-84) (ANS-56.4-83) (ANS-56.5-87) (ANS-56.8-02) (ANS-58.2-88) (ANS-58.9-94)

Non-preferred variation (2) A malfunction, excluding passive failures, of a component that relies on mechanical movement to complete its intended nuclear safety function upon demand. (ANSI/ANS-51.10-02)

active function. A function where mechanical motion, actuation, or a change of state occurs (e.g., the closing of a valve or relay or the change in state of a logic circuit). (ANS-58.14-2011)

active status. Status of being in the position to record new data without destroying old data previously recorded by the instrument. (ANS-2.10-03)

Non-preferred variation (1). Actively perform(ed) the functions of a reactor operator or senior operator on a minimum of seven 8-hour or 5 12-hour shifts per calendar quarter. (ANS-3.1-2014)

activity: A planned interaction with the plant, such as to conduct maintenance, to re-align the plant operating configuration, or to change plant operating parameters; e.g., power level. (ANS/ASME-58.22-2015)

activity median aerodynamic diameter (AMAD): The median diameter, based on activity rather than mass, of a particle with unit density that has the same terminal velocity when settling in air as the particle of interest. (ASME/ANS RA-S-1.3-2016)

actuating (motive) power. Electric, pneumatic or hydraulic supply required to operate the isolation valve. (ANS-56.2-84)

Acute Exposure Guideline Level (AEGL): For the purposes of this standard, AEGLs represent threshold exposure limits for the general public and are applicable to emergency exposure periods ranging from 10 minutes to 8 hours.

- AEGL-1 effects are those that are not disabling and are transient and reversible upon cessation of exposure;
- AEGL-2 effects are those above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape;
- AEGL-3 effects are those above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death [3]. (ANS-58.16-2014)

additive. In the context of containment spray systems, any substance added to the spray water to adjust pH or enhance fission product removal. (ANS-56.5-87)

additive subsystem. That portion of the containment spray system which is specifically designed to place additive(s) into the spray water during spray operation. (ANS-56.5-87)

adequate. Established to be acceptable by the safety analysis of the plant. (ANS-4.1)

adjusted probable minimum flow. The probable minimum flow adjusted for man's activities. (ANS-2.13-79)

administrative controls. Rules, orders, instructions, procedures, policies, practices, or designation of authority and responsibility. (ANS-58.14-94) (ANS-3.2)(ANS-51.1/52.1-93) (ANS-3.2-06)

Variant form: (ANS-56.2-84) and (ANS-59.1).

Non-preferred variation (1): Specific requirements including administrative hold and administrative conditional restriction. Administrative controls remain in effect until the examining physician certifies that they are no longer necessary or a condition becomes permanent and reported to the U.S. Nuclear Regulatory Commission

~NRC! with a request for a license

Restriction. (ANS-3.4-2013)

administrative conditional restriction: A restriction placed on an operator by the facility licensee allowing the operator to continue to perform licensed duties within the restrictions. Administrative conditional restrictions include,

but are not limited to, “no solo operations,” “no working at heights,” and “shall take medication as prescribed.”(ANS-3.4-2013)

administrative hold: An administrative restriction placed on an operator by the facility licensee restricting the license holder from performing licensed duties pending further evaluation of a health status change. (ANS-3.4-2013)

Administrative limit. Leakage limit assigned to each Type B or Type C component as an indication of potential valve or penetration degradation and used to establish Type B and Type C test performance-based intervals. (ANS-56.8-02)

adversely affect. In the context of fire PRA, to impact, via fire, plant equipment items and cables leading to equipment or circuit failure (including spurious operation of devices). (ASME/ANS RA-Sb–2013)

Aerodynamic entrainment. The suspension and transport of particulate materials, initially at rest, by the flow of gas. (ANS-5.10-98)

Aerodynamic equivalent diameter (AED). The diameter of a sphere with a density of 1g/cm³ that exhibits the same terminal velocity as the particle of concern. (ANS-5.10-98)

aggregate. Aggregate is the granular material which is mixed with water and cement to form concrete. Concrete for radiation shielding is classified as ordinary or high density according to the unit weight of aggregate used. The aggregates defined in this section are those usually used for radiation shielding; other aggregates are sometimes used when it can be objectively shown that they produce concrete of the required strength, durability, and shielding characteristics.

(1) Aggregate for Ordinary Concrete. Fine and coarse aggregates for ordinary density concrete are described in Descriptive Nomenclature of Constituents of Natural Mineral Aggregates, ASTM C294. They must normally meet the requirements of Specifications for Concrete Aggregates, ASTM C33, except aggregates for concrete to be placed by the PA (pre-placed aggregate) method which meet the gradation requirements of Pre-placed Aggregate Concrete for Structural and Mass Concrete, ACISP-304.

(2) Aggregate for High Density Concrete. Fine and coarse aggregate for high density concrete is special aggregate or mixtures of special aggregate with the natural mineral aggregates used for normal density concrete. Special aggregates are iron shot, steel punchings, or natural-mineral or synthetic aggregate as described in Descriptive Nomenclature of Constituents of Aggregates for Radiation Shielding Concrete, ASTM C638 and meeting the requirements of Specifications for Aggregates for Radiation-Shielding Concrete, ASTM C637.

(3) Hydrous Aggregate. If the water content of the cured concrete cannot be maintained at a level high enough for the desired neutron attenuation requirements with the aggregates specified in (1) and (2), special aggregates having a relatively high water-of-hydration content may be used. Properties of hydrous aggregates are given in ASTM C637.

(4) Boron-Containing Aggregates. Boron containing aggregates are sometimes mixed with other aggregates to enhance neutron capture and reduce secondary gamma ray production. Boron containing minerals are described in ASTM C638. (ANS-6.4-85)

air temperature: *It is preferred that the term (dry-bulb temperature) and the associated definition be used in ANS standards.*

air temperature: The temperature indicated by a thermometer exposed to the air in a place sheltered from direct solar radiation (ANS-3.11-2015).

Airborne release factor (ARF). The fraction of affected material that can be suspended in air and become available for airborne transport. (ANS-5.10-98)

Airborne release rate (ARR). The fractional rate of affected material that is suspended into air and becomes available for transport as a function of time. (ANS 5.10-98)

aircraft impact. Accidental impact of an aircraft into a safety-related structure, system or component such that the resulting missile, fire, or smoke could affect the ability of the structure, system or component to perform its intended safety function. (ANS-2.12-78)

Note: Future users of this definition should consider deletion of the word “accidental”

Non-preferred variation (1) Variant form: (ANS-2.19-89)

ALARA. As Low As Reasonably Achievable. (ANS-55.1-91)

As stated in 10CFR20, ALARA means making every reasonable effort to maintain exposures to radiation as far below the dose limits in this part as is practical consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed materials in the public interest.

albedo. The probability under specified conditions that a particle entering into a region through a surface will return through that surface. (ANS-6.4-95)

aleatory variability. The variability inherent in a non-deterministic (i.e., stochastic, random) phenomenon (see Variability). Aleatory variability is accounted for by modeling the phenomenon in terms of a probability model. In principle, aleatory uncertainty cannot be reduced by the accumulation of more data or additional information, but the detailed characteristics of the probability model can be improved. Sometimes aleatory variability is called randomness. (ANS-2.27-2008) (ANSI/ANS-2.29-2008)

aleatory uncertainty. The uncertainty inherent in a nondeterministic (stochastic, random) phenomenon. Aleatory uncertainty is reflected by modeling the phenomenon in terms of a probabilistic model. In principle, aleatory uncertainty cannot be reduced by the accumulation of more data or additional information. (Aleatory uncertainty is sometimes called “randomness.”) (ASME/ANS RA-Sb–2013, ANS-2.30-2015)

aliquot. A known fractional part of a defined quantity.(ANS-16.1-03)

alpha testing. Operational testing by users or an independent team of testers at the developers’ site. (ANS-10.7-2013)

alternate shutdown. The maintenance of safe hot shutdown or achievement and maintenance of safe cold shutdown independent of and separate from the control room. (ANS-58.6-D92); see, also; dedicated shutdown.

alternate shutdown station. See; auxiliary shutdown station (ANS-58.6-92)

alternate source. A source of water which when combined with the primary source, has sufficient capacity to allow maintaining hot shutdown conditions for a minimum period of 24 hours plus a cool down period sufficient to reduce plant temperature to levels where low

temperature and pressure decay heat removal equipment can be implemented. (ANS-51.10)

ambient flow. Natural horizontal or vertical groundwater movement through the subsurface, or resulting from natural hydraulic gradients in an open borehole, well, or piezometer. (ANS-2.17-2010)

analysis. Analysis of radiation transport in and through shields including predictions of dose rates and neutron and gamma-ray fluxes as modified by the introduction of shields in the systems involved. (ANS-6.4-85)

analyte. The particular radionuclide(s) to be determined in a sample of interest. As a matter of clarity when interpreting various clauses of this standard, a gamma-ray spectral analysis is considered one analysis category but may include multiple target analytes. (ANS-41.5-2012)

analytical protocol specification (APS). The output of a project planning process that contains the project's analytical data needs and requirements in an organized, concise form. (ANS-41.5-2012)

anisotropic. The properties at any point within a medium are different in different directions. (ANS-2.9-89) (ANS-2.17-89)

annual or annually. Twelve months plus or minus three months with the objective of a long-term average of once a year. (ANS-3.3-88)

anticipated operational occurrence. licensing-basis events (LBEs) and conditions of plant operation that are expected to occur one or more times during the life of the plant. Event sequences from the PRA are classified as AOOs when their expected frequency of occurrence exceeds 1×10^{-2} events/plant-year ($1E-02$ events/plant-year). (ANS-53.1-2011)

Non-preferred variation(1) Those conditions of normal operation which are expected to occur one or more times during the life of the nuclear power unit and include but are not limited to a loss of all offsite power, an inadvertent control rod withdrawal, and tripping of the turbine generator set. (ANS-54.1-89)

Variant form: (ANS-6.8.1-89)

anticipated transients without scram. (ATWS) Transients resulting from anticipated operational occurrences in combination with a failure to scram. (ATWS) (ANS-54.1-89) (Also, anticipated transients without trip (ATWT))

approved. Signifies that devices, materials, or assemblies have been successfully tested or accepted by prior class or type testing for a specific purpose or application by a nationally recognized testing laboratory. (ANS-59.4-79W86)

aquifer. A geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to springs, seeps, and wells. (ANS-2.17-2010)

aquifer, confined. An aquifer bounded above by an aquitard. (ANS-2.17-2010)

aquifer, unconfined. An aquifer whose upper surface is a water table. (ANS-2.17-2010)

aquitard. A geologic formation that restricts, but does not prevent, groundwater movement into or between aquifers. (ANS-2.17-2010)

area monitor channel. A gamma radiation sensitive detector, electronic processing and alarm circuitry, readout devices, and interconnecting cables used to measure and display the exposure rate present at the detector location. (ANS-6.8.1-81)

area probability sample. A probability sample selected using a frame which identifies population elements by their geographic location. Note: A frame is a scheme which assigns a unique identification to each population element. (ANS-2.6-81)

area source: A two-dimensional array of pollutant sources so widely dispersed and uniform in strength that they can be treated in a dispersion model as an aggregate pollutant release from a defined area at a uniform rate (ANS-2.15-2013).

areal density. The total mass of fissionable material per unit area projected perpendicularly onto a plane. (For an infinite, uniform slab, it is the product of the slab thickness and the concentration of fissionable material within the slab.) (ANS-8.1-2014) (ANS-8.12-87)

area source. An area of the earth's crust that is assumed to have relatively uniform earthquake source characteristics for use in the PSHA. (See also "volumetric source zone"). (ANSI/ANS-2.27-2008) (ANSI/ANS-2.29-2008)

armed response individual. An onsite individual, not necessarily uniformed, whose primary duty in the event of attempted toxicological and/or radiological sabotage, is to respond, armed and equipped, to delay or prevent such an act. (ANS-3.3-88)

arrhenius model. Used in accelerated aging tests that relates the rate of reaction of a material to temperature by a simple exponential function,

$$r = A \exp(0/kT),$$

where r is the reaction rate, A is a material constant (frequency factor), 0 is the activation energy of the material (eV), k is Boltzmann's constant (0.8617×10^{-4} eV/ $^{\circ}$ K) and T is absolute temperature ($^{\circ}$ K). (ANS-6.4.2-85)

as-built, as-operated. A conceptual term that reflects the degree to which the PRA matches the current plant design, plant procedures, and plant performance data, relative to a specific point in time.

NOTE: At the design certification stage, the plant is neither built nor operated. For these situations, the intent of the PRA model is to reflect the "as-designed, as-to-be-built, and as-to-be-operated" plant. (ASME/ANS RA-Sb-2013)

assumption. A decision or judgment that is made in the development of the PRA model. An assumption is either related to a source of model uncertainty or is related to scope or level of detail. An assumption related to a model uncertainty is made with the knowledge that a different reasonable alternative assumption exists. A reasonable alternative assumption is one that has broad acceptance within the technical community and for which the technical basis for consideration is at least as sound as that of the assumption being made. An assumption related to scope or level of detail is one that is made for modeling convenience. An assumption is labeled "key" when it may influence (i.e., have the potential to change) the decision being made. Therefore, a key assumption is identified in the context of an application. (ASME/ANS RA-Sb-2013)

as-found leakage rate. The leakage rate prior to any repairs or adjustments to the barrier being tested. (ANS-56.8-02)

as-found testing. Leakage rate testing after some period of normal service conditions, performed prior to any repairs or adjustments. (ANS-56.8-02)

as-left leakage rate. The leakage rate following any repairs or adjustments to the barrier being tested. (ANS-56.8-02)

as-left testing. Leakage rate testing performed following repair or adjustment. (ANS-56.8-02)

as low as is reasonable. *It is preferred that the term (ALARA. As Low As Reasonably Achievable) and the associated definition be used in ANS standards.*

Non-preferred variation (1) Every reasonable effort is made to maintain exposures to radiation as far below the dose limits as is practical consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed materials in the public interest. (ANS-2.17-2010)

assured station blackout response facilities. The capability to withstand a station blackout demonstrated by the application of all requirements of this standard. (ANS-58.12-85)

at-initiator human failure event: a type of initiating event; human failure events that cause, or contribute to, an initiating event (e.g., the human failure events that directly involve plant personnel actions at the time of the initiating event, including actions correctly performed but which are based on erroneous indications). This group does not include malicious acts such as sabotage. (ANS/ASME-58.22-2015)

at power. Those plant operating states characterized by the reactor being critical and producing power, with automatic actuation of critical safety systems not blocked and with essential support systems aligned in their normal power operation configuration. (ASME/ANS RA-Sb-2013)

at reactor storage (AR). Storage capability of spent fuel at the reactor facility following unloading. (ANS-2.15-2013)(ANS-2.19-89)

atmospheric transport and dispersion: The process by which material that has been released from its place of confinement, moves through and spreads upon release to the atmosphere. (ASME/ANS RA-S-1.3-2016)

atmospheric/barometric pressure: The pressure exerted by the atmosphere as a consequence of gravitational attraction exerted upon the "column" of air lying directly above the point in question (ANS-3.11-2015).

atmospheric turbulence: Fluctuations occurring in all three velocity components and unpredictable in detail; however, statistically distinct properties of the turbulence can be identified and profitably analyzed. Turbulence exhibits a broad range of spatial and temporal scales resulting in efficient mixing of fluid properties (ANS-3.11-2015).

audit. A planned and documented activity performed to determine by investigation, examination, or evaluation of objective evidence the adequacy of and compliance with established procedures, instructions, drawings, and other applicable documents, and the effectiveness of implementation. An audit should not be confused with surveillance or inspection activities performed for the sole purpose of process control or product acceptance. (ANS-3.2-93) (ANS-41.5-2012)

authorized individual. An individual who has been designated by the appropriate authority in writing, or by another equivalent method, to enter a protected or vital area. (ANS-3.3-88)

auto-load. The automatic application of loads to the diesel generator in a predetermined sequence.(ANS-59.52-93)(ANS-59.52-98)

automatic isolation valve. A valve whose closure is initiated by automatic means without any action by a plant operator upon receipt of an isolation signal from a protection system; or a simple or positive acting check valve. (ANS-56.2-84)

auxiliary fuel handling crane. A crane used for handling equipment including fuel assemblies and new fuel shipping containers. (ANS-57.1-93) (ANS-57.3-93) (ANS-57.1-98)

auxiliary shielding. The auxiliary shielding is the shielding provided for the equipment and piping that collects, processes, or stores radioactive materials external to the primary coolant system. (ANS-6.3.1-87)

auxiliary shutdown station. One location separate from the control room with information and controls available that permits actions to be taken to achieve, monitor, and maintain the safe shutdown condition. This is the primary location for activities required to maintain safe shutdown and supervise cool down following hot shutdown. (ANS-58.6-92)

auxiliary supporting features. Systems, structures, components (SSCs) that provide support services (e.g., cooling, lubrication and power) required by safety-related systems to accomplish their safety-related functions. (See ANSI/IEEE-603-1991)(ANS-50.1-93)

availability. A plant or System, Structure, Component (SSC) attribute defined as the probability or fraction of time that the SSC is capable of performing its function at the time of demand. (ANS-53.1-2011)

Non-preferred variation(1) the complement of unavailability (ASME/ANS RA-Sb–2013)

B.

background. Ambient signal response due to spurious electronic noise or incidental radiation in the vicinity of the detector system as recorded by measuring instruments that is independent of radioactivity contributed by the radionuclides being measured in the sample.(ANS-41.5-2012)

background radiation. That level of radiation which originates from sources other than the one being measured. (ANS-6.8.2-86)

background source zone. A part of the earth's crust, usually of large areal dimension, within which potentially damaging earthquakes could occur that are not associated either with known fault sources or even with the uniform pattern, rate, or style of deformation or seismicity commonly identified with volumetric seismic source zones. In PSHA calculations, earthquakes that cannot be associated with other sources default to a background source zone. (ANSI/ANS-2.27-2008) (ANSI/ANS-2.29-2008)

backtrack. To reset the simulator to some prior time in its operation. (ANS-3.5-2009)

backup system. An alternate system of similar functional capability to the normally operating system. It need not be the same seismic category and safety class as the system it backs up. (ANS-57.2-D92) (ANS-57.2-99)

Non Preferred Variant form: (ANS-54.2-85)

barriers to fission product release. Those major physical barriers that are designed to contain and prevent the uncontrolled release of fission products from anywhere within the reactor coolant pressure boundary or primary coolant boundary, as applicable(ANS-58.3)(ANS-58.4-90W)

baseline concentration, local. The concentration or activity of a substance that is indicative of local site conditions prior to the operation of the nuclear power plant. (ANS-2.17-2010)

baseline concentration, regional. The concentration or activity of a substance that is indicative of regional conditions prior to the operation of the nuclear power plant. (ANS-2.17-2010)

basic event. An event in a fault tree model that requires no further development, because the appropriate limit of resolution has been reached. (ASME/ANS RA-Sb–2013)

batch. A group of samples prepared at the same time, in the same location, using the same method, and by the same analyst.(ANS-41.5-2012)

benchmark: An experiment used for validation. (ANS-8.24-07)

benchmark applicability²⁾: The benchmark parameters (e.g., material compositions, geometry, neutron energy spectra) and their bounding values from which the bias and bias uncertainty of a calculational method are established. (ANS-8.24-07)

benchmark experiment. An experiment appropriate for the validation of calculational methods applicable to the evaluation of the neutron absorber system. (ANS-8.21-95)

benevolent failure: a failure of an active or passive system component, or a structural member of the reactor or containment pressure boundary that alters accident progression in a manner that reduces the severity of current reactor or containment status or mitigates consequences of subsequent events. An example is failure of a safety/relief valve to reclose on demand, causing unintentional depressurization of the reactor coolant system (RCS). This event has the beneficial effect of reducing reactor vessel pressure, thereby reducing the potential for adverse creep rupture of the reactor coolant system (e.g., induced steam generator tube rupture (SGTR)) and (later in time) high-pressure failure of the reactor pressure vessel (RPV) lower head. Such failures are often precluded from consideration in the Level 1 PRA, but can be credited in the Level 2 analysis to facilitate a more realistic assessment of severe accident progression especially when there is a clear link to severe accident conditions causing the failure. (ASME/ANS RA-S-1.2-2015)

best estimate. Predicted reference unit performance data derived from engineering evaluation or operational assessment by subject matter experts for specific conditions. (ANS-3.5-2009)

best-estimate value. The mean value of the probability density function for the random variable of interest. Where the probability density function is not known, the best-estimate value is based on a statistical sample of data or judgment.

Variant form:(ANS-51.1/52.1-93)

beyond the design basis events (BDBE). *It is preferred that the term (**beyond-design-basis event (BDBE)**) and the associated definition be used in ANS standards.*

beyond the design basis events (BDBE). Those events of lower probability than design basis events. (ANS-54.1-89)

beta testing. This testing follows alpha testing and is a form of user acceptance testing. The software is released to a limited group of people outside of the development team to permit further testing in order minimize the number of defects. (ANS-10.7-2013)

beyond-design-basis event (BDBE). LBEs that are not expected to occur during the lifetime of a large fleet of nuclear power plants but are considered to assure that the risk to the public from low-frequency events is acceptable. Event sequences from the PRA are classified as BDBEs when their expected frequency of occurrence is between 5×10^{-7} events/plant-year (5E-07 events/plant-year) and 1×10^{-4} events/plant-year (1E-04 events/plant-year).(ANS-53.1-2011)

Note: Future user of this definition should consider that some natural phenomena are considered design bases events event though their probabilities are above the stated range

bias: The systematic difference between calculated results and experimental data. Positive bias is where the calculated results are greater than the experimental data. (ANS-8.24-07)

Non-preferred variation (1) A fixed deviation from the true value that remains constant over replicated measurements within the statistical precision of the measurement. Synonyms are deterministic error, fixed error, and systematic error. (ANS-41.5-2012)

bias uncertainty: The uncertainty that accounts for the combined effects of uncertainties in the benchmarks, the calculational models of the benchmarks, and the calculational method. (ANS-8.24-07)

binder. Solidification agent (ANS-16.1-03)

bioassay. A radioanalytical measurement to determine the amount and kind of radioactive materials present in the body or specific organs.(ANS-3.7.1-95}

biogeochemical processes. The chemical interactions that exist among the atmosphere, hydrosphere, lithosphere, and biosphere. (ANS-2.17-2010)

blind fault. A blind fault is a fault that does not rupture all the way up to the surface and consequently does not have a surface trace. These features are usually associated with thrust faults, which are formed by compressive stresses. Blind thrust faults do not penetrate the uppermost layers of crust, but they cause the surface layers to fold over them as they deform, forming a tell-tale hill at the surface that reveals their presence to observers. (ANSI/ANS-2.27-2008)

Non-preferred variation (1) A buried fault or fault zone that does not rupture to the ground surface but can cause surface deformation (ANS-2.30-2015).

blowdown. Water intentionally discharged from a closed cycle water system to control total dissolved solids (TDS).(ANS-2.13-79)

body burden. The total quantity of a radionuclide present in the whole body or body organ. (ANS-3.7.1-92)

body-burden analysis/whole body counting. Measurement of the amount(s) of radioactive material(s) in the whole body or body organs. (ANS-3.7.1-92)

boiling water reactor coolant pressure boundary. The reactor coolant pressure boundary (RCPB) means all those pressure containing components of the boiling water reactor, such as pressure vessels, piping, pumps and valves which are:

- (1) Part of the reactor coolant system (the reactor coolant system extends to and includes the outermost containment isolation valve in the main steam and feedwater piping), or
- (2) Connected to reactor coolant system, up to and including any and all of the following:
 - (a) The outermost containment isolation valve in system piping which penetrates primary reactor containment.
 - (b) The second of two valves normally closed during normal reactor operation in system piping which does not penetrate primary reactor containment.
 - (c) The reactor coolant system safety and relief valves. (ANS-52.1-83W) (ANS-56.3-86)

boiling water reactor coolant pressure branch run. A pipe run that originates as a branch of the main run and ends at a terminal end, another main run, another branch run or is free ended, with the exception of the following:

- (a) free-ended branch lines throughout which there is no significant restraint to thermal expansion may be considered part of the main run.
- (b) branch lines which are included with the main run piping in the stress analysis computer mathematical model (such that the levels of stress and fatigue in the branch runs are accurately determined relative to those in the main run), and are shown to have a significant effect on the main run behavior (such as when the piping sizes are similar), may be considered part of the main run. (ANS-58.2-80)

boundary (RCPB). Boundary (RCPB) means all those pressure containing components of the boiling water reactor, such as pressure vessels, piping, pumps, and valves which are:

- (1) Part of the reactor coolant system (the reactor coolant system extends to and includes the outermost containment isolation valve in the main steam and feedwater piping), or
- (2) Connected to reactor coolant system, up to and including any and all of the following:
 - (a) The outermost containment isolation valve in system piping which penetrates primary reactor containment
 - (b) The second of two valves normally closed during normal reactor operation in system piping which does not penetrate primary reactor containment
 - (c) The reactor coolant system safety and relief valves. (ANS-56.3-97W)

bounding analysis. Analysis that uses assumptions such that the assessed outcome will meet or exceed the maximum severity of all credible outcomes. (ASME/ANS RA-Sb-2013)

bremsstrahlung. Gamma radiation emitted by an electron when it is deflected by the Coulomb field of an atomic nucleus of charge Z ; the fraction of energy radiated as photons by an electron of initial energy E (MeV) is approximated numerically by $ZE/1000$. (ANS-6.4.2-85)

bridge tree. an event tree (or equivalent logic structure) that extends the sequences delineated in the Level 1 PRA to account for the status of containment systems. A bridge tree is sometimes used to link (or provide a "bridge" between) the Level 1 event trees (or

equivalent) for core damage sequences and the Level 2 containment event tree, especially when the latter is constructed solely to reflect the potential severe accident phenomena. (ASME/ANS RA-S-1.2-2015)

brittle solids. Solids that will fragment into particles upon impact or crush forces that exceed the tensile/compressive strength of the material. (ANS-5.10-98)

broken rod. A rod that has been severed into two or more pieces and requires special handling. (ANS-57.10-93)

buildup factor. In the passage of radiation through a medium, the ratio of the total value of a specified radiation quantity at any point to the contribution to that value from radiation reaching the point without having undergone a collision. (ANS-6.4.3-91)

buildup factor, exposure, B_D . A photon buildup factor in which the quantity of interest is exposure. The energy response function is that of absorption in air. (ANS-6.4.3-91)

buildup factor, energy absorption, B_A . A photon buildup factor in which the quantity of interest is the absorbed or deposited energy in the shield medium. The energy response function is that of absorption in the material. (ANS-6.4.3-91)

bullet-resisting. Protection against complete penetration, passage of fragments of projectiles, and spalling (i.e., fragmentation) of barrier material that could cause injury to a person standing directly behind the barrier. Bullet-resisting barrier material meets the rating for high powered rifle as set forth in Underwriter's Laboratories Publication, "Standard for Bullet-Resisting Equipment" UL 752. (ANS-3.3-88)

burnable absorber: A burnable absorber is a material added to the fuel assembly to control reactivity via neutron absorption, mainly near the beginning of the fuel life. As irradiation progresses, the burnable absorber is converted to a less absorbing material. If the burnable absorber is physically part of the fuel assembly (nonremovable), it is said to be "fixed." Otherwise, it is said to be "removable." Integral fuel burnable absorbers are part of the fuel inside the cladding and are a form of fixed burnable absorber. Reference to burnable absorbers in this standard unless otherwise noted is meant to address only the fixed type. (ANS-8.27-15)

burnable absorber credit: Burnable absorber credit is the accounting for an overall reduction in reactivity associated with the presence of fixed burnable absorbers. Since the irradiation of fuel with burnable absorbers could result in increased reactivity early in its life, taking credit for burnable absorbers in irradiated fuel requires depletion analysis. "Gadolinium credit" is an example of burnable absorber credit. (ANS-8.27-15)

burnup: Burnup is the amount of energy released from a region of a fuel assembly per initial mass of actinides (e.g., uranium and plutonium) in that region. The region could be a complete fuel assembly or some part of the assembly. The specifications of the appropriate regions are normally clearly defined for each application to avoid ambiguity, e.g., assembly-averaged burnup, node-averaged burnup, or rod-averaged burnup. Examples of units for a uranium-based fuel with this region-specific burnup are megawatt-days per tonne of initial uranium and gigawatt-days per tonne of initial uranium. Since burnup is normalized to a mass, it is also known as specific burnup. (ANS-8.27-15)

(Note: The term burnup and fuel burnup are both used in this glossary. NCS CC should review the terminology and select the preferred term for future use.)

burnup credit: Burnup credit is the accounting for an overall reduction in reactivity associated with the irradiation of fuel in a reactor and with cooling time. Burnup credit is a criticality safety control that includes both analysis and implementation. (ANS-8.27-15)

C.

cable. Referring solely to “electric cables,” a construction comprising one or more insulated electrical conductors (generally copper or aluminum). A cable may or may not have other physical features such as an outer protective jacket, a protective armor (e.g., spiral wound or braided), shield wraps, and/or an uninsulated ground conductor or drain wire. Cables are used to connect points in a common electrical circuit and may be used to transmit power, control signals, indications, or instrument signals.(ASME/ANS RA-Sb–2013)

cable failure mode. The behavior of an electrical cable upon fire-induced failure that may include intracable shorting, intercable shorting, and/or shorts between a conductor and an external ground. (See also *hot short*.) (ASME/ANS RA-Sb–2013)

calculational margin: An allowance for bias and bias uncertainty plus considerations of uncertainties related to interpolation, extrapolation, and trending. (ANS-8.24-07)

calculational method (method). The mathematical procedures, equations, approximations, assumptions, and associated numerical parameters (e.g., cross sections), which yield the calculated results. (ANS-8.1-14) (ANS-8.24-07)

calibration. The set of operations or processes conducted under specified conditions that establish the relationship between values indicated by a measuring instrument or system and the corresponding known values. The term “calibration” refers to both the first calibration after the instrument is placed in use and to any recalibrations subsequently performed. (ANS-41.5-2012)

calm: Any wind speed below the starting threshold of the wind speed or direction sensor; or any wind speed below that which is appropriate for input into plume models, whichever is greater. In the U.S., calm is typically defined as any speed less than 1 mph. (ANS-3.11-2015)

canister. A container or restraints used to hold rods in a close-packed array. The canister may or may not have grids and may or may not act as a confinement barrier. (ANS-57.10-93)(57.10-96)

canning (canned). The placement of spent fuel in a container for purposes of confinement. (ANS-57.9-92)

This also applies to plutonium metals and plutonium oxides (e.g., 3013 can).

capable fault. This definition is taken directly from Title 10, Code of Federal Regulations, Part 100 "Reactor Site Criteria," Appendix A, Seismic and Geological Siting Criteria for Nuclear Power Plants, paragraph III (g):

"A 'capable fault' is a fault which has exhibited one or more of the following characteristics:

- (1) Movement at or near the ground surface at least once within the past 35,000 years or movement of a recurring nature within the past 500,000 years.
- (2) Macro-seismicity instrumentally determined with records of sufficient precision to demonstrate a direct relationship with a fault.
- (3) A structural relationship to a capable

fault according to characteristics(1) or (2) of this paragraph such that movement on one could be reasonably expected to be accompanied by movement on the other."

In some cases, the geologic evidence of past activity at or near the ground surface along a particular fault may be obscured at a particular site. This might occur, for example, at a site having a deep overburden. For these cases, evidence may exist elsewhere along the fault from which an evaluation of its characteristics in the vicinity of the site can be reasonably based. Such evidence shall be used in determining whether the fault is a capable fault within this definition. (ANS-2.19-89)(ANS-2.7-82)

capable of measurement. Condition where the instrument system (i.e., sensor to recorded data) is within the channel accuracy specified in this standard. (ANS-3.11-00)

capability. SSC ability to maintain requirements to meet top-level regulatory criteria (TLRC) and quantitative health objectives (QHOs). (ANS-53.1-2011)

capacity factor. The capacity factor is defined as the energy actually supplied by a plant in a given time interval, divided by the product of the design power and the time interval. The capacity factor may be used in assessing the annual absorbed dose, provided the principal sources are directly related to capacity. (ANS-6.6.1-2015)

capillary zone. The region above the water table where pores are saturated but where the water gauge pressure is negative; also called the tension-saturated zone. (ANS-2.17-2010)

Category I structure. Guidance for determining the category of a structure, given in U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide 1.29, "Seismic Design Classification." (ANS-2.2-02)

cell. A unit for storage of an individual fuel assembly. It is a subassembly of a storage rack. (ANS-57.2-D92)(ANS-57.3-93)(ANS-57.2-99)

Census Bureau geographic unit. The term means any of the following:

Block, block group, county, county equivalent, census county divisions, census tract, enumeration district, incorporated places, minor civil division, state economic areas, township (See U.S. Department of Commerce DAD No. 33, Series CG-3m Aug. 1973 and the 1970 Census User's Guide, Oct 1974) (ANS-2.6-81)

central alarm station (CAS) A continuously manned area, which is designated a vital area, and which functions as the primary location for monitoring the security system operation. (ANS-3.3-88)

certification. Documented confirmation by an individual or group of the successful completion of a qualification program. ~~Confirmation shall be by an individual or group other than the individual that provided the training.~~(ANS-3.1- 2014)

certified reference material. A reference material, one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation that is issued by a certifying body [e.g., National Institute of Standards and Technology (NIST), International Atomic Energy Agency]. (ANS-41.5-2012)

CEUS (Central and Eastern United States). That portion of the United States east of the Rocky Mountains (approximately the 104th West parallel. (ANS-2.27-2008) (ANS-2.29-2008)

channel. Electrical circuitry used to achieve control or monitoring of a train of safety equipment.(ANS-58.6-92)

Variant form: (ANS-4.1)(ANS-6.8.2-86)

channel calibration (primary calibration). The determination and if required, adjustment of an instrument, sensor, or system such that it responds within a specified range to an acceleration, velocity, or displacement input, as applicable, or responds as intended to the stimulus provided by a known constant input. (ANS-2.2-02)

channel check. The qualitative verification of the functional status of a time-history accelerograph (T/A). This check is an "in-situ" test and may be the same as a channel functional test. (ANS-2.2-02)

channel functional test (secondary calibration). The determination, without adjustment, that an instrument, sensor, or system responds to a known input of such character that it will verify that the instrument, sensor, or system is functioning in a manner that can be calibrated. (ANS-2.2-02)

charcoal adsorption system. A processing system incorporating activated charcoal at ambient or reduced temperatures for adsorption and decay of radioactive gases. ANS-55.1-92)(ANS-55.4-93) (ANS-55.4-99)

chemical attack. Detrimental influence due to chemical reaction. (ANS-58.3-92) ANS-58.3-98)

chemical wastes. Liquid radioactive wastes having high conductivity, (i.e., greater than 200 microsiemens), variable insoluble solids content, variable radioactivity content and not containing soaps, detergents, oils, or similar organic materials. (ANS-55.6-93) (ANS-55.6-99)

circuit failure mode. The manner in which a conductor fault is manifested in the circuit. Circuit failure modes include loss of motive power, loss of control, loss of or false indication, open circuit conditions (e.g., a blown fuse or open circuit protective device), and spurious operation.. (ASME/ANS RA-Sb–2013)

circulating activity. Activity from radioactive isotope fission product species circulating in the primary coolant helium, such as noble gases and volatile iodine. (In a depressurization event like offset rupture, activity in the helium primary coolant is more easily released and dispersed.) (ANS-53.1-2011)

classified. Designation applied to an item that has been assigned a safety and, if applicable, a pressure integrity classification.

clean lube oil tank. The clean lube oil storage tank provides a reserve supply of lube oil for all diesel generator engines.(ANS-59.52-93)

clean steam. Steam generated by the vaporization of condensate. (ANS-55.1-92)(ANS-55.4-93)

Non-preferred variation (1) Steam generated by the vaporization of non-radioactive demineralized water. (ANS-55.4-99)

closed cycle circulating water system. A system in which the same water, with the exception of that lost by evaporation, drift, leakage, and blowdown; which is replenished by makeup, is used repeatedly in the circulating water system. (ANS-2.13-79)

closed system. A piping system which penetrates the containment and is a closed loop either inside or outside the containment. Under normal operating conditions or loss-of-coolant accident conditions for closed systems inside containment, the fluid in the system

does not communicate directly with either primary coolant or containment atmosphere. (ANS-56.2-84)

code. A uniquely identifiable sequence of instructions and data that is part of a computer software module ~e.g., main program, subroutine, and macro. (ANS-10.7-2013) (ANS-10.8-2015)

cohort: A subset of the off-site population that mobilizes for, or moves differently from others, in the modeling of emergency response actions. (ASME/ANS RA-S-1.3-2016)

coincident occurrence. An occurrence that takes place simultaneously with an initiating occurrence but is independent of the initiating occurrence. A coincident occurrence is not the single failure or common cause failure defined elsewhere herein.(ANS-50.1-93)

cold shutdown. The condition in which the reactor is sub-critical and the reactor coolant system average temperature is below the required temperature to permit major maintenance, consistent with technical specification operational limits. (ANS-58.14-93)

Variant form: (ANS-51.1/52/1-1993)(ANS-58.6-92)

Non-preferred variation (1) Aa set of POSs during which the reactor is subcritical with the primary system depressurized at relatively low temperature (<200°F) and the reactor vessel intact (head on), with heat removal via RHR shutdown cooling. Cold shutdown is defined by Technical Specifications (Mode 5 for PWRs, Mode 4 for BWRs) for the condition with the primary temperature below 200°F and with the reactor vessel head tensioned. (ANS/ASME-58.22-2015)

collective design dose equivalent. The design dose equivalent of a group obtained by summing the anticipated dose equivalents of the individuals comprising that group. (ANS-6.7.1-85)

collective qualifications. Sum of individual qualifications for the people of that functional level in the organization. (ANS-3.1-87)

collocated worker: For the purposes of this standard, a collocated worker is a site worker outside the immediate facility and normally located there for an 8-hour day. A typical distance to consider is 100 meters from a facility (building perimeter) or estimated release point. (ANS-58.16-2014)

combined event. An event consisting of the simultaneous occurrence of two or more natural or external man-made hazards. (ANS-2.12-78)

combined standard uncertainty.(CSU). The standard (1σ) uncertainty of a calculated result obtained by propagating the standard uncertainties of a number of input values of the measurement process. The value is sometimes referred to as total propagated uncertainty (TPU).(ANS-41.5-2012)

combustible material. Material that does not meet the definition of non-combustible or limited combustible. (ANS-59.4-79W86)

commercial codes and standards. Standards that would be used in the design of conventional or commercial industrial components or sub-components. Examples of commercial standards include the following: Power Piping, ANSI/ASME-B31.2-1989; ANSI/ASME Boiler and Pressure Vessel Code-1992, Section VIII, "Pressure Vessels," Division 1; Valves--Flanges, Threaded and Welding End, ANSI/ASME-B16.34-1988; Overhead Hoists, ANSI/ASME B30.1601987; and "Specification for Electric Overhead Traveling Cranes," CMAA-70-1988. (ANS-57.1-92)

commercial grade (C). A procurement classification applied to an item that is intended to be used as a safety-related item and:

- (1) is not subject to design or specification requirements that are unique to NRC licensed facilities or activities; and
- (2) is used in applications other than NRC licensed facilities or activities; and
- (3) is to be ordered from the manufacturer or supplier on the basis of specifications set forth in the manufacturer's published product description (e.g., catalog).

(Commercial grade items are dedicated* prior to use in a safety-related application.)(See 10 CFR 21.)

*For guidance on the dedication of commercial grade items, see EPRI NP 5652, "Guideline for the Utilization of Commercial Grade Items in Nuclear Safety-Related Applications" (NC16-07) and NRC Generic Letters 89-02 and 91-05. (ANS-50.1).

commercial grade item (ASME NQA-1). An item satisfying (a),(b), and (c) below:

- (a) not subject to design or specification requirements that are unique to nuclear facilities;
- (b) used in applications other than nuclear facilities;
- (c) is to be ordered from the manufacturers' published product description (e.g., catalog).

(ANS-58.14-92)(ANS-7-4.3.2-92)

Variant form: (ANS-7.10-93)

commercial grade dedication. A process of evaluating, including testing, and accepting commercial grade items to ensure their suitability for safety application.(ANS-58.14-92)(ANS-7-4.3.2-92)

commercial-grade supplier performance. Performance to commercial-grade contract specifications not nuclear safety quality specification. (ANS-53.1-2011)

commercial nuclear power plant. A commercial electrical generating facility using a nuclear reactor as its heat source to provide steam to a turbine generator. (ANS-2.17-2010)

commercial standards. *It is preferred that the term (**commercial codes and standards**) and the associated definition be used in ANS standards*

commercial standards. Standards that would be used in the design of conventional or commercial industrial facilities in the vicinity of an Independent Spent Fuel Storage Installation (ISFSI). Examples include ANSI/ACI 318-89, ANSI/ASME B31.1-89, ANSI/API 620.-86, and ANSI/API 650-88]. (ANS-57.9-92)

commitment period: Length of time used to calculate the dose accrued to individuals from intake of radioactive sources (e.g., ingestion, inhalation). ([ASME/ANS RA-S-1.3-2016](#))

committed effective dose: The sum of the products of the committed organ or tissue equivalent doses and the appropriate tissue weighting factors (w_T), where τ is the integration time in years following the intake. The commitment period is taken to be 50 years for adults and to age 70 years for children. (ANS-10-15)

common-cause events. An event that adversely impacts the performance of two or more components during a short time interval as a result of a single shared cause. (ANS-53.1-2011)

common cause failure. Multiple failures of structures, systems, or components (SSCs) as a result of a single phenomenon.(ANS-51.1/52.1]-1983)

Non-preferred variation (1) Multiple failures attributable to a common cause. (ANS-54.1-89)

Non-preferred variation (2) A failure of two or more components during a short period of time as a result of a single shared cause. (ASME/ANS RA-Sb–2013)

commonly usable domain. Within any zone of the plant, it includes all areas of the zone that can be physically reached by an individual without the use of portable ladders, scaffolding, or other special equipment. (ANS-6.7.1-85)

community distribution. For any specific expert judgment, the distribution of expert judgments of the entire relevant (informed) technical community of experts knowledgeable about the given issue. (ASME/ANS RA-Sb–2013)

compactible solid waste. Solid waste that can be compressed by applying external pressure less than 1000 psi. (ANS-40.37-2009)

comparable facility. A commercial power reactor of the same type, e.g. a boiling water reactor (BWR) design, regardless of vendor or vintage within that reactor design type. (ANS-3.1-2014)

complementary cumulative distribution function: Plot of consequence parameter being calculated against its probability or frequency of exceedance (commonly referred to as a CCDF). (ASME/ANS RA-S-1.3-2016)

Non-preferred variation (1): complementary cumulative distribution function (CCDF): complement of cumulative distribution function. (ASME/ANS RA-S-1.4-2013)

cumulative distribution function: integral of the probability density function; it gives the probability of a parameter of being less than or equal to a specified value. (ASME/ANS RA-S-1.4-2013)

complex flow: A non-uniform atmospheric flow field (ANS-2.15-2013).

complex terrain: Variations in terrain elevation within the study region that generate flow features that significantly influence the transport and diffusion of pollutants in the air (ANS-2.15-2013).

compliance verification. Compliance verification is the process of determining whether the data are complete, correct, consistent, and in compliance with established standards or written analytical specifications [e.g., statement of work (SOW), contract, project plans]. The process of compliance verification is independent of validation. The compliance verification is conducted at various levels both internal and external to the data generator. The output of verification is a data set ready for data validation.(ANS-41.5-2012)

component. An item that performs a specific function within a system (usually has a component-level plant unique identification code) and can be either an assembly of interconnected parts or a single part. (ANS-58.14-2011) (ANS-58.16-2014)

Non-preferred variation (1) An item in a nuclear power plant, such as a vessel, pump, valve, or circuit breaker. (ASME/ANS RA-Sb–2013)

composite variability. The composite variability includes the aleatory (randomness) uncertainty (β_R) and the epistemic (modeling and data) uncertainty (β_U). The logarithmic standard deviation of composite variability, β_c , is expressed as $(\beta_R^2 + \beta_U^2)^{1/2}$. (ASME/ANS RA-Sb–2013) (Note: The subscripts and superscripts are needed for clarity).

computed values. Parameters representing the state of reference unit systems or components that the simulator mathematical models calculate.(ANS-3.5-2009)

computer code system: A calculational method, computer hardware, and computer software -including the operating system. (ANS-8.24-07)

computer program. *It is preferred that the term (**computer software**) and the associated definition be used in ANS standards*

computer program. A schedule or plan that specifies actions that may or may not be taken, expressed in a form suitable for execution by a programmable digital computer. (ANS-7-4.3.2-1990-W2000)

computer software. A set of ordered instructions and data that specify operations in a form suitable for execution by a digital computer. (ANS-10.7-2013)

Non-preferred variation (1) Computer code and associated documentation and data. (ANS-10.8-2015)

computer system. A system that includes computer hardware, software, firmware, and interfaces. (ANS-10.7-2013)

concealed fault. A fault that once ruptured to the earth's surface but that has subsequently been buried by deposition of material atop the surface trace during the period between surface ruptures. (ANS-2.27-2008)

concentration. The relative amount of a particular gas within a gas mixture may be expressed in terms of a volumetric concentration. Volumetric concentration is the ratio of the partial volume of the gas considered to the total gases comprising the volume mixture,

$$XG = NG/NTG$$

Where;

XG = volumetric concentration of gas

NG = volume of gas (SCM)

NTG = Total volume of gases (SCM)

(ANS-56.1-85)

Non-preferred variation (1) The quantity of radioactive material stated in terms of activity (or mass) per unit of volume or mass of a medium.(ANS-41.5-2012)

conceptual site model (CSM). An abstract, qualitative representation of the relevant flow and transport FEPs that affect subsurface radionuclide transport at the site. The CSM is best presented as a set of two-dimensional graphics (plan and profile) or a three-dimensional graphic (isometric), which qualitatively present the interrelationships among the FEPs, along with supporting text. (ANS-2.17-2010)

concurrent hot short. The occurrence of two or more hot shorts such that the shorts overlap in time (e.g., a second hot short occurs before a prior hot short has self-mitigated or has been mitigated by an operator action). (ASME/ANS RA-Sb–2013)

condemnation: Permanent denial of the use of land or buildings following contamination by radioactive material released from a facility. (ASME/ANS RA-S-1.3-2016)

condition adverse to quality. An all-inclusive term used in reference to any of the following: failures, malfunctions, deficiencies, defective items, and non-conformances. A significant condition adverse to quality is one which, if uncorrected, could have a serious effect on safety or operability. (ANS-3.2-93)

condition restoration time. The maximum time allowed to restore process parameters, set points for automatic protection devices, or inoperable equipment to within the specified conditions.(ANS-58.4-W90)

conditional core damage frequency: the frequency per year of core damage given the occurrence of a specific plant configuration at a given instant in time; e.g., a plant operating state, external hazard damage state, or a component out of service. (ANS/ASME-58.22-2015)

conditional core damage probability (CCDP): the probability of core damage given the occurrence of a specific plant configuration (e.g., a plant operating state, external hazard damage state, or a component out of service) over a limited period of time. (ANS/ASME-58.22-2015)

conditional large early release probability (CLERP): the probability of large early release given the occurrence of a specific plant configuration (e.g., a plant operating state, external hazard damage state or a component out of service) over a limited period of time.(ANS/ASME-58.22-2015)

conditional license: A license issued by the NRC with specific restrictions to accommodate and adequately control identified physical or mental health situations that do not meet the minimum requirements of this standard. (ANS-3.4-2013)

conduction cooldown events, pressurized or depressurized. An event involving a loss of forced circulation heat removal in which core heat removal is accomplished via thermal conduction, convection, and radiation heat transfer from the reactor core to the RPV walls and thermal radiation and convection heat transfer to the reactor cavity and/or reactor cavity cooling system (RCCS). Conduction cooldown may occur with the reactor pressurized or depressurized and with or without operation of the RCCS. (ANS-53.1-2011)

confidence level. The probability that the true leakage rate does not exceed the upper confidence limit (UCL). (ANS-56.8-02)

confinement. A safety function that involves the retention of radioactive material, or mitigation of release, using one or more radionuclide transport barriers. (ANS-53.1-2011)

Non-preferred variation (1) The structure, system or component (SSC) provided for the purpose of controlling the release of radioactive particulate matter. It may be either a physical barrier or a high efficiency filtration system.(ANS-57.9-92)(ANS-57.10-93)

Non-preferred variation (2) The SSC provided for the purpose of controlling the release of hazardous particulate matter. It may be either a physical barrier or a high-efficiency filtration system. (ANS-58.16-2014)

confinement system. *It is preferred that the term (**Confinement**) and the associated definition be used in ANS standards*

A barrier and its associated systems, including ventilation, that are placed around an area containing radioactive materials to prevent the uncontrolled release of those materials. (ANS-54.1-89)

confining layer. A geologic unit within the saturated or unsaturated zones that has a distinctly lower hydraulic conductivity than the underlying and overlying geologic units; also called an aquitard when in the saturated zone. (ANS-2.17-2010)

consequence assessment. Evaluation of the radiological consequences of an accident. In this standard, consequences are assessed in terms of integrated radiological dose exposure to an individual (e.g., the public) at the exclusion area boundary (EAB). (ANS-53.1-2011)

conservative. The application of uncertainties in the values of analysis input parameters, analysis models, or results in a manner which will tend to ensure the adequacy of structures, systems, or components (SSCs) to perform their intended function. (ANS-56.10-87)

Variant form: (ANS-56.4-83)

consumable. Materials or supplies consumed or expended during installation, operation, testing, maintenance or repair of plant structures, systems components or parts such as:

- items consumed or expended during the operation of components or routinely replaced during maintenance (e.g., diesel fuel, o-rings, gaskets, hydraulic fluid, lubricating oil, grease, packing, and paint);
- items consumed or expended in maintaining the chemical control of system process fluids (e.g., resins, additive chemicals and gases such as boron, pH buffer, bromophenol blue, and nitric acid); or
- items consumed or expended during maintenance, installation, and modification activities that are generally used throughout the plant and might not be included in the above (e.g., solvents, layout fluid, welding rods, lead-testing fluid, tape, and penetrant testing materials).

[Developed for ANS-51.1/52.1] (ANS-58.14-2011)

container. The primary receptacle forming an isolation boundary between the contained waste and the environment. (ANS-55.1-92)

containment. *It is preferred that the term (**Primary containment**) and the associated definition be used in ANS standards*

See primary containment and secondary containment.

See also, primary reactor containment. (ANS-56.1-85) (ANS-56.5-87)(ANS-56.10-87)

A physical barrier to limit radioactive release to the environment associated with zero leakage and testing on the containment to assure its function. Containments are used for more than reactors. They also are used for shipping and storage of radioactive materials. See ASME B&PVC, Section III, Division 3.

Variant form: For the purposes of this standard, the principal enclosure that acts as a leak-tight barrier, to prevent the release of radioactive material from the SSC containing the radioactive material under DBE conditions. (ANS-58.16-2014)

containment atmosphere. Free volume enclosed by the primary reactor containment. (ANS-56.1-85)(ANS-56.2-84)

Note use of the term “primary containment “ is recommended

containment atmosphere mass weighted average temperature (T). The temperature derived from weighing each temperature sensor reading by the mass it represents.(ANS-56.8-02)

containment boundary. A physical boundary capable of preventing or limiting the escape of radioactivity which may be released into the primary containment. This boundary may be different than that of the primary containment as defined in ANSI/ANS-51.1-1983 and ANSI/ANS-52.1-1983. For example, closed systems outside of the primary containment may serve as a boundary. (ANS-58.12-85)

containment capacity analysis: deterministic analysis of a containment structure to determine its capacity (or capability) to withstand defined internal or external loads, or a specific challenge to its integrity. (ASME/ANS RA-S-1.2-2015)

containment bypass. A direct or indirect flow path that may allow the release of radioactive material directly to the environment bypassing the containment. (ASME/ANS RA-Sb-2013)

containment challenge. Severe accident conditions (e.g., plant thermal hydraulic conditions or phenomena) that may result in compromising containment integrity. These conditions or phenomena can be compared with containment capability to determine whether a containment failure mode results. (ASME/ANS RA-Sb-2013)

containment event tree (CET): a logic diagram that begins with a Level 1 PRA end state (e.g., accident sequence or plant damage) and progresses through a series of branches: (1) that represent expected system or operator performance that either succeeds or fails; (2) that delineate the chronological and physical progression of core damage; (3) that characterize containment response; and, (4) that represent processes affecting fission product release to the environment. The end states of the CET can be associated with release categories. (ASME/ANS RA-S-1.2-2015)

containment failure. Loss of integrity of the containment pressure boundary from a core damage accident that results in unacceptable leakage of radio nuclides to the environment. (ASME/ANS RA-Sb-2013)

containment failure mode. The manner in which a containment radionuclide release pathway is created. It encompasses both those structural failures of containment induced by containment challenges when they exceed containment capability and the failure modes of containment induced by human failure events, isolation failures, or bypass events such as ISLOCA. (ASME/ANS RA-Sb-2013)

containment foundation. The foundation of the containment or reactor building including adjacent foundations if they are constructed integrally with the containment foundation. (ANS-2.2-02)

containment integrated leakage rate test (CILRT). The leakage rate test performed on the primary reactor containment by simulating some of the conditions (e.g., penetrations

vented, drained, flooded, or in operation) that exist during a design-basis accident (DBA). The CILRT consists of the following phases or activities:

- (1) inspecting the primary containment;
- (2) pressurizing the primary containment system;
- (3) stabilizing the containment atmosphere;
- (4) conducting a Type A test;
- (5) conducting a verification test;
- (6) depressurizing the primary containment system.

(ANS-56.8-02)

Note use of the term “primary containment” is recommended

containment isolation. Closure of mechanical barrier(s) in appropriate fluid systems penetrating the containment which could otherwise represent open paths to the environment for fission products from inside the containment. (ANS-56.2-84)

containment isolation valve. A valve that is relied upon to perform a containment isolation function.(ANS-56.2-84)(ANS-56.8-02)

containment leakage rate test program. The comprehensive testing of the primary containment system that includes Type A, Type B, Type C and leakage rate verification tests.(ANS-56.8-02)

containment performance. A measure of the response of a nuclear plant containment to severe accident conditions. (ASME/ANS RA-Sb–2013)

containment pressures tests. Those periodic and one time tests, including the integrated leak rate test (ILRT) and structural integrity tests (SITs), conducted to verify containment design leakage and structural integrity. (ANS-56.6-86)

containment, primary containment, or reactor containment. *It is preferred that the term (Primary containment) and the associated definition be used in ANS standards*

For the purpose of this standard, a structure or vessel that encloses the reactor vessel and other components of the reactor coolant pressure boundary and which provides an essentially leak-tight barrier against the uncontrolled release of fission products to the environment. (ANS-56.2-84)

contamination. Occurrence of material in a location where it is not considered indigenous to its surroundings. (ANS-2.17-2010)

continuous communications. The capacity, through the availability of adequate equipment, to transmit information from one point to another at any given time. (ANS-3.3-88)

continuous leakage monitoring system. A permanently installed, on-line pneumatic measurement system that continuously monitors the leakage rate of containment system penetrations at a pressure not less than P_a . (ANS-56.8-02)

continuous occupancy. State in which operating personnel could be required to be present continuously during the accident duration (e.g., the control room).(ANS-5.6.1-90)

consequence: The effects of a radiological release to the atmosphere that can include doses to an individual or population, health effects or individual risk of health effects, contaminated land areas, and economic costs. (ASME/ANS RA-S-1.3-2016)

Control Air System (CAS). Instrument quality air, nitrogen or other inert gas. (ANS-59.3-92)

Non-preferred variation (1) Variant form: (ANS-59.3-83)

control components. Items that control coolant flow or reactivity and must be handled or shifted in position during fuel loading or refueling. Examples are: control rods, flow limiting orifices, burnable poison rods. (ANS-57.2-92)(ANS-57.3-93) (ANS-57.2-99)

Non-preferred variation (1) Variant form: (ANS-57.1-92)

control components change mechanism. Handling equipment used to move control components from one fuel assembly or core location to another or to a temporary storage location. (ANS-57.1-92)

control height. The term control height is a guidance height of two to three meters above the floor as used by station radiation protection personnel. (ANS-6.3.1-87)

control Raschig rings (control sample). Raschig rings that are periodically removed from service for scheduled measurements, and then are returned to service after these short test periods.(ANS-8.5-96)

control total. A population count or estimate for a geographic area which the sum of the estimates or counts, or both, of all the district geography partitions of the area must equal. Distinct geographic partitions, means partitions which do not overlap (i.e., they contain to area in common). (ANS-2.6-81D)

control transfer device. A device that is used to select and isolate the location of control and eliminates the potential for simultaneous control from the Alternate Shutdown Station and the control room. (ANS-58.6-92).

control volume. The smallest geometric subdivision for which thermodynamic states are computed. (ANS-56.4-83)

control unit. A census or other geographic unit used to produce a control total for population estimates of the geographic sub-units into which it has been partitioned. (ANS-2.6-81)

controlled access. Access to areas that are controlled for purposes of radiation protection. (ANS-5.6.1-90)

Variant form: (ANS-6.7.1-85)

controlled area. That portion of a nuclear facility, including outside yard areas, enclosed equipment, systems, and facilities which may contain radioactive material by definition or design. Controlled area does not normally, but may temporarily, include portions of secondary system areas of the plant. (ANS-55.6-93) (ANS-55.6-99)

controlled condition. The state of the plant that is achieved when the "subsequent action" portion of the plant emergency procedures is implemented and the critical safety functions are being accomplished or maintained by the control room operator. (ANS-4.5)

controlled parameter. A parameter that is kept within specified limits. (ANS-8.1-14)

controlled shutdown and cooldown. A shutdown and cooldown condition in which the fuel and reactor coolant pressure boundary conditions might exceed technical specification limits and implementation of plant emergency procedures might be required.

controlled manual shutdown: a POS evolution during which the reactor power level is decreased from full power to low power and finally to zero power with control rods inserted. (ANS/ASME-58.22-2015)

Controllers. Personnel who direct the conduct of the scenario. (ANS-3.8.4-95)

controls. Apparatus and mechanisms, the manipulation of which, directly affect the reactivity, power level, cooling, containment, and other requirements for safe operation of the nuclear reactor. (ANS-3.4-87)

convective eddy formation: Movement of air parcels under the influence of density differences (e.g., buoyancy). (ASME/ANS RA-S-1.3-2016)

conversion. Modification of existing software to enable it to operate with similar functional capability in a different hardware/software environment. (ANS-10.2-88)

cooling water. Water provided to transfer the heat absorbed by the containment heat removal system to the ultimate heat sink. (ANS-56.5-87)

cooling time: The time following fuel irradiation during which radioactive decay results in changes in fuel composition. (ANS-8.27-15)

core damage. Any physical disruption of the nuclear core including fuel, fission products, and containing geometry consisting of cladding, structure, and flow alignment that could release significant amounts of radioactivity from fission products by being undercooled or overreactive. (ANS-53.1-2011)

Non-preferred variation (1) Uncovery and heatup of the reactor core to the point at which prolonged oxidation and severe fuel damage are anticipated and involving enough of the core, if released, to result in offsite public health effects. (ASME/ANS RA-Sb-2013)

core damage frequency (CDF). Expected number of core damage events per unit of time. (ASME/ANS RA-Sb-2013)

core recovery. An expression in percentage of core recovered during drilling operation.

$$\text{CR in \%} = 100 \times \frac{\text{total length of core recovered}}{\text{length of core run}}$$

(ANS-2.19-89)(ANS-2.11-78)

core release fraction. The fraction of the total core radioactive inventory released during an accident with similar chemical or physical properties (e.g., noble gases, halogens).(ANS-5.6.1-90)

correction factor, shield-tissue interface. A correction factor to be applied to the basic infinite medium exposure buildup factor to correct for the scattering in a tissue phantom after emerging from a shield. (ANS-6.4.3-91)

corrective actions. (1) Those measures taken to terminate or mitigate the consequences of an emergency at or near the source of the emergency.(ANS-3.8.1-93)(ANS-3.8.2-93) (ANS-3.8.6-94) (ANS-3.8.2-95) (ANS-3.8.6-95)

Non-preferred variation (1) Variant form: (ANS-3.7.2-79)(ANS-3.2-93)

Non-preferred variation (2) Activities undertaken to manage or remediate the occurrence or movement of subsurface radionuclides. (ANS-2.17-2010)

coseismic. A term that relates an area or occurrence of a phenomenon to the simultaneous arrival of earthquake waves. (ANS-2,27-2008)

coseismic deformation: Movement of the ground surface due to fault displacement during an earthquake (ANS-2.30-2015).

cover gas. Gas in liquid storage tanks pressurized to prevent in-leakage of air. (ANS-55.1-92)(ANS-55.4-93) (ANS-55.4-99)

crane.

1) Auxiliary Fuel Handling Crane - a crane used for handling equipment including fuel assemblies and new fuel shipping containers.

2) Cask Crane - a crane designed for handling spent fuel shipping casks. (ANS-57.2-D92) (ANS-57.2-99)

credible event: For the purposes of this standard, an event (external or internal) that must be considered because of the feasibility of its occurrence. (ANS-58.16-2014)

credible passive failure. The passive failure of a piping system or single structural steel load bearing member at a discontinuity; the integrity of which has not been verified by volumetric examination (e.g., radiographic, ultra-sonic). (ANS-57.7-92)

critical area. Those areas which contain nuclear safety-related structures, systems, or components (SSCs). (ANS-59.4-70W83)

critical characteristics. Important design, material, and performance attributes of an item that, once verified, will provide reasonable assurance that the item will perform its intended safety function. (ANS-53.1-2011)

critical level (L_c). The minimum measured analyte quantity or concentration (a posteriori result) required to give a stated confidence that a positive amount of the analyte is present. For this standard, the stated confidence level will be assumed to be 95%. Correspondingly, the probability of a Type I error (probability of erroneously concluding a radionuclide is detected in a sample that is blank) is set at 0.05. However, other confidence levels may be established by the MQOs. See "decision level"(ANS-41.5-2012)

critical outcome. A long-term, strategic goal, stated in terms of the expected results, that captures the essence of the desired end state to be achieved. (ANS-2.17-2010)

critical parameters. (1) Those parameters that require direct and continuous observation to operate the power plant under manual control.(2) Input parameters to plant safety systems. (ANS-3.5-85)

critical safety functions. Those safety functions that are essential to prevent a direct and immediate threat to the health and safety of the public. These are the accomplishing or maintaining of:

- (1) reactivity control;
- (2) reactor core cooling;

- (3) reactor coolant system integrity;
- (4) primary reactor containment integrity; and,
- (5) radioactive effluent control (ANS-4.5)

critical SSC. System, Structure Component (SSC), with critical characteristics, that performs critical safety functions, failure of which causes significant safety risks. (ANS-53.1-2011)

critical (sub-critical) flow. A fluid flow regime in which the fluid velocity is equal to (less than) the velocity of sound in the fluid at local fluid state conditions, or which is (is not) at its maximum value with respect to some other parametric restraint.(ANS-56.4-83) (ANS-56.10-87)

critical time period. The time frame over which relevant meteorological data are evaluated to determine that a particular type of ultimate heat sink design (e.g., cooling lakes, rivers, spray ponds, mechanical draft cooling towers, and natural draft cooling towers) will be able to perform its critical function. (ANS-2.21-2012)

criticality accident (accident). The release of energy as a result of accidentally producing a self-sustaining or divergent neutron chain reaction. (ANS-8.1-14)(ANS-8.3-97)(ANS-8.6-83)(ANS-8.10-15)(ANS-8-20-91)

criticality safety staff: The collection of criticality safety engineers, senior criticality safety engineers, criticality safety engineers in training, and other criticality safety technical support personnel. (ANS-8.26-08)

Non-preferred variation (1). Specialists skilled in the techniques of nuclear criticality safety assessment and familiar with plant operations while, to the extent practicable, administratively independent of process supervision. (ANS-8.20-91)

cross-section processing code. A computer code that converts data in ENDF-6 [2] format to a form that is appropriate for use in applications. A cross-section processing code performs calculations such as resonance reconstruction, Doppler broadening, and multigroup averaging. (ANS-6.1.2-2013)

crud. Insoluble particulate materials in the process streams. (ANS-55.6-93) (ANS-55.6-99)

Non-preferred variation (1) Variant form: (ANS-57.10-93)

cryogenic adsorption systems. Processing systems utilizing an adsorbent at cryogenic temperatures for separation or adsorption and decay of radio-active gases. (ANS-55.1-92) (ANS-55.4-93) (ANS-55.4-99)

cryogenic distillation units. Equipment employing cryogenic temperature distillation for separation of noble gases from waste gas streams. ANS-55.1-92) (ANS-55.4-93) (ANS-55.4-99)

cumulative absolute velocity (CAV). The time integral of absolute acceleration over the duration of the strong shaking. This quantity has been shown to be a good indicator of the damage potential of an earthquake time history. (ANS-2.2-02)

cumulative fraction leached. The sum of the fractions leached during all previous leaching intervals, plus the fraction leached during the last leaching interval, using the initial amount of the species of interest present in the specimen as unity (100%) and assuming no radioactive decay.(ANS-16.1-03)

current value. That magnitude of a variable that is associated with the present time and is available for display with-in the response time limits of an information display channel. (ANS-4.5)

cycles of concentration. The ratio of total dissolved solids (TDS) in the water in a closed cycle cooling system to the TDS in the makeup water. (ANS-2.13-79)

cyclostrophic wind. The cyclostrophic wind is the horizontal wind velocity for which the centrifugal force exactly balances the horizontal pressure gradient force. The cyclostrophic wind is a good approximation of the real wind in cases of very great wind speed and strong curvature such that the centrifugal force is clearly dominant over nonpressure gradient forces (e.g., Coriolis force). (ANS-2.3-2011)

D.

damage criteria. Those characteristics of the fire-induced environmental effects that will be taken as indicative of the fire-induced failure of a damage target or set of damage targets. (ASME/ANS RA-Sb-2013)

damage target. See target. (ASME/ANS RA-Sb-2013)

damage threshold. The values corresponding to the damage criteria that will be taken as indicative of the onset of fire-induced failure of a damage target or set of damage targets. (ASME/ANS RA-Sb-2013)

damaged rod. A rod which exhibits visible evidence of structural change to the fuel cladding that would compromise the rod consolidation process or fuel confinement. (ANS-57.10-93)

damaged fuel. Fuel units that exhibit visible evidence of structural damage to the fuel rod cladding or container. (ANS-57.9-92)

damped natural wavelength. A characteristic of a wind vane empirically related to the delay distance and the damping ratio. (ANS-3.11-2015)

damping: The more or less steady diminishing in time or space (or both) of the amplitude of any physical quantity (ANS-3.11-2015).

damping ratio. Ratio of the actual damping, related to the inertial-driven overshoot of wind vanes to direction changes, to the critical damping, the fastest response where no overshoot. (ANS-3.11-2015)

data. A representation of facts, concepts, or instructions in a formalized manner suitable for communication, interpretation or processing by a programmable digital computer. (ANS-7-4.3.2-82)

data processing. The preparation and compilation of recorded data for subsequent evaluation. (ANS-2.10-90)

data quality assessment (DQA). The last phase of the data collection process, which consists of a scientific and statistical evaluation of the data set to assess its validity and usability. The focus of DQA is the evaluation of the data relative to their intended use.(ANS-41.5-2012)

data quality objective(s) [DQO(s)]. (1) Qualitative and quantitative statements derived from the DQO process that clarify the study objectives, define the most appropriate type of

data to collect, determine the most appropriate conditions from which to collect the data, and specify tolerable limits on decision error rates. Because DQOs will be used to establish the quality and quantity of data needed to support decisions, they should encompass the total uncertainty resulting from all data collection activities, including analytical and sampling activities. (ANS-2.17-2010)

Non-preferred variation (1) The qualitative and quantitative statements that specify the type and quality of data required to support decisions for any process requiring radiochemical analysis (radioassay). ANS-41.5-2012)

data quality objective process. A systematic, strategic-planning tool based on the scientific method that identifies and defines the type, quality, and quantity of data needed to satisfy a specified use. DQOs are the qualitative and quantitative outputs from the DQO process. (ANS-2.17-2010)

data set. A reading of the values of each sensor used in the calculation of containment dry air mass. (ANS-56.8-D93)

Non-preferred variation (1) The set of readings from all primary test instrumentation for a CILRT taken over a single scan of the data acquisition system (DAS) or CILRT software. (ANS-56.8-02)

deaggregation. Process used to determine the fractional contribution of each magnitude-distance (M-D) pair or of each seismic source zone, to the total seismic hazard. To accomplish the M-D deaggregation, a set of magnitude and distance bins are selected and the annual probability of exceeding selected ground acceleration parameters from each M-D pair is computed and divided by the total probability of exceedance for all modeled earthquakes. (ANS-2.29-2008)

Non-preferred variation (1) Determination of the functional contribution of each magnitude-distance pair to the total seismic hazard. To accomplish this, a set of magnitude and distance bins are selected, and the annual frequency of exceeding selected ground motion parameters from each magnitude-distance pair is computed and divided by the total probability. (ASME/ANS RA-Sb-2013)

decision level (DL) (also L_c). The minimum measured analyte quantity or concentration (a posteriori result) required to give a stated confidence that a positive amount of the analyte is present. For this standard, the stated confidence level will be assumed to be 95%. Correspondingly, the probability of a Type I error (probability of erroneously concluding a radionuclide is detected in a sample that is blank) is set at 0.05. However, other confidence levels may be established by the MQOs. (ANS-41.5-2012)

decontamination factor (DF). The ratio of the concentration of the radioactive material in the influent stream to its concentration in the effluent. (ANS-55.1-92 (ANS-55.4-99) (ANS-55.6-99)

decontamination wastes. Liquid radioactive wastes generated by decontamination of radioactive plant components, equipment and tools other than personnel protective clothing and equipment. (ANS-55.6-93) (ANS-55.6-99)

dedicated shutdown. Systems and equipment provided specifically for maintaining the reactor in a safe shutdown condition, to compensate for a fire in one or more fire areas which could otherwise affect the safe shutdown capability. (ANS-58.6-92); See alternate shutdown (ANS-58.6-92 proposed)

deep bed plants. Those plants utilizing deep bed demineralizers in the condensate polishing system. (ANS-55.6-93) (ANS-55.6-99)

default value. The value assigned to a variable by the program when that value is not specified by the user. (ANS-10.5-79)

defense-in-depth (DID). An established safety philosophy in which multiple lines of defense and safety margins are applied to the design, operation, and regulation of plants to assure that public health and safety are adequately protected. This standard focuses on those aspects of DID of interest in the design of modular helium-cooled reactors (MHRs) that include both deterministic and probabilistic elements. As used in this standard, plant capability DID is reflected in the reactor design, programmatic DID is in the requirements and regulations, and risk-informed evaluation of DID is the process of evaluating the adequacy of DID measures. Note that the NRC statement of DID is a safety philosophy that employs successive compensatory measures to prevent accidents or lessen the effects of damage if a malfunction or accident occurs. ⁽¹⁾ The NRC's safety philosophy ensures that the public is adequately protected and that emergency plans surrounding a nuclear facility are well conceived and will work. Moreover, the safety philosophy ensures that safety will not be wholly dependent on any single element of the design, construction, maintenance, or operation of a nuclear facility.

Footnote: (1) The NRC's statement of DID derives from Speech No. S-04-009, presented at the 3rd Annual Homeland Security Summit Session, "The Best-Laid Plans: A Case Study in Preparedness Planning; The Very Best-Laid Plans (the NRC's Defense-in-Depth Philosophy)," Remarks of Nils J. Diaz, Chairman, U.S. Nuclear Regulatory Commission, June 3, 2004, "Preparedness and Defense-in-Depth": <http://pbadupws.nrc.gov/docs/ML0415/ML041550865.pdf> (page last reviewed/updated March 29, 2012). (ANS-53.1-2011)

defense in depth: the concepts of providing access controls and multiple physical barriers to radionuclide release, successive measures to prevent an accident or mitigate the consequences of an accident, and the use of redundancy and diversity to accomplish key safety functions. (ANS/ASME-58.22-2015)

definitive care. The complete medical and surgical treatment of persons exposed or contaminated as a result of an incident involving radioactive material. (ANS-3.7.1-92)

Variant form (ANS-3.7.1-1995)

delay distance. The distance that air flowing past a wind vane moves while the vane is responding to 50% of the step change in the wind direction. (ANS-3.11-2015)

demineralized water. Water purified by ion exchange to a quality at least equal to Type IV in American National Standard Specification for Reagent Water, ANSI/ASTM D1193-77. (ANS-57.2-92) (ANS-57.2-99)

demonstrably conservative analysis. Analysis that uses assumptions such that the assessed outcome will be conservative relative to the expected outcome. (ASME/ANS RA-Sb-2013)

departure from nucleate boiling (DNB) In the PWR, the onset of the transition from nucleate to film boiling.

departure from nucleate boiling ratio (DNBR) In the PWR, the ratio of the heat flux ratio (DNBR) required to cause departure from nucleate boiling (DNB) to the actual channel heat flux for given conditions.

dependency: Requirement external to an item and upon which its function depends and is associated with dependent events that are determined by, influenced by, or correlated to other events or occurrences. (ASME/ANS RA-Sb-2013)

dependent events. Event combinations for which the occurrence of one event gives information about (i.e., increases or decreases) the possibility of the occurrence of the other event. For example, the occurrence of a hazard such as an earthquake may increase the chance of an explosion at a nearby industrial facility. (ANS-2.12-78)

depletion analysis: Analysis of the change of the concentration of one or more specified nuclides in a material or one of its constituents. (ANS-8.27-15)

depressurization event. An event that results in loss of helium primary coolant pressure to the surrounding building atmosphere resulting from a breach in the helium pressure boundary (HPB). (ANS-53.1-2011)

design. The process and result of developing a concept, detailed plans, supporting calculations, and specifications for a facility and its parts that describe the facility, using an engineering process. The description may include specifications, engineering drawings, reports demonstrating compliance with regulatory requirements, and other relevant documentation. (ANS-53.1-2011)

Non-preferred variation (1) Technical and management processes which lead to and include the issuance of design output documents such as drawings, specifications and other documents defining technical requirements and performance of radiation shields. (ANS-6.4-85)

design bases. Information that identifies the specific functions to be performed by facility SSCs and the specific values or ranges of values chosen for controlling parameters as reference bounds for design. These values may be (a) restraints derived from generally accepted “state-of-the-art” practices for achieving functional goals or (b) requirements derived from analysis (based on calculation and/or experiments) of the effects of a postulated accident for which the SSC is relied upon to function. (ANS-53.1-2011)

design basis. All the related specifications and detailed plans that support calculations for a facility from an initial design concept and its parts extending through its fulfillment as a detailed design constructed as a plant. The range of conditions and events explicitly taken into account in the design of a facility, according to established criteria, such that the facility can withstand them without exceeding authorized limits by the planned operation of safety systems. (ANS-53.1-2011)

design basis accident (DBA). Event sequences deterministically selected for the purpose of performing conservative deterministic safety analyses to demonstrate that DBA dose requirements can be achieved by assuming that only safety-related SSCs perform as required. (ANS-53.1-2011)

Non-Preferred variation (1) The accident initiated by a single component failure or operator error, as described in the safety analysis of the plant, that results in the maximum primary containment internal peak pressure and in fission product release to the containment atmosphere. (ANS-56.8-02)

Non-preferred variation (2) An event that is a condition of normal operation including an anticipated operational occurrence, a design-basis accident (or transient), an external event, or a natural phenomenon, for which the plant must be designed to ensure that the

three basic safety-related functions are achievable (see definition of safety function). (ANS-58.16-2014)

design basis accident events. *It is preferred that the term (**Design Basis Event (DBE)**) and the associated definition be used in ANS standards*

design basis accident events. Those events postulated in the plant safety analyses, any one of which may occur during the lifetime of a particular plant, excluding those events (defined as "normal" and "anticipated operational occurrences" in 10 CFR 50) expected to occur more frequently than once during the lifetime of a particular plant; and those events not expected to occur but postulated in the plant safety analyses because their consequences would include the potential for release of significant amounts of radio-active material to the environs. (ANS-4.5-W96)

design basis accidents and transients. *It is preferred that the term (**Design Basis Event (DBE)**) and the associated definition be used in ANS standards*

design basis accidents and transients. Those design basis events that are accidents and transients initiated by a single component failure or operator error and are described in the safety analyses of the plant⁽³⁾ and are used in the design to establish acceptable performance requirements for structures, systems and components (SSCs). Design basis accidents and transients that are applicable to the plant are identified in the plant licensing basis documentation (LDB).Footnote:(3) These descriptions are primarily in the accident analyses chapter of the FSAR or SSAR. (ANS-58.14-93)

design basis documentation (DBD). The set of documents that is controlled and contain the specifications for the design of the plant. The design basis documentation typically includes design specifications, piping and instrumentation drawings, electrical schematics and safety analyses. (ANS-58.14-93)

design-basis earthquake (DBE). A commonly employed term for the safe shutdown earthquake (SSE), defined separately below. (ASME/ANS RA-Sb-2013)

design basis event (DBE).

(See, also **design events**)

An event that is a condition of normal operation, including anticipated operational occurrences, design basis accidents (or transient), external events, or natural phenomena for which the plant must be designed to ensure the three basic safety-related functions are achieved. See the definition for "safety-related" for a description of the three basic safety-related functions. (ANS-58.14-2011)

Non-preferred variation (1) An event that is a condition of normal operation including an anticipated operational occurrence, a design basis accident (or transient), an external event, or a natural phenomenon, for which the plant must be designed to ensure that the three basic safety-related functions are achievable. (See 10 CFR 50.49(b)1. for the functions.) (ANS-58.14-93) (ANS-58.6-92) (ANS-58.11-93) (ANS-59.52-93) (ANS-59.52-98)

Non-preferred variation (2) Variant form: (ANS-59.1-92) (ANS-59.51-89)

Non-preferred variation (3) Those LBEs that are not expected to occur during the lifetime of a single plant but may be encountered during the lifetime of a population of plants. Event sequences from the PRA are classified as DBEs when their expected

frequency of occurrence is between 1×10^{-4} events/plant-year (1E-04 events/plant-year) and 1×10^{-2} events/plant-year (1E-02 events/plant-year). (ANS-53.1-2011)

design-basis hazard event: a particular hazard event having the characteristics of the hazard severity and type that are specified in the plant design basis, and against which the plant is designed. If no specific characteristics are specified in the plant design basis for a specific hazard, then there is no design-basis hazard event for that hazard. Examples include wind speed (for high winds and tornadoes); peak ground acceleration, spectral shape, and time history (for seismic); and maximum rate and duration of precipitation (for rainfall or snowfall). (ASME/ANS RA-Sb-2013)

design-basis functions. Functions performed by SSCs that are (a) required by or otherwise necessary to comply with regulations, license conditions, orders, or technical specifications or (b) credited in licensee safety analyses to meet regulatory requirements. (ANS-53.1-2011)

design basis hurricane. The design basis hurricane is a postulated hurricane used for design purposes only, having characteristics with a frequency of exceedance commensurate with the facility safety goal. (ANS-2.3-2011)

design basis radioactivity concentrations. Concentration of radiochemical constituents provided in reference Safety Analysis Report (SAR) by Nuclear Steam supply system (NSSS) supplier. (ANS-55.6-93) (ANS-55.6-99)

design bases response spectra (DBRS). Response spectra which were used to design Seismic Category I structures, systems and components (SSCs). (ANS-2.10-90)

design bases time-history. The acceleration time-history which corresponds to the design bases response spectra (DBRS). (ANS-2.10)

design basis tornado. The design basis tornado is a postulated tornado, used for design purposes only, having characteristics consistent with a frequency of exceedance commensurate with the facility safety goal. (ANS-2.3-2011)

design change. Any revision or alteration of the technical requirements defined by approved and issued design output documents and approved and issued changes thereto. (ANS-3.2-93)

design dose equivalent rate. The design dose equivalent rate is the radiation level determined by the designer. (ANS-6.3.1-87)

design database. The design documents, performance data, records, assumptions, simplifications, derivations, and other definable data that form the basis of the design of the simulator hardware and software. (ANS-3.5-2009)

design life. Plant life estimation used for design aging calculations to support the licensed plant life. (ANS-53.1-2011)

design margins. Additional performance capability above required design parameters that system design specifies to compensate for uncertainties at any design stage or to provide additional capacity or reliability. (ANS-53.1-2011)

designer. The organization that has the responsibility for preparing the fuel assembly design. (ANS-57.5-96)

design events. The purpose of categorizing Design Events is to provide a means of establishing design requirements to satisfy operational and safety criteria of the installation.

These Design Events are; normal operation (Design Event I), classified on the basis of expected frequency of occurrence (Design Events II and III), or postulated because their occurrence may result in the maximum potential impact on the immediate environs (Design Events IV). Evaluation of the consequences of any such event can then be used to specify the performance requirements of the systems and subsystems within the installation.

design Event I. Definition. Design Event I consists of that set of events that are expected to occur regularly or frequently in the course of normal operation at the installation.

Examples are:

- (1) Cask receipt, inspection, unloading, and maintenance;
- (2) Fuel unit transfer from cask to pool or pool to cask;
- (3) Collection and disposal of air or waterborne radionuclide generated during ISFSI operation; and,
- (4) Fuel rod consolidation, if performed at the Independent Spent Fuel Storage Installation (ISFSI).

design Event II - Definition. Design Event II consists of that set of events, that although not occurring regularly, can be expected to occur with moderate frequency or on the order of once during any calendar year of installation operation. Examples are:

- (1) Failure of any single active component to perform its intended function upon demand;
- (2) Spurious operation of certain active components;
- (3) A loss of external power supply for a limited duration;
- (4) Minor leakage from flanges piping or component connections; and,
- (5) A single operator error followed by proper corrective action.

design Event III - Definition. Design Event III consists of that set of infrequent events that could reasonably be expected to occur once during the lifetime of the installation. Examples are:

- (1) A credible passive failure of a radioactive liquid retaining boundary; and,
- (2) A loss of external power for an extended interval.

design Event IV - Definition. Design Event IV consists of the events that are postulated because their consequences may result in the maximum potential impact on the immediate environs. Their consideration establishes a conservative design basis for certain systems with important confinement features. Typically this set of events will consist of site specific design events as defined in Design Phenomena. By adherence to the requirements of this standard, the designer may exclude such events as criticality, total loss of pool water, and dropped cask as Design Event IV possible events.(ANS-57.7-92) (ANS57.7-97)

Variant form: (ANS-57.9-92) (ANS-57.10-93)

design function. A principal function for which a SSC was included in the plant design. Design functions, as they relate to safety-related items, support one or more of the three basic safety-related functions. For example, the emergency core cooling system (ECCS) is included in the plant design to perform the primary design function of providing coolant to the reactor vessel during or following a loss-of-coolant accident (LOCA), in order to maintain the unit in a safe shutdown condition. (ANS-58.14-2011)

design input. Those criteria, parameters, bases, or other design requirements upon which detailed final design is based. (ANS-3.2-93)

design output. Documents, such as drawings, specifications, and other documents, defining technical requirements of structures, systems, and components (SSCs). (ANS-3.2-93)

design parameters. Material properties, dimensional characterizations, or physical response phenomena necessary to describe or evaluate fuel assembly behaviour. (ANS-57.5-96)

design phenomena. Those natural phenomena and man-induced low probability events for which an ISFSI is designed. Title 10 CFR Part 72 "Licensing Requirements for the Storage of Spent Fuel in an Independent Spent Fuel Storage Installation (ISFSI)", Subpart E, "Siting Evaluation Factors," or ANSI/ANS-2.19-1981(R1990) provides the requirement for identification and evaluation of design basis natural or man-induced events. 10 CFR 72, Subpart F provides the general design criteria for structures, systems, and components (SSCs) that are important to confinement. (ANS-57.9-92) (ANS-57.7-97)

design requirements. A design requirement is the limiting value of a design parameter that ensures that the consequences of any DBE do not result in:

- (1) Violation of plant nuclear safety criteria (including off-site radiological dose criteria); and,
- (2) Unacceptable degradation of plant components that are required to mitigate the consequences of a DBE. (ANS-58.8-92)

designated rating. That rating required by the fire hazard analysis without any other consideration to its construction capability for purposes of other perils such as tornadoes, radiation, earthquake, etc. (ANS-59.4-79W83)

designated local hospital. A hospital located near a nuclear plant where formal arrangements have been made in advance for the emergency care of personnel who have been injured, contaminated, or exposed, and may also provide definitive care if appropriate facilities and staff are available. (ANS-3.7.1-95)

designated medical examiner. A licensed medical practitioner designated by the facility operator to perform nuclear reactor operator medical examinations. (ANS-3.4-87)

designated vehicle. A vehicle limited to use to onsite plant functions that remains within the protected area except for operational, maintenance, repair, security and emergency purposes. A vehicle, for purposes of this definition, is any motorized prime mover with sufficient power and mechanics to permit its use as an instrument of radiological sabotage; other means of transport, such as electric or gasoline driven carts, jitneys, or trams commonly used within the protected area for the conveyance of material and supplies, are not vehicles. (ANS-3.3-88)

desk audit. An off-site or remote review of laboratory-submitted documents. (ANS-41.5-2012)

detergent waste. Liquid radioactive waste containing detergents, soaps, or similar organic materials. (ANS-55.6-93) (ANS-55.6-99)

deterministic. Based on an exact model (in contrast with stochastic: based on a probabilistic model). (ANS-53.1-2011)

deterministic safety analysis. Engineering analysis of the plant response using computer models, calculations, and data that predict the transient response of the plant to an event sequence, mechanistic source term, and radiological consequences using validated models and data. (ANS-53.1-2011)

development environment. The system and environment (including all supporting software components and software development tools) on which the software is developed and maintained by the development organization. (ANS-10.7-2013)

dew point temperature: The temperature to which a given air parcel must be cooled at constant pressure and constant water vapor content in order for saturation to occur (ANS-3.11-2015).

dewatered. Liquid or slurry wastes that have had excess water removed to meet applicable burial site criteria. (ANS-55.1-92)

diagnostic models: Models that map multiple observations taken all at the same time onto a field that spans the geographical location of the observations. Diagnostic models are not able to forecast conditions into the future except by persistence (ANS-2.15-2013).

diffusion: The spreading of gaseous and/or particulate matter caused by turbulent motions in the atmosphere (ANS-2.15-2013).

diffusion, dispersion. That component of dispersion that addresses the variation of the concentration of material in a medium along the path of transport. (ANS-3.8.6-95)

direct gamma rays.

The term direct gamma rays is used to denote those gamma rays that do not undergo scattering interactions in transit from the source volume to the receptor location. It differs from “uncollided gamma rays” in that scattering internal to distributed sources (such as a pipe containing radioactive fluid) may be included in the direct category.(ANS-6.6.1-2015)

discrete time points. The time points during the time course of a DBE that define the time intervals evaluated in this analysis. These points are defined below and are illustrated in Figure 1 of ANS-58.8.

(1) start of event (t_{ST}). The time at which the DBE is initiated.

(2) indication of event (t_{IND}). The time at which the DBE is identified to the plant operators by readily available information, e.g., one or more alarm(s) or display indication(s).

(3) earliest credited action (t_{ECA}). The earliest time following t_{IND} at which credit for safety-related operator actions can be taken.

(4) manual action initiated (T_{MAI}). The time which can not occur prior to t_{ECA} selected by the designer for initiation of a safety-related operator action.

(5) safety-related action completed (t_{SAC}). The time at which the safety-related operator action is evaluated to be completed.

(6) safety-related function completed (s_{FC}). The time at which an indication is received that a safety-related system is operating as necessary to achieve its safety-related function.

(7) design requirement limit (t_{LIM}). The time at which a design requirement would be exceeded if a safety-related function has not been completed. (ANS-58.8-92)

dispersion. The combined influence of both the transport of material in a medium (e.g., atmosphere, body of water) and the diffusion of the material during the transport. (See diffusion) (ANS-3.8.6-95)

Non-preferred variation (1) The sum of the processes of transport and diffusion (ANS-2.15-2013).

dispersion coefficient (L^2T^{-1}) A measure of the spreading of a flowing substance due to the nature of the porous medium, with its interconnected channels distributed at random in all directions. (ANS-2.17-89)

dispersivity (L) A geometric property of a porous medium which determines the dispersion characteristics of the medium by relating the components of pore velocity to the dispersion coefficient. (ANS-2.17-89)

displacement. "The relative movement of the two sides of a fault, measured in any chosen direction. In addition, the specific amount of such movement." (See Glossary of Geology, American Geological Institute, 1972). As used here, the term applies to either slip or separation as measured or inferred along a fault. (ANS 2.7-82)

disqualifying condition. A medical or psychological condition that precludes approval for nuclear power plant reactor operator or senior operator licensure. (ANS 3.4-94)

Non-preferred variation (1) A physical or mental health condition that prohibits the approval of an operator license. (ANS-3.4-2013)

distance constant. The distance that air flows past a rotating anemometer during the time it takes the cup wheel or propeller to reach 63 percent of the equilibrium speed after a step change in the wind speed. (ANS 3.11-2000)

distribution coefficient ($M^{-1}L^3$) The quantity of the radionuclide absorbed by the solid per unit weight of solid divided by the quantity of radionuclide dissolved in the water per unit volume of water. (ANS 2.17-89)

distribution system. Piping, raceway, duct, or tubing that carries or conducts fluids, electricity, or signals from one point to another. (ASME/ANS RA-Sb-2013)

diversity. Use of different design principles in functionally redundant components in order to reduce susceptibility to common-cause failures. (ANS 53.1-2011)

document. Any written or pictorial information describing, defining, specifying, reporting, or certifying activities, requirements, procedures, or results. A document is considered to be a Quality Assurance Record when it is complete and furnishes evidence of the quality of items or services affecting quality. (ANS 3.2-93)

domain: The geographical region of interest for a modeling study.

dose. A quantity of energy absorbed in a reference medium per unit mass. There are several different units of dose in current use:

(1) The Gray (Gy) is a measure of the dose of any ionizing radiation in terms of the energy absorbed per unit mass. One Gray (Gy) is equal to the absorption of one Joule per kilogram (1 Gy = 100 rad). (2) The Sievert (Sv) is a measure of the dose of any ionizing radiation to body tissues in terms of its estimated biological effect relative to a dose of one Roentgen (R) of x-rays. (1 Sv = 100 rem). (ANS 5.6.1-90)

Non-preferred variation (1) Variant form: (ANS 6.4-85)

dose equivalent (H). The product of the absorbed dose (D), the quality factor (Q), and the modifying factor (N): $H = DQN$, where: N is the product of all modifying factors specified by the International Commission on Radiation Protection (ICRP) (i.e., see Publication 26 and Report 33). Such factors might, for example, take account of absorbed dose rate and fractionalization. At present, the ICRP has assigned the value of 1 to the factor N. The special name for the unit of dose equivalent is the sievert (Sv); 1 Sv = 1 J/kg. (ANS-6.1.1-91)

dose conversion factor: A parameter describing the energy from particles and waves deposited in an organ, tissue, or body. (ASME/ANS RA-S-1.3-2016)

dose equivalent rate. Dose equivalent rate is used as defined by the International Commission on Radiation Units and Measurements (ICRU), "Radiation Quantities and Units," ICRU Report No. 33-1980 and the unit is millirem per hour, mrem/h (10 \square Sv/h). (In System International, SI Units, 100 rem = 1 sievert). (ANS-6.3.1-87)

dose rate and absorbed dose. *It is preferred that the term (**dose equivalent (H)**) and the associated definition be used in ANS standards*

dose rate and absorbed dose. The term dose is used herein to refer to either exposure (i.e., roentgens), absorbed dose (i.e., rad or gray), dose equivalent (i.e., rem or seivert), or ambient dose equivalent (rem or seivert). These later terms are specifically defined in Report No 51 of the International Commission on Radiation Units and Measurements. For gamma rays, to the degree of approximation acceptable, for practical purposes, and for the purposes of this standard, the absorbed dose, dose equivalent, and dose equivalent index may be considered numerically equivalent. (ANS-6.6.1-2015)

dosimeter. An instrument used for measuring or evaluating the absorbed dose, exposure, or similar radiation quantity. (ANS-3.7.95)

drawdown (L). The lowering of the water level caused by withdrawal of water, with reference to some datum and to the time since withdrawal began. (ANS-2.9-89)

drift. Water lost from a cooling tower as liquid droplets (i.e., aerosols) entrained in the exhaust air. In the case of spray systems, drift comprises the liquid droplets which become airborne and fall outside the spray collection system. (ANS-2.13-79)

drift loss. *It is preferred that the term (**Drift**) and the associated definition be used in ANS standards*

drift loss. The emission of small water droplets entrained in the cooling tower air flow. The droplets contain the dissolved solids found in the circulating water.(ANS-2.21-2102)

drill. Supervised instruction period intended to test, develop, and maintain skills in a particular operation. A drill is often a component of an exercise.(ANS-3.8.3-93)(ANS-3.8.4-93) (ANS-3.8.5-D92) (ANS-3.8.4-95)(3.8.3-95)

Non-preferred variation (1) A supervised instruction period aimed at developing and maintaining skills in a particular operation. A drill is often a component of an exercise. (ANS-3.7.3-79)

Non-preferred variation (2) : Supervised instruction intended to test, develop, maintain, and practice the skills required in a particular emergency response activity. A drill may be a component of an exercise. (ANS-8.23-07)

dry active waste (DAW). Radioactively contaminated compactable and non-compactable material (e.g., rags, paper, plastic, rubber, and wood, glass, concrete, metal). (ANS-55.1-92)

dry basis. A measurement or a calculation performed on the assumption that there is no water vapor or steam present. (ANS-56.1-85)

dry-bulb temperature. The temperature registered by the dry-bulb thermometer of a psychrometer or simply the temperature of the air. (ANS-2.21-2102)

dry cleaning waste. Liquid solvent wastes generated in the operation of dry cleaning laundry equipment. (55.6-93) (ANS-55.6-99)

dry, combustible solid waste. Solid waste, including materials that contain incidental amounts of drainable liquids, that can be easily oxidized by conventional incineration techniques. (ANS-40.37-2009)

dry, noncombustible solid waste. Solid waste that cannot be easily oxidized by conventional incineration techniques. (ANS-40.37-2009)

dry primary containment. Concept that relies on the volumetric and thermal capacitance of the enclosed free volume as well as the energy removal capabilities of the Containment Heat Removal System (CHRS) to mitigate the consequences of postulated pipe breaks. (ANS-56.4-83)

drywell. In a boiling water reactor, the innermost structure surrounding the reactor coolant pressure boundary. (ANS-56.4-83)

dual porosity model. A flow and transport model applied to a porous medium composed of two porosity fractions or domains. One fraction stores and transmits solute (mobile flow domain), while the second fraction only stores solute (immobile domain). Fluid and solute exchange between the mobile and immobile domains occur as functions of the hydraulic head and concentration gradient between the two, respectively. (ANS-2.17-2010)

duplicate. A second aliquot of the sample (equally sized, prepared, and analyzed as part of the same batch) used to measure the overall precision of the sample measurement process beginning with laboratory subsampling of the field sample. (ANS-41.5-2012)

E.

early fatalities: Deaths from the acute effects of radiation that may occur within a few months of the exposure. (ASME/ANS RA-S-1.3-2016)

economic factors: Expressions of the costs of various aspects of actions following a release of material to the environment. For instance, costs can be incurred for evacuation or relocation of population, decontamination of land or buildings, or interdiction of foodstuffs, or condemnation of land. (ASME/ANS RA-S-1.3-2016)

edit. The action of processing data into a meaningful order for subsequent use or disposition to an output medium. (ANS-10.5-79)

education. Successful completion of the requirements established by an accredited educational institution.(ANS-3.1-2014)

effective dose equivalent (H_E). The sum of products, of the form

$$\sum w_T H_T,$$

where: W_T is the weighing factor specified by the ICRP to represent the proportion of the stochastic risk resulting from irradiation of tissue T to the total risk when the whole body is irradiated uniformly, and H_T is the average dose equivalent in tissue T. The values of W_T recommended by the ICRP are given in Table 2 of ANS-6.1.1-91.

The remainder organs or tissues are taken to be the five not specifically listed that received the highest dose equivalents; a weighing factor (W_T) of 0.066 is applied to each of them, including various portions of the gastrointestinal tract, which are treated as separate organs. The weighing factor values given in Table 2 are under review by the ICRP and are subject to change during the projected life of this standard.

The special name for the unit of effective dose equivalent is the sievert (Sv):

$$1\text{Sv} = 1\text{J/kg}.$$

In this standard the terms "dose" and "fluence-to-dose" are used to denote "effective dose equivalent" and "fluence-to-effective dose equivalent," respectively. (ANS-6.1.1-91)

effective multiplication factor (k_{eff}) *Physically*, the ratio of the total number of neutrons produced during a time interval (excluding neutrons produced by sources whose strengths are not a function of fission rate) to the total number of neutrons lost by absorption and leakage during the same interval. *Mathematically* (computationally), the eigenvalue number that, when divided into the actual mean number of neutrons emitted per fission in an assembly of material, would make the calculated result for the nuclear chain reaction of the assembly critical (ANS-8.1-14)

effluent concentration limit. The concentration values (given in columns 1 and 2 of Table 2 in 10 CFR 20, Appendix B [1],⁽¹⁾) equivalent to the radionuclide concentrations that, if inhaled or ingested continuously over the course of a year, would produce a total effective dose equivalent of 0.05 rem (50 millirem or 0.5 mSv).

Footnote: (1) Numbers in brackets refer to corresponding numbers in Sec. 8, "References."(ANS-2.17-2010)

effluent discharge (radioactive). The emission of an effluent (i.e., containing plant-related, licensed radioactive material) into the unrestricted area.(ANS-2.17-2010)

effluent monitor. Instrument used to determine the level of radioactivity in any path which discharges to the environment. (ANS-6.8.2-86)

electrical overcurrent protective device. An active or passive device designed to prevent current flow from exceeding a predetermined level by breaking the circuit when the predetermined level is exceeded (e.g., fuse or circuit breaker). (ASME/ANS RA-Sb-2013)

emergency. Any unplanned situation which activates the plant's radiological emergency response plan. (ANS-3.8.1-93) (ANS-3.8.3-93)(ANS-3.8.4-93) (ANS-3.8.5-92)(ANS-3.8.6-94)(ANS-3.8.2-95) (ANS-3.8.4-95)(3.8.3-95)

Non-preferred variation (1) An emergency is a condition that calls for immediate action, beyond the scope of normal operating procedures, to avoid an accident or to mitigate the consequences of one. (ANS-15.16-2015)

emergency action level (EAL).

A parameter or criterion used as a basis for emergency classification. (ANS-3.8.3-93) (ANS-3.8.6-94)(3.8.3-95)

Non-preferred variation (1) Specific instrument readings, or observations; radiological dose or dose rates; or specific contamination levels of airborne, waterborne, or surface-deposited radioactive materials that may be used as recognized conditions that result in actions such as (a) establishing emergency classes and (b) initiating appropriate emergency measures. (ANS-15.16-2015)

emergency classes. Four emergency classes have been established. These classes are as follows:

(1) **notification of unusual event (NUE):** Events which are in progress or have occurred, which indicate a potential degradation of the level of safety of the plant. Notification of Unusual Events are non-routine occurrences which may be of interest to government authorities or to the public. No releases of radioactive material requiring offsite response or monitoring are expected unless further degradation of safety systems occurs. **(This is no longer used.)**

(2) **alert:** Events which are in progress or have occurred, which involve actual or potential substantial degradation of the level of safety of the plant. Any radiological releases are expected to be limited to small fractions of the Environmental Protection Agency (EPA) Protective Action Guideline, "Manual of Protective Action Guides and Protective Actions for Nuclear Incidents, EPA 400-R-92-001, Environmental Protection Agency" exposure levels.

(3) **site area emergency:** Events which are in progress or have occurred, which involve actual or likely major failures of plant functions needed for protection or station personnel and the public. Any radioactive re-releases are not expected to exceed EPA Protective Action Guideline exposure levels except near the site boundary.

(4) **general emergency:** Events which are in progress or have occurred, which involve actual or imminent substantial core degradation with potential for loss of containment integrity. Radiological releases can reasonably be expected to exceed EPA Protective Action Guide-line exposure levels offsite. (ANS-3.8.1-93) (ANS-3.8.2.93) (ANS-3.8.3-93)(ANS-3.8.6-94) (ANS-3.8.2-95) (3.8.3-95)

Non-preferred variation (2): Emergency classes are classes of accidents grouped by severity level for which predetermined emergency measures should be taken or considered. (ANS-15.16-2015)

emergency control center (ECC). A facility operated by the licensee for the purpose of evaluating and controlling emergency situations and coordinating emergency responses. (ANS-3.7.2-79)

emergency coordinator: A person authorized to direct the overall emergency response. (ANS-8.23-07)

emergency diesel generator. A diesel generator unit designed in accordance with "IEEE Standard Criteria for Diesel Generator Units Applied as Standby Power Supplies for Nuclear

Power Generating Stations", ANSI/IEEE Standard 387) and installed to provide a standby power supply in accordance with "IEEE Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations", ANSI/IEEE Standard 308. The diesel generators provide standby electric power to comply with the pertinent requirements of 10 CFR 50, Appendix A General Criterion 17, Electric Power Systems. (ANS-59.51-89) [ANS-59.52-93](ANS-59.52-98)

emergency plan: An emergency plan is a document that provides the basis for actions to cope with an emergency. It outlines the objectives to be met by the emergency procedures and defines the authority and responsibilities to achieve such objectives. (ANS-15.16-2015)

emergency planning zone (EPZ). Area for which emergency planning is needed to assure that prompt and effective actions can be taken to protect the public. (See also Plume EPZ and Ingestion EPZ).(ANS-3.8.1-87)(ANS-3.8.5-D92)(ANS-3.8.2-95)

Non-preferred variation (1) Two areas surrounding a production or utilization facility, for the U.S. one is about 16.09 km (ten miles) in diameter (called the plume exposure pathway emergency planning zone, EPZ) in which detailed planning to enhance the health and safety of the close-in population is required for protection from plume exposure, and the second is about 80.45 km (50 miles) in diameter (called the ingestion exposure pathway emergency planning zone) where preparation to interdict or condemn food and water for protection of the population is required. (ASME/ANS RA-S-1.3-2016)

Non-preferred variation (2) An area surrounding a plant with a well-defined boundary for which emergency planning is provided including provisions for protective actions such as evacuation and sheltering. (ANS-53.1-2011)

Non-preferred variation (3): Area for which off-site emergency planning is performed to assure that prompt and effective actions can be taken to protect the public in the event of an accident. *The EPZ size is dependent on reactor power level and the distance beyond the site boundary at which the protective action guides could be exceeded.* (ANS-15.16-2015)

emergency procedures. Written procedures which specify actions, including: manipulation of plant controls, to reduce the consequence of an accident or potentially hazardous condition which has already occurred, implementation of the emergency plan, or preparation for possible hazardous natural occurrences. (ANS-3.2)

Non-preferred variation (1) Emergency procedures are documented instructions that detail the implementation actions and methods required to achieve the objectives of the emergency plan. (ANS-15.16-2015)

emergency response: Actions taken by offsite populations to cope with the health and safety aspects of an incident at a production or utilization facility. (ASME/ANS RA-S-1.3-2016)

Non-preferred variation (1) Actions taken from the time of identification of a suspected, imminent, or actual criticality accident to stabilization of the event, including the assumption that an accident has occurred, response to the emergency, and actions to begin subsequent recovery operations. (ANSA-8.23-07)

emergency response facility (ERF) An area or collection of areas designated for emergency use that include:

(1) **control room (CR)**: Onsite facility from which the nuclear power plant is operated. The control room is normally the facility where basic response functions are initially performed.

(2) **emergency news center (ENC)**: Facility outside protected area where designated Public Information Officers, from licensee and government agencies provide media updates and respond to information requests.

(3) **emergency operations facility (EOF)**: Facility outside the protected area from which the overall accident management and coordination with offsite response organizations are performed.

(4) **operations support center (OSC)**: Facility outside the protected area from which the overall accident management and coordination with offsite response organizations are performed.

(5) **technical support center (TSC)**: Onsite facility separate from the control room where technical analysis, direction, communications, and other designated emergency functions are performed. (ANS-3.8.1-93) (ANS-3.8.1-93) (ANS-3.8.3-93) (ANS-3.8.4-93) (ANS-3.8.6-94) (ANS-3.8.2-950) (ANS-3.8.4-95) (3.8.3-95)

emergency response plan. *It is preferred that the term (**Emergency Plan**) and the associated definition be used in ANS standards*

emergency response plan. A licensing document which describes the licensee's overall emergency response functions, organization, facilities, and equipment, as well as appropriate state, county or local plans. This document is supplemented by specific implementing procedures. (ANS-3.8.1-87)

Emergency Response Planning Guideline (ERPG): For the purposes of this standard, ERPGs provide estimates for concentration ranges where a person may reasonably anticipate observing adverse effects as a consequence of exposure to the chemical in question. The three ERPG tiers are defined as follows:

- ERPG-3 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects;
- ERPG-2 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair an individual's ability to take protective action;
- ERPG-1 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient health effects or perceiving a clearly defined, objectionable odor [4]. (ANS-58.16-2014)

emergency start and operation. Automatic start and subsequent running or loading of the diesel engine, or both, in response to a safety signal such as emergency core cooling or loss of offsite power. (ANS-59.52-98)

emergency ventilation system (EVS). An engineered safety feature consisting of fans, gas absorbers, and particulate filters used to reduce the secondary containment atmosphere's pressure below environmental conditions following a Loss of Coolant Accident

(LOCA) for the purpose of dose suppression. This system is referred to as the standby gas treatment system (SGTS) in BWR units. (ANS-56.4-83)

end fitting (nozzle). The portion of the spent fuel assembly which defines the upper and lower extremities. Removal of an end fitting allows access to the individual rods. (ANS-57.10-93)

end state. A stable plant state configuration from which conditions will not deteriorate without a new, separate event; the plant state at the end of an event sequence modeled in a PRA. Examples of end states include successful termination and release of radioactive material in a specified release category. (ANS-53.1-2011)

Non-preferred variation (1) The set of conditions at the end of an accident sequence that characterizes the impact of the sequence on the plant or the environment. In most PRAs, end states typically include success states (i.e., those states with negligible impact), plant damage states for Level 1 sequences, and release categories for large early release frequency (LERF) sequences. (ASME/ANS RA-Sb-2013)

energetic event. An event that generates a sufficient amount of energy over a brief period (such as less than one minute) to result in the airborne suspension of the material-at-risk, and damages equipment and systems that might result in loss of confinement. (ANS-5.10-98)

energy dependence. Change in instrumentation response with respect to radiation energy for a constant fluence or fluence rate (flux density). (ANS-6.8.2-86)

engineered barrier. A man-made cover, wall, or device used to prevent fluid flow or contaminant migration. (ANS-2.17-2010)

engineered safety feature (ESF). A nuclear safety-related structure, system, or component (SSC) that serves to control and limit the consequences of releases of energy or radioactivity if an event were to occur to the extent that the worker and public health and safety might be impaired if these energy or radioactivity releases were not additionally restrained. (ANS-51.1)(ANS-56.4-83);

Non-preferred variation (1) A structure, system, or component (SSC) that is relied upon during or following design basis events to ensure the capability to prevent or mitigate the consequences of those events that could result in potential offsite exposures comparable to the guideline exposures of 10 CFR 100.11 excluding reactor coolant pressure boundary (RCPB) and reactor protection system (PRS) items. (ANS-58.14-93)

Non-preferred variation (2) A SSC (structure, system or component) that is relied upon during or following a DBE to ensure the capability to prevent or mitigate the consequences of that DBE that could result in potential off-site exposures comparable to the guideline exposures in applicable regulations,⁽³⁾ excluding reactor coolant pressure boundary (RCPB) and reactor trip system (RTS) items.

Footnote: (3) Refer to the definition of "safety-related" in Sec. 2.2 for further information regarding "guideline exposures in applicable regulations."(ANS-58.14-2011)

Non-Preferred Variation (3) For the purpose of this standard, system(s) which is (are) required to prevent, arrest, or mitigate the consequences of an accident or LOCA. ANS-56.2-84)

Non-Preferred Variation (4) A safety class structure, system, or component that serves to control and limit the consequences of releases of energy and radioactivity in the event

of Plant Condition 3,4, or 5 events to the extent that the public health and safety might be impaired if these energy and radioactivity releases were not additionally restrained. (ANSI/ANS-51.10-02)

engine-driven oil pump. A pump which receives its motive power directly from the diesel engine and provides proper lubricating oil circulation under all operating conditions. (ANS-59.52-98)

engine lubricating oil cooler. A heat exchanger that provides cooling of the lubricating oil to maintain temperature within specified operating limits. (ANS-59.52-98)

Enhanced Fujita (EF) Scale. A rating system originally devised (Fujita [1]) to facilitate categorizing tornadoes according to the damage they produce and later modified (Enhanced Fujita [2]) and adopted by the National Weather Service as shown in Table 2-1. Enhanced Fujita (EF) scale winds are defined to apply at the 33 ft (10 m) height. (ANS-2.3-2011)

entity or entities. Formal and informal rock-stratigraphic units, soil-stratigraphic units and bio-stratigraphic units (see American Commission on Stratigraphic Nomenclature, mineral deposits, structural features, geomorphic features, and artificial structures.(ANS-2.7-82)

enumeration. A census. (ANS-2.6-81D)

environment. The pressure, temperature, and humidity conditions of the outdoor ambient atmosphere at the nuclear power plant site. (ANS-56.4-83)

environmental qualification. Testing and analytical demonstration that equipment is suitable for its intended purpose and environment. (ANS-53.1-2011)

epicenter. The point on the earth's surface directly above the focus (i.e., hypocenter) of the earthquake source. (ANS-2.29-2008)

epistemic uncertainty. Uncertainty attributable to incomplete knowledge about a phenomenon that affects

the ability to model it. Epistemic uncertainty is captured by considering a range of model parameters within a given expert interpretation or multiple expert interpretations each of which is assigned an associated weight representing statistical confidence in the alternatives. In principle, epistemic uncertainty can be reduced by the accumulation of additional information associated with the phenomenon. The uncertainty in the parameters of the probability distribution of a random phenomenon is epistemic. (ANS-2.27-2008) (ANS-2.29-2008) (ANS-2.30-2015)

Non-preferred variation (1) The uncertainty attributable to incomplete knowledge about a phenomenon that affects our ability to model it. Epistemic uncertainty is reflected in ranges of values for parameters, a range of viable models, the level of model detail, multiple expert interpretations, and statistical confidence. In principle, epistemic uncertainty can be reduced by the accumulation of additional information. (Epistemic uncertainty is sometimes also called "modeling uncertainty.") (ASME/ANS RA-Sb-2013)

equipment. A constituent of components, a component, an assemblage of components, a system, or a structure having at least one function.(ANS-51.1-1988)

Non-preferred variation (1) A term used to broadly cover the various components in a nuclear power plant. Equipment includes electrical and mechanical components (e.g., pumps, control and power switches, integrated circuit components, valves, motors, fans, etc.), and instrumentation and indication components (e.g., status indicator lights, meters,

strip chart recorders, sensors, etc.). Equipment, as used in this Standard, *excludes* electrical cables. (ASME/ANS RA-Sb-2013)

equipment qualification. The generation and maintenance of data and documentation to demonstrate that equipment is capable of operating under the conditions of a qualification test, or test and analysis. (ASME/ANS RA-Sb-2013)

equivalent test. A test method utilized in place of a standard or reference test which achieves the same end result. (ANS-6.4.2-85)

essentially unshielded. As used in this standard, essentially unshielded, relative to air scattering means less than one mean-free-path of attenuation for the dominant energy. If the user of this standard chooses to use an alternative definition in the calculations, the user should clearly define its use in documenting the calculations. (ANS-6.6.1-2013)

estimate. A population estimate is a substitute for a complete count of the population as of a current or past date. Usually the estimate utilizes contemporary data. (ANS-2.6-81D)

Eulerian method: A method of studying atmospheric motions in which one considers volume elements at fixed locations in space across which material flows (ANS-2.15-2013).

evacuation: A response to an emergency at a facility involving removal of a selected portion of the population surrounding the facility. Evacuation is usually described in the emergency plans of a facility for the close-in population within the plume exposure pathway Emergency Planning Zone (usually about 16 km (10-miles) from the site) and is often planned to be accomplished in advance of the release of material as a means of dose avoidance. (ASME/ANS RA-S-1.3-2016)

evacuation occurrence. A circumstance that prevents attaining or maintaining safe shutdown condition from the control room. The circumstance is only that adequate control from the control room is no longer considered possible or desirable. (ANS-58.6-92)

evaluated nuclear cross-section data. Microscopic cross-section representation derived from basic experimental data, from nuclear models and systematic, and from consideration of integral measurements. (ANS-6.1.2-2013)

evaluated nuclear data file. Evaluated nuclear data file stored using a specified format and procedure. Examples are ENDF/B-VII.1, JEFF-3.1.2, and JENDL-4.0. (ANS-6.1.2-2013)

evaluated nuclear data file/B (END F/B). A U.S.-evaluated nuclear data file prepared and reviewed by subject matter experts that is coordinated and maintained by the Cross Section Evaluation Working Group (CSEWG) and the National Nuclear Data Center (NNDC) at Brookhaven National Laboratory. (ANS-6.1.2-2013)

evaluator expert. An expert who is capable of evaluating the relative credibility of multiple alternative hypotheses, and who is expected to evaluate all potential hypotheses and bases of inputs from proponents and resource experts, to provide both evaluator input and other experts' representation of the community distribution. (ASME/ANS RA-Sb-2013)

evaluators. Personnel responsible for assessing the planning, preparation, implementation, and conduct of the drill or exercise. (ANS-3.8.4-95)

event. A condition that deviates from normal operation, i.e., an initiating occurrence or an initiating occurrence plus single failure or coincident occurrence combination. See also "event sequence family." (ANS-53.1-2011)

Non-preferred variation (1) A describable situation that must be accounted for in design. (ANS-57.5-96)

Non-preferred variation (2) Variant form: (ANS-51.1)

Non-preferred variation (3) For the purposes of this standard, a condition of plant operation that is postulated for deterministic analysis purposes. An event might consist of an initiating occurrence, coincident occurrence, single failure, or common-cause failure, including the consequential effects or combinations thereof. Events that are selected for detailed analysis in design-basis documentation become DBEs. (ANS-58.16-2014)

event family. *It is preferred that the term (event sequence family) and the associated definition be used in ANS standards*

event family. See “event sequence family.”

event frequency: the expected number of occurrences of an event such as an initiating event or event sequence per unit of time, normally expressed in events per plant (or reactor) operating year or events per plant (or reactor) calendar year. For PRAs that are performed on multi-unit plants, event frequencies are normally measured on a per plant year basis, whereas PRAs that are performed on a single reactor unit are normally measured on a per reactor year basis. (ASME/ANS RA-S-1.4-2013)

event sequence: a representation of a scenario in terms of an initiating event defined for a set of initial plant conditions (characterized by a specified *plant operational state* (POS)) followed by a sequence of system, safety function and operator failures or successes, with sequence termination with a specified end state (e.g., prevention of release of radioactive material, or release in one of the reactor specific release categories (See *release category*)). An event sequence may contain many unique variations of events (*minimal cutsets*) that are similar in terms of how they impact the performance of safety functions along the event sequence. (ASME/ANS RA-S-1.4-2013)

Non-preferred variation (1) A specific event tree pathway in a PRA model that begins with an initiating event in a specified plant operating state and describes the successful and unsuccessful responses of the SSCs that perform safety functions in response to the initiating event and ends in a well-defined end state. (ANS-53.1-2011)

event sequence analysis. An analysis that is performed as part of a PRA to determine the possible plant responses to an initiating event by constructing event trees, defining event sequences and end states, determining the success criteria for each event tree top event, and defining the end states. (ANS-53.1-2011)

event sequence family. A group of event sequences with similar initiating events, safety function responses, and end states. As used in this standard, many LBEs are defined by organizing individual event sequences from the PRA into event sequence families to avoid having to process too many event sequences and to prevent the subdivision of event sequences with similar consequences for application of the acceptable frequencies and consequences expressed by the TLSC curve. As used in this definition, the term “event” commonly refers to an event sequence family. When event sequences are combined into event sequence families, the frequency classification is based on the total frequency of the family. (ANS-53.1-2011)

Non-preferred variation (1) a grouping of event sequences with a common or similar plant operating state, initiating event, hazard group, challenges to the plant safety functions, response of the plant in the performance of each safety function, response of each

radionuclide transport barrier, and end state. An event sequence family may involve a single event sequence or several event sequences grouped together. Each *release category* may include one or more event sequence families. Event Sequence families are not required to be explicitly modeled in a PRA. Each event sequence family involving a release is associated with one and only one release category. (See *event sequence* and *release category*.) (ASME/ANS RA-S-1.4-2013)

event tree. A logic diagram that begins with an initiating event or condition and progresses through a series of branches that represent expected system or operator performance that either succeeds or fails and arrives at either a successful or failed end state. (ASME/ANS RA-Sb-2013)

Non-preferred variation (1) A logic diagram that begins with an initiating event and progresses through a series of branches that represent the possible system or operator responses including successful and unsuccessful performance of safety functions in response to the initiating event and termination of each branch in a well-defined end state. (ANS-53.1-2011)

event tree top event. The conditions (i.e., system behavior or operability, human actions, or phenomenological events) that are considered at each branch point in an event tree. (ASME/ANS RA-Sb-2013)

examining physician: A licensed physician ~Medical Doctor or Doctor of Osteopathy! Who is responsible for evaluating applicants and operators and who has the ultimate responsibility for certifying that the medical examination was conducted in accordance with this standard and that the individual meets the physical and mental health requirements of this standard. The examining physician shall be conversant with this standard and shall have a general understanding of the routine and emergency activities required of a nuclear power plant reactor operator. (ANS-3.4-2013)

excessive radiation dose. Any dose to personnel corresponding to an absorbed dose from neutrons and gamma rays equal to or greater than 0.12 Gy (12 rad) in free air. (ANS-8.3-97)

exchange capacity (ion exchange capacity) The amount of exchangeable ions measured in milligram equivalents per gram of solid material at a given pH. (ANS-2.17-89)

exclusion area. That area surrounding the reactor in which the reactor licensee has the authority to determine all activities including exclusion or removal of personnel and property from the area. See 10 CFR 100.3(a). "Definitions." (ANS-3.7.2-79)

Non-preferred variation (1) Variant form: (ANS-3.6-81)

exercise. A planned event that is used to evaluate the integrated capability and a major portion of the basic elements existing within emergency preparedness plans and organizations. (ANS-3.8.4-95) (3.8.3-95)

Non-preferred variation(1) An event that tests a major portion of the basic elements existing within an Emergency Plan and the Emergency Response Organization. This event should demonstrate the capability of the emergency preparedness organization to cope with a radiological or hazardous chemical emergency which could result in offsite consequences. (ANS-3.7.3-79)

Non-preferred variation(2) An event that tests the integrated capability and a major portion of the basic elements existing within emergency plans and emergency response organizations. (ANS-3.8.3-93) (ANS-3.8.4-93)(ANS-3.8.1-87) (ANS-3.8.5-92)

Non-preferred variation (3): An activity that tests one or more portions of the integrated capability of emergency response plans, equipment, and organizations. (ANS-8.23-07)

expected basis radioactivity concentrations. Radiochemical constituents as provided in American National Standard, ANSI/ANS-18.1-84, "Radio-active Source Terms for Normal Operation of Light Water Reactors". (ANS-55.6-93) (ANS-55.6-99)

experience. Applicable work in Power Plant design, construction, preoperational and start-up testing activities, operation, maintenance, onsite activities, or technical services. Observation of others performing work in the above areas is not experience. (ANS-3.1-87)

experimental benchmark. An experiment for which conclusions can be drawn as to the accuracies of calculational models and the underlying nuclear data. An experimental benchmark contains the following:

- a complete description of the conditions under which the experiment took place, including input data such as reactor geometry, material compositions, core power distribution, relevant material temperatures, and experimental conditions specified in sufficient detail to model or to replicate the experiment;
- measured data and their associated uncertainties along with a complete specification of data correlations.

An experimental benchmark can provide "integral" or "differential" metrics. "Integral" pertains to integral quantities such as reaction rates, while "differential" provides energy-dependent spectral information. (ANS-6.1.2-2013)

experiments. Performance of those plant operations carried out under controlled conditions in order to establish characteristics or values not previously known. (ANS-3.2-2012)

expert elicitation. A formal, highly structured, and documented process whereby expert judgments, usually of multiple experts, are obtained. ASME/ANS RA-Sb-2013)

expert judgment. Information provided by a technical expert, in the expert's area of expertise, based on opinion, or on an interpretation based on reasoning that includes evaluations of theories, models, or experiments. (ASME/ANS RA-Sb-2013)

exposed structural steel. Structural steel elements that are not protected by a passive fire barrier feature (e.g., fire retardant coating) with a minimum fire-resistance rating of 1 hr. (ASME/ANS RA-Sb-2013)

exposure. The exposure, X , is the quotient of dQ by dm , where dQ is the absolute value of the total charge (Coulombs) of the ions of one sign produced in air when all the electrons (i.e., negatrons and positrons) are liberated by photons in a volume element of air having mass dm are completely stopped in air.

$$X = dQ/dm \text{ Coulombs kg}^{-1}$$

The special unit of exposure rate is the roentgen (R)

$$R = 2.58 \times 10^{-4} \text{ Coulombs kg}^{-1}.$$

(ANS-6.8.1-81)

exposure pathway. A mechanism by which radioactive material is transferred from the (local) environment to humans. There are three commonly recognized exposure pathways: inhalation, ingestion, and direct radiation. For example, ingestion is an exposure pathway,

and it might include dose contributions from one or more routes of exposure. For example, one route of exposure that might contribute to the ingestion exposure pathway is often referred to as grass-cow-milk-infant-thyroid route of exposure. (ANS-2.17-2010)

exposure period: Length of time used to calculate the dose accrued to exposed individuals from external radioactive sources (e.g., cloudshine, groundshine). (ASME/ANS RA-S-1.3-2016)

exposure rate. The exposure rate, x , is the quotient of dx by dt , where dx is the increment of exposure in the time interval dt .

$$x = dx/dt \text{ Coulombs s}^{-1}\text{kg}^{-1}$$

The special unit of exposure rate is the roentgen per second (Rs^{-1}) or the roentgen per hour (Rh^{-1}). (ANS-6.8.1-81)

Non-preferred variation (1) Variant form: (ANS-6.3.1-87)

exogenous. Originating from outside. (ANS-2.6-81)

extended test interval. The maximum allowable Type A, Type B, or Type C test interval following the demonstration of good performance history. (ANS-56.8-02)

external data files. The data files which exist prior to or after execution of a computer program. (ANS-10.2-88)

Non-preferred variation (1) Variant form: (ANS-10.5-79)

external event.(1) An event originating outside a nuclear power plant that directly or indirectly causes an initiating event and may cause safety system failures or operator errors that may lead to core damage or large early release. Events such as earthquakes, tornadoes, and floods from sources outside the plant and fires from sources outside the plant are considered external events. (See also *internal event*.) By historical convention, loss of offsite power (LOOP) not caused by another external event is considered to be an internal event. (ASME/ANS RA-Sb-2013)

Non-preferred variation (1) - (also referred to as external plant hazard event): An event originating from an external plant hazard outside a plant that causes safety system failures, operator errors, or both, that in turn may lead to an initiating event, an event sequence, and a radioactive material release source term. Events such as earthquakes, tornadoes, and floods from sources outside the plant and fires from sources outside the plant are considered external events (see also "internal event" and "internal plant hazard"). By convention, loss of off-site power not caused by another external event is considered to be an internal event. Note that external events may or may not involve an external event induced initiating event. (For example, an external event may occur without damage to the plant with continued plant operation.) (ANS-53.1-2011)

Non-preferred variation (2) - For the purposes of this standard, an event caused by man involving vehicles, equipment, or structures that occur external to a facility and has the potential for causing damage to the facility or the environment. (ANS-58.16-2014)

external man-made hazard. Results from an accident created by man involving vehicles, equipment, or structures, which occur external to an ISFSI and has the potential for causing damage. (ANS-2.19-89)

external plant hazard. *It is preferred that the term (**external event**) and the associated definition be used in ANS standards*

external plant hazard. A hazard located outside the plant that can cause an external event. Examples of external hazards include earthquake faults, chemical or process plants, and airports. See “external event” and “internal plant hazard.” (ANS-53.1-2011)

extracameral effect. Response of an instrument caused by the influence of radiation on any portion of the system other than the detector.(ANS-6.8.1-81)(ANS-6.8.2-86)

extreme environmental load. Load which is credible, but highly improbable.(ANS-2.12-78)

extremely rare event. One that would not be expected to occur even once throughout the world nuclear industry over many years (e.g., $<1E-6$ /reactor-yr). (ASME/ANS-RA-Sb–2013)

extreme winds. Wind motions other than winds caused by a tornado. They include winds resulting from hurricanes, cyclones, thunderstorms, and due to orographic effects. (ANS-2.19-89)

F.

F scale. A six-tier rating system devised by Fujita to facilitate categorizing tornadoes according to the damage they produce, F-0 to F-6.F-scale winds are defined to apply at the 33 ft (10 m) height.

Although wind speeds are associated with each F-scale rating, rigorous justification for them has not been firmly established. (ANS-2.3-83)

facilitator/integrator. A single entity (individual, team, company, etc.) who is responsible for aggregating the judgments and community distributions of a panel of experts to develop the composite distribution of the informed technical community (herein called “the community distribution”). (ASME/ANS RA-Sb–2013)

facility: This word is used throughout the standard in a manner consistent with existing, operating facilities; however, it is also intended to apply to facilities that have ceased operations (i.e., in the decommissioning phase), facilities that have not yet been built (i.e., in the design stage), operations with fissionable materials outside structures (e.g., below-grade storage and disposal sites), and the movement of materials between on-site facilities. (ANS-8.26-07)

Non-preferred variation (1): A defined area where fissionable material is located. (ANS-8.23-07)

Facility licensee. An applicant for, or holder of, a license for a nuclear facility.(ANS-3.4-94)

Non-preferred variation (1) The organization that holds the facility license issued under 10 CFR 50-1 or 10 CFR 52-1. (ANS-3.4-2013)

facility operator. An authorized representative of a holder of a license pursuant to 10 CFR 50, "Licensing of Production and Utilization Facilities", or any government, public, or private organization which is the owner and operator or is the designated responsible operator of a nuclear facility. (ANS-3.4-87)

facility worker: For the purposes of this standard, facility workers are those who are inside the facility and who can be in very close proximity to the hazardous materials, often directly

manipulating them. These workers perform their duties in accordance with procedures, are trained in those operations, are knowledgeable of the hazards, and are trained in emergency response in case of upsets. (ANS-58.16-2014)

failed fuel.

A fuel assembly with a perforation of, or a defect in, the fuel cladding, or any distortion or break causing a structural change that requires, due to the fuel condition, any of the following:

Use of abnormal fuel handling procedures or equipment,

Premature replacement of a fuel assembly,

Replacement of its component parts, or restrictions on plant operation.

(ANS-57.2-93) (ANS-57.2-99)

Non-preferred variation(1) Fuel with a perforation of, or a defect in, the fuel cladding or any distortion or break causing a structural change that requires use of abnormal fuel unit handling procedures or equipment, premature replacement of a fuel assembly, replacement of its component parts, or restrictions on plant operation. (ANS-57.1-92)(ANS-3.8.x)

failure. The inability of an item to accomplish its design function. (ANS-50.1)(ANS-58.11-93) (ANS-58.14-2011)

Variant form: (ANS-4.1)

Non-preferred variation (1) The inability to perform an action or function at the proper time or performance of an action at an improper time. An alternate is a change from an operable state meeting specified requirements to an inoperable state that does not meet specified requirements. (ANS-53.1-2011)

failure, common mode *It is preferred that the term (common cause failure) and the associated definition be used in ANS standards.*

failure, common mode A specific functional manifestation of a failure (i.e., the means by which an observer can determine.

failure mechanism. (1) Any process that results in failure modes, including chemical, electrical, mechanical, physical, thermal, and human error; a failure mode and its associated cause. (ANS-53.1-2011)

Non-preferred variation (1) Failure Mechanism - Any of the processes that results in failure modes, including chemical, electrical, mechanical, physical, thermal, and human error. (ASME/ANS RA-Sb-2013)

failure mode. A specific functional manifestation of a failure (i.e., the means by which an observer can determine that a failure has occurred) by precluding the successful operation of a piece of equipment, a component, or a system (e.g., fails to start, fails to run, leaks). (ANS-53.1-2011) (ASME/ANS RA-Sb-2013)

NOTE: In the context of Fire PRA, spurious operation is also considered a failure mode above and beyond failures that preclude successful operation.

failure mode and effects analysis (FMEA). A process for identifying failure modes of specific components and evaluating their effects on other components, subsystems, and systems. (ASME/ANS RA-Sb-2013)

Non-preferred variation (1) A procedure for analysis of potential failure modes within a system for classification by severity or determination of the failure's effect upon the system. Widely used in the manufacturing industries in various phases of the product life cycle. Failure causes are any errors or defects in process, design, or item, especially ones that affect the customer, and can be potential or actual. Effects analysis refers to studying the consequences of those failures. (ANS-53.1-2011)

failure, passive. (See passive failure).

failure probability. The likelihood that an SSC will fail to operate upon demand or fail to operate for a specific mission time. (ASME/ANS RA-Sb-2013)

failure rate. Expected number of failures per unit time, evaluated, for example, by the ratio of the number of failures in a population of components to the total time observed for that population. (ASME/ANS RA-Sb-2013)

failure, undetected. *It is preferred that the term (**undetected failure**) and the associated definition be used in ANS standards.*

fast time. To increase the rate of simulation for some or all computed values with respect to real time. (ANS-3.5-2009)

fault. A fracture in the earth along which blocks of crust on either side have moved with respect to one another. (ANS-2.27-2008) (ANS-2.29-2008)

Non-preferred variation (1) A "fault" is a surface or zone of rock fracture along which there has been displacement. Included are structures such as the "growth faults" in the thick sequences of poorly consolidated sediments of the Gulf Coastal Plain. Excluded are surfaces or zones along which there has been displacement related to surficial or near-surface processes such as glacial-shove features, landslides, karst terrain, or features related to activities of man such as mining, or withdrawal or addition of subsurface fluids. (ANS-2.7-82) (ANS-2.19-89)

Variant form: (ANS-2.11-78)

fault/fault zone: A fracture in the earth along which blocks on either side have moved with respect to one another. Faulting may occur along multiple planes (see Fault Displacement) and includes secondary faulting. The area encompassing this faulting is a fault zone (ANS-2.30-2015).

fault displacement: The relative movement of the two sides of a fault, measured in any chosen direction; also, the specific amount of such movement. As used here, the term applies to either slip or separation as measured or inferred along a fault. *Principal* faulting occurs along a main plane (or planes) that is (are) the locus of release of seismic energy. *Secondary* or distributed faulting is rupture that occurs in the vicinity of the principal faulting, possibly on splays of the main fault or antithetic faults (ANS-2.30-2015).

fault source. A fault or zone for which the tectonic features causing earthquakes have been identified. These are usually individual faults, but they may be zones comprising multiple faults or regions of faulting if surface evidence of these faults is lacking but the faults are suspected from seismicity patterns, tectonic interpretations of crustal stress and strain, and other evidence. Regions of blind thrust faults are a good example of the latter. (ANS-2.27-2008) (ANS-2.29-2008)

fault tree. A deductive logic diagram that depicts how a particular undesired event can occur as a logical combination of other undesired events. (ASME/ANS RA-Sb-2013)

features, events, and process(es) [FEP(s)]. An assessment of the relevant (a) features, which are identified physical characteristics of the total system, and how they behave over time; (b) events, which are occurrences of abnormal radionuclide releases; and (c) processes, which include physical, chemical, and biological processes that govern radionuclide transport. (ANS-2.17-2010)

field monitoring. The outdoor measuring and sampling activities conducted to determine the exposure rate and contamination level to people and the environment during and after an emergency. (ANS-3.8.6-94) (ANS-3.8.2-95) (3.8.3-95)

Variant form: (ANS-3.8.2-93) (ANS-3.8.3-93) (ANS-3.8.5-D92)

figure of merit. The quantitative value, obtained from a PRA analysis, used to evaluate the results of an application (e.g., CDF or LERF). (ASME/ANS RA-Sb–2013)

fill line (neck). Those components, including piping, valves, and filters used to provide a means to replace fuel oil into the supply tank.(ANS-59.51-89)

fire analysis tool. As used in this Standard, “fire analysis tool” is broadly defined as any method used to estimate or calculate one or more physical fire effects (e.g., temperature, heat flux, time to failure of a damage target, rate of flame spread over a fuel package, heat release rate for a burning material, smoke density, etc.) based on a predefined set of input parameter values as defined by the fire scenario being analyzed. Fire analysis tools include, but are not limited to, computerized compartment fire models, closed-form analytical formulations, empirical correlations such as those provided in a handbook, and lookup tables that relate input parameters to a predicted output. (ASME/ANS RA-Sb–2013)

fire area. That portion of a building or plant that is separated from other areas by boundary fire barriers (e.g., walls, floors, or roofs). (ANS-59.4-79W83)

Non-preferred variation (1) A portion of a building or plant that is separated from other areas by rated fire barriers adequate for the fire hazard (RG 1.189). (Note that a rated fire barrier is a fire-barrier with a fire-resistance rating.)(ASME/ANS RA-Sb–2013)

fire barrier. A physical barrier, such as a floor, wall, or partition with penetrations or openings properly protected, which prevents the spread of fire from one side to the other. (ANS-59.4-79W83)

Non-preferred variation (1)- A continuous vertical or horizontal construction assembly designed and constructed to limit the spread of heat and fire and to restrict the movement of smoke (NFPA 805 [1-4]). (ASME/ANS RA-Sb–2013)

fire compartment¹. A subdivision of a building or plant that is a well-defined enclosed room, not necessarily bounded by rated fire barriers. A fire compartment generally falls within a fire area and is bounded by noncombustible barriers where heat and products of combustion from a fire within the enclosure will be substantially confined. Boundaries of a fire compartment may have open equipment hatches, stairways, doorways, or unsealed penetrations. This is a term defined specifically for fire risk analysis and maps plant fire areas and/or zones, defined by the plant and based on fire protection systems design and/or operations considerations, into compartments defined by fire damage potential. For example, the control room or certain areas within the turbine building may be defined as a fire compartment (This definition is derived from NUREG/CR-6850–EPRI TR-1011989 [1-5]). In this Standard, “physical analysis unit” is used to represent all subdivisions of a plant for Fire PRA. Physical analysis units include fire compartments.

Footnote: (1) It is noted that the term “fire compartment” is used in other contexts, such as general fire protection engineering, and that the term’s meaning as used here may differ from that implied in an alternate context. However, the term also has a long history of use in Fire PRA and is used in this Standard based on that history of common Fire PRA practice. (ASME/ANS RA-Sb–2013)

fire extinguishing (suppression) system. A fixed system utilizing an appropriate agent such as water, carbon dioxide, halogenated agents, foam, etc. for control or extinguishment, or both, of fire within the system's designated area of influence. The system may be either automatic or manual in operation. (ANS-59.4-79W83)

fire-induced initiating event. That initiating event assigned to occur in the FPRA plant response model for a given fire scenario (adapted from NUREG/CR-6850–EPRI TR-1011989). (ASME/ANS RA-Sb–2013)

fire modeling. As used in this Standard, “fire modeling” refers to the process of exercising a fire analysis tool including the specification and verification of input parameter values, performance of any required supporting calculations, actual application of the fire analysis tool itself, and the interpretation of the fire analysis tool outputs and results. (ASME/ANS RA-Sb–2013)

fire protection program. The integrated effort involving equipment, procedures, and personnel used in carrying out all activities of fire protection. It includes system and facility design, fire prevention, fire detection, annunciation, confinement, suppression, administrative controls, fire brigade organization, inspection and maintenance, training, quality assurance, and testing (RG 1.189 [1-3]). (ASME/ANS RA-Sb–2013)

fire protection program element. Fire Rating (Fire Resistance Rating) - The time, in minutes or hours, that materials or assemblies have withstood a fire exposure as established in accordance with the test procedures of NFPA 251-1972, "Standard Methods of Fire Tests of Building Construction and Materials," ASTM E119-76, "Methods of Fire Tests of Building Construction and Materials," or other recognized rating tests. (ANS-59.4-79W83)

Non-preferred variation (1) fire-resistance rating. The time, in minutes or hours, that materials or assemblies have withstood a fire exposure as established in accordance with an approved test procedure appropriate for the structure, building material, or component under consideration (NFPA 805). (ASME/ANS RA-Sb–2013)

fire scenario. A set of elements that describes a fire event. The elements usually include a physical analysis unit, a source fire location and characteristics, detection and suppression features to be considered, damage targets, and intervening combustibles. (ASME/ANS RA-Sb–2013)

fire scenario selection. The process of defining a fire scenario to be analyzed in the fire PRA that will represent the behavior and consequences of fires involving one or more fire ignition sources. Fire scenario selection includes the identification of a fire ignition source (or set of fire ignition sources); secondary combustibles and fire spread paths; fire damage targets, detection and suppression systems and features to be credited; and other factors that will influence the extent and timing of fire damage. (ASME/ANS RA-Sb–2013)

fire suppression system. Generally refers to permanently installed fire protection systems provided for the express purpose of suppressing fires. Fire suppression systems may be either automatically or manually actuated. However, once activated, the system should perform its design function with little or no manual intervention. (ASME/ANS RA-Sb–2013)

fire wrap. A localized protective covering designed to protect cables, cable raceways, or other equipment from fire-induced damage. Fire wraps generally provide protection against thermal damage. (ASME/ANS RA-Sb-2013)

firmware. The combination of software and data that reside on read-only memory. (ANS-7-4.3.2-92)

fissile assembly (assembly). A system consisting of fissile material and other components that significantly influence the reactivity. (ANS-8.6-83)

fissile material. A material, other than natural uranium, that is capable of sustaining a neutron chain reaction. (ANS-8.7-75)

fission product barrier. A physical barrier that prevents the release of radioactive materials to the environment (e.g., fuel cladding, reactor coolant pressure boundary, primary containment).

fission product barriers. The fuel cladding, reactor coolant pressure boundary, and primary containment. (ANS-51.1)

fission product removal. The process of removing fission products from the post-accident containment atmosphere. (ANS-56.5-87)

fitting function, Taylor. A buildup factor function of distance from the source in the form:

$$B(E,x) = A_1 \exp(-a_1 x) + A_2 \exp(-a_2 x) \quad (1)$$

where: x is the distance from the source in mean free paths and parameters A_1 , a_1 , and a_2 are functions of the attenuating medium and the source energy, E . The fourth parameter, A_2 , is constrained to equal $1 - A_1$. (ANS-6.4.3-91)

fitting function, G-P (Geometric Progression). A build up factor function of distance from the source in the form:

$$B(E,x) = 1 + \frac{b-1}{K-1} \left(1 - \frac{1}{K^x} \right) \quad \text{for } K \neq 1 \text{ and} \\ B(E,x) = 1 + (b-1)x \quad \text{for } K = 1 \quad (2)$$

$$K(E,x) = c x^a = d \left[\frac{\tanh(x/X_k - 2) - \tanh(-20)}{1 - \tanh(-20)} \right] \quad (3)$$

Where: x is the distance from the source in mean free paths (mfp) and b is the value of the buildup factor at 1 mfp. The variation of parameter K with penetration represents the photon dose multiplication and change in the shape of the spectrum from that at 1 mfp, which determined the value of b . Equation (3) represents the dependence of K on x ; a, c, d , and X_k are fitting parameters that depend on the attenuating medium and source energy, E . (ANS-6.4.3-91)

fixed continuous monitor. Any area radiation monitor which operates continuously in a specified location. (ANS-6.8.1-81)

fixed moderator. A moderator with an established geometric relationship to the locations occupied by the fixed neutron absorber and fissionable material. (ANS-8.21-95)

fixed neutron absorber. Neutron absorbers in solids with an established geometric relationship to the locations occupied by fissionable material. (ANS-8.21-95)

flame spread rating. The numbers or classifications obtained according to NFPA 255-1972. "Method of Test of Surface Burning Characteristics of Building Materials." (ANS-59.4-79W83)

flood area: an area within a plant that is defined for the purpose of performing an internal-flooding PRA. Flood areas are normally defined in terms of one or more of the following: building types; location within a building; and the physical barriers that delay, restrict, or prevent the propagation of floods to adjacent areas. (ASME/ANS RA-Sb-2013)

flood-induced accident sequence: an accident sequence that includes a flood-induced initiating event and the potential for undesired consequences, with a specified end state, e.g., core damage. (ASME/ANS RA-Sb-2013)

flood-induced failure mechanism: the failure mechanism of an SSC induced by a flood. Possible SSC failure mechanisms include shorting out of electrical connections, blockage of air intakes, and structural damage from flood loads. (ASME/ANS RA-Sb-2013)

flood-induced initiating event: an initiating event that is caused by a flood either directly (e.g., loss of system function caused by diversion of flow associated with the flood) or indirectly (e.g., an exigent plant shutdown caused by the loss of function of one or more flood damaged SSCs). (ASME/ANS RA-Sb-2013)

flood propagation path: a physical pathway that would allow the progression of a flood and associated flood damage within and among different flood areas. (ASME/ANS RA-Sb-2013)

flood rate: the flow rate of water or steam across the breach or opening in the pressure boundary of the flood source during the flood event. Depending on the context, the flood rate may be a time-dependent rate, a maximum rate, or an average rate over the duration of the flood. (ASME/ANS RA-Sb-2013)

flood scenario: a description of an event that results in a flood-induced initiating event. The factors considered in the definition of a flood scenario include flood area; flood source; flood rate; flood propagation path; impact on plant SSCs; human actions considered in flood initiation, mitigation, and termination; and means of detection (sensors, alarms, indications, etc.). (ASME/ANS RA-Sb-2013)

flood source: an inventory of water or steam normally contained within a system, tank, component, reservoir, river, lake, or ocean that provides the potential for flooding-induced failure of SSCs in the event the flood source container or pressure or retention boundary is breached. (ASME/ANS RA-Sb-2013)

flood termination: as used in the definitions of flood scenario and flood volume, the cessation of the flood rate by isolation of the flood source or exhaustion of the flood source inventory. (ASME/ANS RA-Sb-2013)

flood volume: the total flood volume of water released from the source from flood initiation to termination or to a specific point in time during a flood scenario; unless specified as the localized volume in specific flood areas for scenarios that involve multiple flood areas, flood volume is normally used to calculate the nominal flood height, which is associated with the submergence failure cause. Water-spray volumes are generally different from flood volumes, but spray water may accumulate and contribute to flood volumes. (ASME/ANS RA-Sb-2013)

flood-coastal. Abnormally high water on open and semi-enclosed bodies of water resulting from storm surge and tsunamis, precipitation, tide, wind-wave activity, and possible flood at nearby stream. (ANS-2.12-78)

flooding. The abnormal presence of a quantity of fluid, either in the form of accumulation, flow, or spray, in buildings which contain structures, systems or components (SSCs) necessary for safe shutdown, emergency core cooling capability, or whose failure could result in offsite radiological consequences comparable to the guideline exposures of 10 CFR 100, "Reactor Site Criteria" (ANS-56-11-88)

flood-lake. Abnormally high water on enclosed bodies of water resulting from high lake level, storm surge and seiche, precipitation, wind-wave activity, and possible flood of nearby stream. (ANS-2.12-78)

flood-river Abnormally high water on an inland stream resulting from precipitation and snow melt runoff, possible ice blockage, wind-wave activity, and possible dam failure or stream diversion. (ANS-2.12-78)

fluence-to-dose factor. (h_T). The quotient of effective dose equivalent (H_E) by fluence \square (theta) at a specific energy

$$h_E = H_E/\square \quad (6.1.1-91)$$

flux (specific discharge, darcy velocity) (LT^{-1}). The volumetric or mass discharge per unit cross-sectional area of medium (solids plus pores); called the Darcian flux when applied to water movement. (ANS-2.17-2010)

forecast. A population forecast is a population projection that is useful for analytical, planning, or policy purposes and that is accompanied by a judgment regarding its accuracy. (ANS-2.6-81)

forced outage: an unscheduled plant shutdown that is required due to administrative or hardware issues. See "outage types" for further discussion. (ANS/ASME-58.22-2015)

fractile hazard curve. (1) Epistemic uncertainty is expressed by a distribution of exceedence probability values, a distribution of hazard curves, rather than a single value, or a single curve. In a fractile hazard curve, all the points on the curve correspond to the same fractile of the distribution of the probability of exceedence. A 5% percentile hazard curve indicates that we have a 5% confidence that the calculated hazard would be less than that given by the curve. A 95% percentile hazard curve indicates that we are 95% confident that the hazard is below the hazard given by the hazard curve. (ANS-2.29-2008)

Non-preferred variation (1) A set of hazard curves used to reflect the uncertainties associated with estimated hazard. A common family of hazard curves used in describing the results of a probabilistic seismic hazard analysis (PSHA) consists of curves of fractiles of the probability distributions of estimated seismic hazard as a function of the level of ground motion parameter. (ASME/ANS RA-Sb-2013)

fraction leached. A portion of a constituent of a specimen or waste form that has been released from the specimen or waste form during the leaching process, using the quantity present initially as unity (100%).ANS-16.1-03)

fragility. Fragility of an SSC is the conditional probability of its failure at a given hazard input level. The input could be earthquake motion, wind speed, or flood level. The fragility model used in seismic PRA is known as a double lognormal model with three parameters, which are the median acceleration capacity, the logarithmic standard deviation of the aleatory (randomness) uncertainty in capacity, and the logarithmic standard deviation of the epistemic (modeling and data) uncertainty in the median capacity. (ASME/ANS RA-Sb-2013)

frazil ice. Ice crystals that form in supercooled water that is too turbulent to permit coagulation into sheet ice. (ANS-2.21-2012)

free-fall spill. An elevated release of powder or liquid as a slug of material that falls without obstruction and impacts a hard, essentially unyielding surface. (ANS-5.10-98)

free-field. A ground surface location for an earthquake sensor where the motion will be only of the ground surface and where the effects that are associated with certain surface features, buildings, and components will be insignificant. (ANS-2.2-02)

free liquid. Uncombined liquid not bound by the solid matrix of the solid waste mass, such as liquid that can be drained from a container. (ANS-55.1-92)

free volume. The total enclosed gas volume of a structure or an enclosed space minus the volumes occupied by solid material (e.g., internal walls, pipes, machinery) and liquids (e.g., sumps, suppression pools, etc.) (ANS-56.1-D85)

freeze. The controlled pause of simulation (ANS-3.5-2009)

frequency of exceedance: The frequency that a specified level of seismic hazard is expected to be exceeded at a site or region during a specified exposure period (e.g., once every 50 years) (ANS-2.30-2015).

frequency-consequence (F-C) curve. A curve of frequency based on consequences that defines operating limits for facility events based on the frequency and severity of consequences. (ANS-53.1-2011)

frequency mean value. The mean of an uncertainty distribution that expresses uncertainty in the estimate of an event frequency. (ANS-53.1-2011)

front-line system. A system (safety or nonsafety) that is capable of directly performing one of the accident mitigating functions (e.g., core or containment cooling, coolant makeup, reactivity control, or reactor vessel pressure control) modeled in the PRA. (ASME/ANS RA-Sb-2013)

fuel assembly. A matrix array of fuel rods which is normally treated as a unit for handling and accountability purposes. (ANS-57.8-93)

Non-preferred variation (1) The smallest modular unit comprised of individual fuel rods and associated integral component parts for handling, control, support, and maintenance of the unit's geometry. For boiling water reactors, the channel that encloses the fuel bundle and channel fastener is included as part of the fuel assembly for design purposes. (ANS-57.5-96)

fuel burnup. The fuel burnup unit as used throughout this standard is megawatt days per kilograms of uranium (MWd/kg U) local pellet average. Because of subtle differences between other variables (e.g., with subscripting), the other variables are defined in the text where they first appear. (ANS-5.4-2011)

Non-preferred variation (1) - As used throughout this standard, this term is megawatt-days per metric ton of heavy metal (MWd/t), because of subtle differences between other variables (e.g., with subscripting), the other variables are defined in the text where they first appear. (ANS-5.4)

Note: also see burnup (FWD CC should standardize on one term)

fuel cladding damage. Perforation or excessive distortion or rupture of fuel rod cladding which would permit the release of fission products to the reactor coolant. (ANS-50.1)
[Developed for 51.1/52.1]

fuel damage. Damage to a fuel assembly that breaches the cladding or distorts or disrupts spacer grids, fuel rods, end fittings or overall envelope dimensions, rendering it unfit for service in a reactor. (ANS-57.3-93)(ANS-57.2-99)

fuel damage limits. *It is preferred that term (**fuel design limits**) and the associated definition be used in ANS standards fuel damage limits.*

fuel damage limits. Those limits such as cladding strain, amount of fuel melting, amount of cladding deformation or melting, and fractional fuel failure beyond which the accident consequences are unacceptable. Different fuel damage limits are sometimes specified for different postulated accidents or different type of fuels. (ANS-54.1-89)

fuel design limits. Those limits such as cladding strain, amount of fuel melting, amount of cladding deformation or melting, and fractional fuel failure beyond which the accident consequences are unacceptable. Different fuel damage limits are sometimes specified for different postulated accidents or different type fuels. (ANS-54.1-89)

fuel failure. The release of fission products from the fuel kernel by an modular helium-cooled reactor (MHR) tri-isotopic (TRISO) fuel coating particle failure mechanism. (ANS-53.1-2011)

fuel handling accident. An accident involving nuclear fuel handling having the potential to adversely impact nuclear safety. (ANS-57.3-93)

Non-preferred definition (1) - An accident associated with nuclear fuel handling procedures having the potential to adversely impact nuclear safety by increasing k_{eff} or causing radioactivity release. (ANS-57.2-99)

Variant form: (ANS-57.2-D92)

fuel handling equipment. Equipment used for moving new fuel during receipt and inspection, transporting to storage in-plant and loading this fuel and control components in the reactor. (ANS-57.3-93)

fuel handling machine. Any equipment operating over the spent fuel pool [specifically] designed for handling fuel units and control components. (ANS-57.1-92)(ANS-57.2-D92)
(ANS-57.2-99)

fuel handling system. Handling equipment used for receiving and inspecting new fuel and fuel containing recycled uranium or irradiated fuel and control components in the reactor, and removing from the reactor, transporting to storage, and inspecting irradiated fuel and loading casks for shipment of irradiated fuel from or stor-age on the site. (ANS-57.1-92)

fuel oil subsystem. That portion of the fuel oil system which supplies fuel to a single diesel generator unit. (ANS-59.51-89)

fuel oil system. The set of equipment including pumps, tanks, piping, valves and fill and vent lines required to supply fuel to the emergency diesel generators installed in a nuclear power plant. As used here "system" includes the fuel oil equipment for all of the diesel generators for a nuclear unit. (ANS-59.51-89)

fuel preparation machine. A device consisting of a work platform, frame, and movable carriage used for stripping reusable channels from spent fuel and for rechanneling new fuel

in boiling water reactors (BWRs). It is normally mounted on the wall of the spent fuel pool. (ANS-57.1-92)

fuel rod. Those items of a fuel assembly that are long, thin-walled tubes closed by end caps. A fuel rod may contain fuel (e.g., uranium, plutonium, and fission products) and non-fuel material (springs, inert gas, and so forth). (ANS-57.1-92)

Variant form: (ANS-57.9-92)

fuel rod (fuel pin). The smallest component of a reactor fuel assembly which encapsulates the fuel. (ANS-57.8-93)

Non-preferred definition (1): A long slender column of material containing fissile nuclides, normally encapsulated by metallic tubing. (ANS-8.17-04)

fuel transfer mechanism. Handling equipment used to move fuel units between the spent fuel pool and the reactor area. (ANS-57.1-92)

fuel unit. An item to be handled that contains fuel rods. It can be a fuel assembly, canned spent fuel assembly, or a canister of consolidated fuel rods. (ANS-57.1-92)

Non-preferred variation (1) The fundamental item to be stored in the ISFSI. It can be a spent fuel assembly, canned spent fuel assembly, or consolidated fuel rods. (ANS-57.9-92) (ANS-57.7-97)

Non-preferred variation (2) The fundamental item to be handled, stored, or transported. Examples include an assembly of fuel rods, canned spent fuel, or consolidated fuel rods. (ANS-8.17-04)

full power or nominal full power: a POS during which the reactor power is at or near its normal designed value. In this POS, the primary system configuration (power level, pressure, temperature, boundaries, etc.) is maintained essentially constant. The “low power” state is defined to include all at-power operations below nominal full power. (ANS/ASME-58.22-2015)

full-scope probabilistic risk assessment. A PRA that accounts for all known plant operating states, initiating events and their causes including those from internal and external plant hazards, and event sequences whose end states are sufficiently developed to support and include an estimation of mechanistic source terms and off-site radiological consequences. Full-scope PRAs include a definition of event sequences, quantification of sequence frequencies and consequences, and quantification of uncertainties in the frequency and consequence estimates that is sufficient to account for all risk-significant contributions to each modeled end state. (ANS-53.1-2011)

full scope simulator. A simulator incorporating detailed modeling of systems of the reference plant with which the operator interfaces in the control room environment. The control room operating consoles are included. Such a simulator demonstrates expected plant response to normal and off-normal conditions. (ANS-3.5-85)

function. A design specification for what an SSC is expected to accomplish in order to serve a plant operation, maintenance, or safety purpose. (ANS-53.1-2011)

functional analysis. Analysis of functions provided by SSCs. For safety functions, the analysis of the effects of safety-related SSCs on accident analysis. (ANS-53.1-2011)

functional performance requirements. A qualitative or quantitative determination of acceptable operability by observation of system or component behavior during operation. (ANS-53.1-2011)

functional requirement. Functional description of requirements that the designs provide. Expressed functionally, designers can translate system requirements into hardware designs. (ANS-53.1-2011)

Non-preferred variation(1) One of the several required capabilities of a fuel assembly that is necessary to meet its design function.(ANS-57.5-96)

functional test. A qualitative or quantitative determination of acceptable operability by observation of system or component behavior during operation. (ANS-56.5-87)

functionally simulated hardware. Hardware which has dynamic interface with the real-time simulation. (ANS-3.5-85)

Fussell-Vesely (FV) importance measure. For a specified basic event, Fussell-Vesely importance is the fractional contribution to the total of a selected figure of merit for all accident sequences containing that basic event. For PRA quantification methods that include nonminimal cutsets and success probabilities, the Fussell-Vesely importance measure is calculated by determining the fractional reduction in the total figure of merit brought about by setting the probability of the basic event to zero. (ASME/ANS RA-Sb-2013)

G.

gaseous waste. The waste streams of noncondensable fluids that are radioactively contaminated with gases, condensable vapors, entrained liquids, or particles. (ANS-40.37-2009)

gas inventory. A quantity of gas contained in a free volume. (ANS-56.1-D85)

gas stripper. Degassing equipment to remove dissolved gases from liquids. (ANS-55.1-92)(ANS-55.4-93) (ANS-55.4-99)

Gaussian plume model: An atmospheric dispersion model where the effluent is assumed to have a Gaussian mass distribution vertically and horizontally across the plume centerline (ANS-2.15-2013).

Non-preferred variation (1) : A one-dimensional model for ATD that assumes that a plume moves downwind at the speed of the wind. Dispersion actually takes place in three dimensions, as the plume broadens in the cross-wind direction and grows taller in the vertical direction as it is transported downwind, based on assumed functional descriptions. (ASME/ANS RA-S-1.3-2016)

general design criteria. The set of design criteria given in 10, CFR 50, "Licensing of Production and Utilization Facilities," Appendix A, "General Design Criteria for Nuclear Power Plants". (ANS-56.2-84)

glass volume fraction. The fraction of the interior volume of a Raschig ring-filled vessel that is occupied by the glass in the rings. (ANS-8.5-96)

government agency. Any Federal, State, or local government organization designated in the plant's radiological emergency response plan. (ANS-3.7.1-95) (ANS-3.8.1-93)(ANS-

3.8.2-93) (ANS-3.8.3-93)(ANS-3.8.4-93) (ANS-3.8.5-92)(ANS-3.8.6-94)(ANS-3.8.4-95)
(3.8.3-95)

gradient transfer model: First-order closure model based on K-theory, of which the Gaussian model is a solution. (ASME/ANS RA-S-1.3-2016)

graphite oxidation. An exothermic chemical oxidation reaction of graphite with oxygen or endothermic reaction of graphite with water. (ANS-53.1-2011)

grapple. The action attaching to or the device making the attachment to a fuel assembly or control component. (ANS-57.1-92)(ANS-57.3-93)

gravity wave: A wave disturbance in which buoyancy acts as the restoring force on parcels displaced from hydrostatic equilibrium (ANS-3.11-2015).

gray: A unit of measure for radiation absorbed dose in SI units (1 Gy = 1 joule/kg = 100 rads). (ASME/ANS RA-S-1.3-2016)

greater safety. Preferred configuration of a system or position of an isolation valve from the overall safety viewpoint in the event of a LOCA or any other accident having the same containment isolation requirements as the LOCA. (ANS-56.2-84)

gripper. The device used for engaging a fuel unit or control component. (ANS-57.1-92)

ground acceleration. Acceleration at the ground surface produced by seismic waves. Typically expressed in units of g, the vertical acceleration of gravity at the earth's surface. (ANS-2.29-2008) (ASME/ANS RA-Sb-2013)

groundwater. All water contained in pores, fractures, or voids at or below the water table (also called the phreatic surface); also identifies water in the phreatic zone.²

Footnote: (2) Regulatory agencies and industry might consider groundwater to include all subsurface water, so that all contaminants in the subsurface are evaluated, not only those in the phreatic zone (ANS-2.17-2010)

groundwater recharge. The process involved in the addition of water to the phreatic zone; also the amount of water added to the saturated zone. (ANS-2.17-2010)

group quarters. As defined by the U.S. Bureau of the Census. These include: juvenile homes, boarding houses, barracks, etc. (ANS-2.6-81)

group-averaged nuclear data. Evaluated data averaged over energy groups (intervals) as weighted by specified functions. (ANS-6.1.2-2013)

grout. A fluid mixture of cement, water, and possibly some fine aggregate.(ANS-6.4-85)

guard. A uniformed individual, armed with a loaded firearm, whose primary duty is the protection of a plant against malevolent acts (e.g., toxicological and radiological sabotage).(ANS-3.3-88)

guidelines. Particular provisions, which are considered good practice, but which are not mandatory in programs intended to comply with this standard. The term "should" denotes a guideline; the term "shall" denotes a mandatory requirement. This definition is taken from American National Standard Quality Assurance Program Requirements for Nuclear Facilities, ANSI/ASME NQA-1-1986. (ANS-10.2-88)(ANS-10.5-79)

gust: According to U.S. weather observing practice, gusts are reported when the peak wind speed reaches at least 16 knots and the variation in wind speed between the peaks and lulls is at least 9 knots. The duration of a gust is usually less than 20 s (ANS-3.11-2015).

H.

habitable. Capable of providing for continued occupancy during emergency conditions within pre-established radiological and occupational limits set by the 10 CFR 50, "Domestic Licensing of Production and Utilization Facilities," Appendix A, and General Design Criteria for Nuclear Power Plants." Criterion 19, "Control Room." (3.8.2-93) (ANS-3.8.3-93) (ANS-3.8.2-95) (3.8.3-95)

handling equipment. *It is preferred that the term (**Fuel handling equipment or fuel handling system**) and the associated definition be used in ANS standards"*

handling equipment. Manually or power-operated devices used for performing relocation operations on rods, spent fuel assemblies or canisters.(ANS-57.10-93)

halogens: Five non-metallic elements (i.e., fluorine, chlorine, bromine, iodine, and astatine) in Group 17 of the periodic table. Radionuclide halogens include both vapor and aerosol (particle) forms. (ASME/ANS RA-S-1.3-2016)

handling tools. Portable, manually or power-operated devices used for handling or performing operations on fuel assemblies or control components. (ANS-57.1-92) (ANS-57.3-93)

Note; It is suggested that a change to the term "fuel handling tools " be considered

harden. To strengthen against unfavorable environmental conditions. (ANS-58.3-92) ANS-58.3-98)

harsh environment. An abnormal environment (e.g., high or low temperature, humidity, corrosive conditions) expected as a result of postulated accident conditions appropriate for the design basis or beyond design basis accidents. (ASME/ANS RA-Sb–2013)

hazard. An event or a natural phenomenon that poses some risk to a facility. Internal hazards include events such as equipment failures, human failures, and flooding and fires internal to the plant. External hazards include events such as flooding and fires external to the plant, tornadoes, earthquakes, and aircraft crashes. (ASME/ANS RA-Sb–2013)

hazard analysis: For the purposes of this standard, the determination of material, system, process, and plant characteristics that can produce undesirable consequences, followed by the assessment of hazardous situations associated with a process or activity. Largely qualitative techniques are used to pinpoint weaknesses in design or operation of the facility that could lead to hazardous material releases. The hazard analysis examines the complete spectrum of potential events that could expose members of the public, on-site workers, facility workers, and the environment to hazardous materials. (ANS-58.16-2014)

Non-preferred variation (1) the process to determine an estimate of the expected frequency of exceedance (over some specified time interval) of various levels of some characteristic measure of the intensity of a hazard (e.g., peak ground acceleration to characterize ground shaking from an earthquake). The time period of interest is typically 1 yr, in which case the estimate is called the annual frequency of exceedance. (ASME/ANS RA-Sb-2013)

hazard controls: For the purposes of this standard, controls that include safety SSCs and SACs categorized as SC-1, SC-2, and SC-3. (ANS-58.16-2014)

hazard curve. Curve that gives the probability of a certain ground motion parameter (usually the PGA, PGV, or response spectral values) being exceeded. Hazard curves are generally generated for periods of exposure of one year, and they give annual probabilities of exceedance. (ANS-2.27-2008)(ANS-2.29-2008)

Non-preferred variation (1) Numerical plot that shows the frequency of a certain seismic hazard parameter (e.g., ground motion or fault displacement) being exceeded (ANS-2.30-2015).

[hazard] event: an event brought about by the occurrence of the specified hazard. A hazard event is described in terms of the specific levels of severity of impact that a hazard can have on the plant. For example, an internal flood event would be expressed in terms of the specific flood source and its local impact, such as the resulting water levels in affected plant areas or the extent of the area subjected to spray; a seismic event would be expressed in terms of spectral acceleration and associated spectral shape; a transient event would be expressed in terms of the plant systems affected by the event. (ASME/ANS RA-Sb-2013)

hazard group. A group of similar hazards that are assessed in a PRA using a common approach, methods, and likelihood data for characterizing the effect on the plant. Typical hazard groups considered in a nuclear power plant PRA include internal events, internal floods, seismic events, internal fires, high winds, external flooding, etc. (ASME/ANS RA-Sb-2013)

hazardous waste. Waste that either: (1) is listed as a hazardous waste in Subpart D of 40 CFR 261 or, (2) exhibits any of the hazardous characteristics identified in Subpart C of 40 CFR 261 or, (3) is otherwise identified as a hazardous waste by applicable state regulations. (ANS-55.1-92)

health effects: Impacts on populations exposed to releases of radioactive material. Health effects often used as metrics include early fatalities, latent cancer fatalities, and individual risk of both measures. Dose or effective dose can also sometimes be used as metrics, although neither one is strictly a health effect. (ASME/ANS RA-S-1.3-2016)

HCLPF capacity. Refers to the High Confidence of Low Probability of Failure capacity, which is a measure of seismic margin. In seismic PRA, this is defined as the earthquake motion level at which there is a high (95%) confidence of a low (at most 5%) probability of failure. Using the lognormal fragility model, the HCLPF capacity is expressed as $A_m \exp[-1.65\beta_R + \beta_U]$. When the logarithmic standard deviation of composite variability β_c is used, the HCLPF capacity could be approximated as the ground motion level at which the composite probability of failure is at most 1%. In this case, HCLPF capacity is expressed as $A_m \exp[-2.33\beta_c]$. In deterministic SMAs, the HCLPF capacity is calculated using the CDFM method. (ASME/ANS RA-Sb-2013) (*Note: subscripts and superscripts are needed for clarity.*)

helium pressure boundary (HPB). The pressure boundary for the primary helium coolant including the RPV, piping, vessels, valves, and heat exchangers required to maintain primary helium pressure and act as a barrier to fission product releases to the reactor building. (ANS-53.1-2011)

heat utilization system. The ultimate heat load that uses the thermal energy (heat output) from a reactor for energy production or process purposes. (ANS-53.1-2011)

heterogeneity. The properties or conditions of isotropy or anisotropy vary from point to point in the medium. (ANS-2.9-89)(ANS-2.17-89)

hidden failure. Failure of a component or system that does not become evident until the affected component or system is called upon to function. (ANS-53.1-2011)

high efficiency particulate air (HEPA) filter. A disposable dry-type filter having minimum efficiency of 99.97% for 0.3 micron particles. (ANS-55.1-92)(ANS-55.4-93) (ANS-55.4-99)

high energy arcing fault. Electrical arc that leads to a rapid release of electrical energy in the form of heat, vaporized copper, and mechanical force. (ASME/ANS RA-Sb–2013)

high energy line. Any line, or portion of a line, where the maximum operating pressure exceeds 275 psig, or the maximum operating temperature exceeds 200°F, during normal plant operating conditions. Those lines that operate above these limits for only a relatively short portion (i.e., less than approximately two percent) of the period of time to perform their intended function, may be classified as moderate energy. An example of such a system could be the residual heat removal (RHR) systems in some plant designs. (ANS-56.4-83)(ANS-56.10-87)

Non-preferred variation (1) a pipe or piping system component is classified as high energy if it contains water or steam at maximum operating temperature exceeding 200°F or maximum operating pressure exceeding 275 psig. (ASME/ANS RA-Sb–2013)

high energy line break (HELB): a break or breach in a high energy line. (ASME/ANS RA-Sb–2013)

higher order closure models: An approximation to turbulence that retains prognostic equations for mean variables (e.g., potential temperature and wind) as well as for some of the higher-order statistics including variance (e.g., turbulence kinetic energy or temperature variance) or covariance (e.g., kinematic fluxes such as for heat and momentum). (ASME/ANS RA-S-1.3-2016)

high-hazard fire source. A fire source that can lead to fires of a particularly severe and challenging nature. High-hazard fire sources would include, but are not limited to, the following: catastrophic failure of an oil-filled transformer, an unconfined release of flammable or combustible liquid, leaks from a pressurized system containing flammable or combustible liquids, and significant releases or leakage of hydrogen or other flammable gases. (ASME/ANS RA-Sb–2013)

high integrity container (HIC). A NRC- or state-approved container which provides waste stability for near surface disposal in accordance with 10 CFR 61. (ANS-55.1-92)

high-integrity software. Software that needs to be trusted to work dependably as part of a process that provides critical functions or predictions and whose failure to do so may have catastrophic results, such as serious injury, loss of life or property, vital mission failure, damage to the environment, or breach of national security. (ANS-10.7-2013) (ANS-10.8-2015)

high-level language. A type of programming language that allows software to be written in a more readily understandable form than object code through use of powerful control and data handling constructs. (ANS-10.7-2013)

high purity (clean) wastes. Liquid radioactive wastes of low conductivity, normally less than 50 microsiemens, and low insoluble solids content, normally less than 20 ppm. (ANS-55.6-93) (ANS-55.6-99)

high radiation area. Any area, accessible to personnel, in which there exists radiation at such levels that a major portion of the body could receive in any one hour a dose equivalent in excess of 100 mrem. (ANS-6.8.1-81)

high school diploma. High school diploma or successful completion of the General Education Development (GED) test. (ANS-3.1)

high-temperature gas-cooled reactor (HTGR). A reactor with graphite moderator, helium coolant, and coated particle fuel with core outlet temperatures normally above 750°C. HTGRs with passive core heat removal and reactivity control capabilities in steel RPVs and of modular design are referred to as modular HTGRs or modular helium-cooled reactors (MHRs) (ANS-53.1-2011)

high winds. Tornadoes, hurricanes (or cyclones or typhoons as they are known outside the U.S.), extratropical (thunderstorm) winds, and other wind phenomena depending on the site location. (ASME/ANS RA-Sb-2013)

Holocene. The geologic epoch referring to a period of time between the present and approximately 10,000 years before present. Applied to rocks or faults, this term indicates the period of rock formation or the time of most recent fault slip. (ANS-2.27-2008)

Non-preferred variation (1) The geologic epoch referring to a period of time between the present and approximately 11,700 years before present (ANS-2.30-2015).

holding time. The elapsed time expressed in days from the date of collection (rather than receipt by the laboratory) of the sample until the date of analysis. (ANS-41.5-2012)

homogeneity. The properties or conditions of isotropy or anisotropy are constant from point to point in the medium. (ANS-2.9-89) (ANS-2.17-89)

homogeneous equilibrium model. A critical flow correlation that is based on the assumptions of equal phase velocities, a homogeneous mixture (i.e., both phase and component), phases and components which are in thermal equilibrium, and isentropic flow of the mixture. (ANS-56.4-83)(ANS-56.10-87)

horizontal wind direction: The direction from which the wind is blowing relative to the horizon. Values are reported in degrees azimuth measured clockwise from true north and ranging from 0 to <360 degrees azimuth (i.e., north is 0 degrees azimuth; east is 90 degrees azimuth; south is 180 degrees azimuth; west is 270 degrees azimuth) (ANS-3.11-2015).

horizontal wind speed: The ratio of the distance covered by the movement of air to the time taken to cover it relative to the horizon (ANS-3.11-2015).

hot particle. A discrete radioactive fragment that is insoluble in water, is no larger than approximately 1 millimeter in any dimension, and can expose very small amounts of tissue to very large, highly non-uniform doses. (ANS-3.7.1-1995)

hot short. Individual conductors of the same or different cables coming in contact with each other where at least one of the conductors involved in the shorting is energized resulting in an impressed voltage or current on the circuit being analyzed. (ASME/ANS RA-Sb-2013)

hot shutdown - BWR. In the BWR, the condition in which the reactor is sub-critical and the reactor coolant system average temperature is above the temperature required to permit major maintenance consistent with Technical Specification operational limits. (ANS-58.6-92)

hot shutdown - PWR. In the PWR, the condition in which the reactor is sub-critical and the reactor coolant system average temperature is also below the required temperature to permit operation of the residual heat removal system, consistent with Technical Specification operational limits. (ANS-58.14-93)

hot shutdown: a set of POSs during which the reactor is subcritical with the primary temperature between 200°F and 350°F and with the reactor vessel intact. Hot shutdown is defined by Technical Specifications (Mode 4 for PWRs, Mode 3 for BWRs). (ANS/ASME-58.22-2015)

hot standby. In the PWR, the condition in which the reactor is sub-critical and the reactor coolant system average temperature is above the required temperature to permit operation of the low pressure residual heat removal (RHR) system, consistent with technical specification operational limits. (ANS-51.1-93) (ANS-58.6-92)(ANS-58.14-93) (ANSI/ANS-51.10-02)

Non-preferred variation (1) a POS (or set of POSs) during which the reactor is subcritical with the primary temperature above 350°F, and the reactor vessel intact. Hot standby is defined by Technical Specifications (Mode 3 for PWRs, not used for BWRs). (ANS/ASME-58.22-2015)

human error. Any human action that exceeds some limit of acceptability, including inaction where required, excluding malevolent behavior. (ASME/ANS RA-Sb–2013)

human error probability (HEP). A measure of the likelihood that plant personnel will fail to initiate the correct, required, or specified action or response in a given situation, or by commission performs the wrong action. The HEP is the probability of the human failure event. (ASME/ANS RA-Sb–2013)

human failure event (HFE). A basic event that represents a failure or unavailability of a component, system, or function that is caused by human inaction, or an inappropriate action. (ASME/ANS RA-Sb–2013)

human reliability analysis (HRA). A structured approach used to identify potential human failure events and to systematically estimate the probability of those events using data, models, or expert judgment. (ASME/ANS RA-Sb–2013)

human response action: a postinitiator operator action, following a cue or symptom of an event, taken to satisfy the procedural requirements for control of a function or system. (ASME/ANS RA-Sb–2013)

HVAC systems, related to safety. *It is preferred that the term (HVAC systems, safety-related) and the associated definition be used in ANS standards”*

HVAC systems, related to safety. HVAC systems that are required to accomplish the objectives listed in 1.2 of this standard. (ANS-59.2-85)

HVAC systems, safety-related. HVAC systems that are required to accomplish the objectives listed in 1.2 of this standard.. (ANS-59.2-92)

hydraulic conductivity (LT^{-1}). [1]. A medium has a hydraulic conductivity of unit length per unit time if it will transmit in unit time a unit volume of ground water at the prevailing viscosity through a cross section of unit area, measured at right angles to the direction of flow, under a hydraulic gradient of unit change in head through unit length of flow. [2]. The term "hydraulic conductivity" has been called permeability, coefficient of permeability, field coefficient of permeability, and conductivity.(ANS-2.9-89) (ANS-2.17-89)

hydraulic gradient. The change in hydraulic head with distance. (ANS-2.17-2010)

hydraulic head. One of several measures of the energy content of water (in this case, energy per unit weight), expressed as a height of freshwater above a datum. In fresh groundwater, the hydraulic head is commonly found using the water surface elevation in an open borehole, well, or piezometer. (ANS-2.17-2010)

Hydrogen Control System (HCS). The system or sub-systems and components provided expressly for the purpose of monitoring and controlling post-accident hydrogen or oxygen accumulation in a primary reactor containment. (ANS-56.1-85)

hydrogeologic unit. Any soil, rock unit or zone which by virtue of its porosity or permeability, or lack thereof, has a distinct influence on the storage or movement of ground water. (ANS-2.9-89)(ANS-2.17-89)

hydroseism. Ground water level fluctuations or surges resulting from seismic events. (ANS 2.9-89)

hydrostratigraphy. A conceptual framework that classifies geologic materials of considerable lateral extent into reasonably distinct hydrologic systems. (ANS-2.17-2010)

Hypocenter. The point of the earth's crust where a rupture initiates, creating an earthquake. (ANS-2.29-2008)

I.

ignition frequency. Frequency of fire occurrence generally expressed as fire ignitions per reactor-year. (ASME/ANS RA-Sb-2013)

ignition source. Piece of equipment or activity that causes fire (RG 1.189). (ASME/ANS RA-Sb-2013)

impact area. The area inside a circle of radius 50 miles with the reactor at the center. (ANS-2.6-81D)

implementation. The installation and demonstration of operability of a computer program on a given hardware/software configuration. (ANS-10.2-88)

important to confinement (Important Confinement Features). Those features of the ISFSI whose function is:

(1) To maintain the conditions required to store spent fuel safely (e.g., heat removal system if provided), or

(2) To prevent damage to the spent fuel during handling and storage (e.g., transportation package [cask] unloading equipment), or

(3) To provide reasonable assurance that spent fuel can be received, handled, stored, and retrieved without undue risk to the health and safety of the public. Dose commitment criteria provided in American National Standard Guidance for Defining Safety-Related Features of Nuclear Fuel Cycle Facilities, ANSI N46.1-1980 [7] are available for use in determining systems, structures, and components that have important confinement features with respect to public health and safety. (ANS-57.7-97)

Non-preferred variation (1) Variant form: (ANS-57.9-92)

in situ experiment (experiment). Neutron multiplication, other nuclear reactivity-multiplication, or other nuclear reactivity-determining measurement on a sub-critical fissile assembly where protection of personnel against the consequences of a criticality accident is not provided. (ANS-8.6-83)

incapacity. The medical or psychological condition of the individual does not meet the minimum health requirements of this standard and accommodation is not possible. (ANS-3.4.94)

incendiary device. A self-contained device intended to create an intense fire that can damage normally flame-resistant or retardant materials. (ANS-3.3-88)

induced radioactivity. Radioactivity due to the interaction of an external neutron radiation field with the nuclides of a material. (ANS-6.4.2-85)

independence: For the purposes of this standard, the state in which there is no mechanism by which any single DBE, such as a flood, can cause redundant equipment to be inoperable. (ANS-58.16-2014)

independent. The freedom from and insusceptibility to failure resulting from interaction among redundant safety-related components and systems. (ANS-56.5-87)

independent assessment: *It is preferred that the term (independent review) and the associated definition be used in ANS standard.*

independent assessment: A review of a criticality safety evaluation by a competent individual(s), other than the originator, that confirms the adequacy of the evaluation. The reviewer(s) may be from the same organization as the originator. (ANS-8.17-04)

independent events. Event combinations for which the occurrence of one event does not give information about (i.e., increasing or decreasing) the probability of the occurrence of the other. If two events A and B are independent, the conditional probability for the occurrence of A given the occurrence of B is simply the probability for the occurrence of A alone (i.e., unaffected by the occurrence of B). (ANS-2.12-78)

independent review (alternate). Review completed by personnel not having direct responsibility or direct involvement in the work function under review. (ANS-3.2-2012)

Independent Spent Fuel Storage Installation (ISFSI). A complex designed and constructed for the storage of spent fuel and other materials associated with spent fuel storage. An ISFSI that is located on the site of another facility can/may share common utilities and services with such other facility and still be considered to be independent, provided that such sharing of utilities and services or physical connections does not

(1) Increase the probability or consequences of an accident or malfunction involving components, structures, or systems that are important to confinement, or

(2) Reduce the margin of safety as defined in the bases for any technical specifications of either facility. (ANS-57.7-92) (ANS-57.9-92)

Non-preferred variation (1) Variant form: (ANS-2.19-89)

industrial or military facility accident. Explosion, deflagration, missile, fire, toxic gas release or other potential hazard from a fixed facility. (ANS-2.12-78)(ANS-2.19-89)

inert atmosphere. A gas or gaseous mixture limited in oxygen and other substances that are chemically reactive with sodium or sodium-potassium NaK. (ANS-54.1-89)

inerted containment. A primary reactor containment in which the containment atmosphere is diluted, usually with nitrogen, during normal plant operation. (ANS-56.1-D85)

inertial effect. In sub-compartment pressure and temperature transient analysis, a characteristic of the pressure transient caused by the fluid acceleration term in the momentum equation. (56.10-87)

infiltration. The movement of water from above the ground surface into the vadose zone. (ANS-2.17-2010)

Non-preferred variation (1) The process of downward movement of water from the surface into underlying materials. (ANS-2.9-89)(ANS-2.17-89)

information display channel. An arrangement of electrical and mechanical components or modules, or both, from measured process variable to display device as required to sense and display conditions within a generating station. (ANS-4.5)

ingestion EPZ. An area of approximately 50 miles radius surrounding a nuclear power plant where actions could be necessary to protect the public from the ingestion of contaminated water or foods. (ANS-3.8.2-93)(ANS-3.8.5-92) (ANS-3.8.6-94) (ANS-3.8.2-95)

initial condition. A set of data that represents the status of the reference unit from which real time simulation can begin.(ANS-3.5-2009)

initial test interval. The allowable Type A, Type B, or Type C test interval prior to the demonstration of good performance history. (ANS-56.8-02)

initialization condition. A set of data that represents the status of the referenced plant from which real-time simulation can begin. (ANS-3.5-85)

initiating event: a perturbation during a plant operating state that challenges plant control and safety systems, whose failure could potentially lead to core damage or core damage with radioactivity release. An initiating event could require a response or degrade the reliability of a normally operating system, cause a standby mitigating system to be challenged, or require that the plant operators respond in order to mitigate the event or to limit the extent of plant damage caused by the initiating event. (ANS/ASME-58.22-2015)

Non-preferred variation (1) An initiating event is a single occurrence, including its consequential effects, that places the plant or some portion of the plant in an off-normal condition. An initiating event and its resulting occurrences are not the single failure defined herein. An initiating event can be a single equipment failure, natural phenomenon, or external man-made hazard. (ANS-58.9-94)

Non-preferred variation (2) Initiating Event - Any event, observed or postulated, either internal or external to the plant, that perturbs the steady-state operation of the plant or steady-state maintenance of the plant safety functions, thereby initiating an abnormal event such as transient or HPB breach within the plant. Initiating events trigger sequences of events that challenge plant control and safety systems whose failure could potentially lead to a significant release of radioactive material. Internal events, internal plant hazards, or external plant hazards, defined for specific plant operating states, can cause initiating events. In a PRA, initiating events that occur in specified plant operating states are used as a starting point to define event sequences and LBEs. Used for analytical purposes, the (postulated) event that initiates an event sequence culminating in an analytical outcome for safety analysis. (ANS-53.1-2011)

Non-preferred variation (3) initiating event: a perturbation to the steady-state operation of the plant that challenges plant control and safety systems whose failure could potentially lead to core damage. An initiating event is defined in terms of the change in plant status that results in a condition requiring a reactor trip (e.g., loss of main feedwater system, small LOCA), or a manual trip prompted by conditions other than those in the normal shutdown procedure when the plant is at power. An initiating event may result from human causes, equipment failure from causes internal to the plant (e.g., hardware faults, floods, or fires) or external to the plant (e.g., earthquakes or high winds), or combinations thereof. (ASME/ANS RA-Sb-2013)

initiating occurrence. *It is preferred that preferred term (**initiating event**) and the associated definition be used in ANS Standards.*

initiating occurrence. A single occurrence and its consequential effects that causes a design basis event. An initiating occurrence is not the single failure defined elsewhere herein. An initiating occurrence can be a manual action, automatic action, an equipment failure, a human error, a natural hazard or a man-made hazard. (ANS-51.1/52.1-1983] (ANSI/ANS-51.10-02)

initiator. See initiating event. (ASME/ANS RA-Sb-2013)

injection mode. In the context of this standard with regard to the spray subsystem, the operating condition in which water is sprayed into the containment atmosphere from the injection water supply. With regard to the additive subsystem, the operating condition in which an additive is added to the spray water. (ANS-56.5-87)

injection water supply (PWR). A water storage structure from which water is drawn for the injection mode. (ANS-56.5-87)

input. Data received by a program. (ANS-10.5-79)

in-service verification. Periodic verification of the integrity of the neutron absorber system subsequent to installation. (ANS-8.21-95)

inspection. Examination or measurement to verify whether an item or activity conforms to specified requirements. (ANS-3.2-93)

instruction. A meaningful expression in a computer programming language that specifies an operation to a digital computer. (ANS-7.4.3.2)

instrument quality air. Clean, dry, oil-free air that will not prevent or degrade any system equipment or component from operating. Recommended air quality limits are contained in ANSI ISA0S73-1981. (ANS-59.3-92)

instrument system: All components from sensor to and including data recording and display (ANS-3.11-2015).

instrumentation station. An assembly of one or more instruments that can provide any function or combination of defined functions [see time-history accelerograph (T/A), acceleration sensor, recorder, seismic trigger (S/T). Supports, foundation, housing, and ancillary equipment are also considered to be a part of the instrumentation station. (ANS-2.2-02)

instrumentation system. *It is preferred that the term (**Instrument system**) and the associated definition be used in ANS standards*

instrumentation system. All components from sensor to and including data recording, display, and reduction. (Herein referred to as "system.")(ANS-3.11-00)

integration tests. Tests performed during the hardware-software integration process prior to computer system-validation to verify compatibility of the software and the computer system hardware. (ANS-7.4.3.2-1990)

integrator. A single entity (individual, team, company, etc.) who is ultimately responsible for developing the composite representation of the informed technical community (herein called "the community distribution"). This sometimes involves informal methods such as deriving information relevant to an issue from the open literature or through informal discussions with experts, and sometimes involves more formal methods. (ASME/ANS RA-Sb-2013)

intensity. A measure of the impact of a hazard. (ASME/ANS RA-Sb-2013)

intercable (as in "intercable conductor-to-conductor short circuit"). Electrical interactions (shorting) between the conductors of two (or more) separate electrical cables. (See also intracable.) (ASME/ANS RA-Sa-2009)

interdiction: Temporary denial of the use of land or buildings for some time following contamination by radioactive material released from a facility. It also is associated with the collection of contaminated food prior to ingestion by the general public (ASME/ANS RA-S-1.3-2016)

interface requirements. Requirements pertaining to all the connections facilitating all mass and energy flow to and from an MRWP system. Also included are health, safety, and chemistry support requirements. (ANS-40.37-2009)

interfacing systems LOCA (ISLOCA). A LOCA when a breach occurs in a system that interfaces with the RCS, where isolation between the breached system and the RCS fails. An ISLOCA is usually characterized by the overpressurization of a low-pressure system when subjected to RCS pressure and can result in containmentbypass. (ASME/ANS RA-Sb-2013)

intermediate coolant boundary. The pressure containing portion of those components which are: (1) part of the intermediate coolant system or, (2) connected to the intermediate coolant system up to and including any and all of the following:

- (a) The first valve normally closed or capable of automatic actuation during normal reactor operation in piping which does not penetrate reactor containment;
- (b) The outermost containment isolation valve in piping which penetrates reactor containment; and,
- (c) A passive barrier between the intermediate coolant and the working fluid of a heat extraction system. (ANS-54.1-89)

intermediate coolant system. Those components such as heat exchangers, pumps, tanks and connecting piping which contain intermediate coolant and are necessary to transport reactor core heat from the reactor coolant system to the principal heat extraction system. (54.1-89)

intermediate point of compliance. A location used as a reference point for the purpose of protecting the groundwater resource, where there are no immediate existing receptors but where contamination is regarded as undesirable. (ANS-2.17-2010)

intermediate state: the grouping of event sequences at some point short of the end states as a way of organizing the PRA, typically to aid in developing intermediate results (e.g., fuel damage, plant damage states, etc.). Sometimes referred to in PRA modeling as “pinch point”. (ASME/ANS RA-S-1.4-2013)

internal event. An initiating event resulting from equipment failure, operator action, or other error internal to the plant. These events include equipment misoperation. (ANS-53.1-2011)

Non-preferred variation (1) internal event: a hazard group that encompasses events that result from or involve mechanical, electrical, structural, or human failures from causes originating within a nuclear power plant that directly or indirectly cause an initiating event and may cause safety system failures or operator errors that may lead to core damage. By historical convention, loss of offsite power, which may result from causes within or outside the plant, is considered an internal event (except when the loss is caused by another evaluated hazard group). Also by historical convention, internal flood and internal fire are separate hazard groups and thus not considered internal events. (ASME/ANS RA-Sb–2013)

internal plant hazard. A hazard located inside the plant that could be the source of an internal plant hazard event. Examples of internal plant hazards are rotating machinery, high-energy piping, large-volume water tanks, and sources of combustible material. (ANS-53.1-2011)

internal plant hazard event. An event originating from an internal plant hazard external to modeled SSC supporting safety functions, which could cause an initiating event and/or prevent SSCs from performing safety functions, in response to the initiating event. This event category includes internal fires, internal floods, turbine missiles, high-energy line breaks, and other events that may impact or damage equipment in a spatially connected area in a manner that causes an initiating event, impacts the performance of a safety function, or both. (ANS-53.1-2011)

intracable (as in “intracable conductor-to-conductor short circuit”). Electrical interactions (shorting) between the conductors of one multiconductor electrical cable. (See also *intercable*.) (ASME/ANS RA-Sb–2013)

intraplate and interplate. Intraplate pertains to processes within the earth's crustal plates, while interplate pertains to processes at the interface between the plates. (ANS-2.27-2008)

intrinsic permeability (L^2). The measure of the ability of a rock or soil to transmit fluid under a fluid potential gradient (see definition of hydraulic conductivity). (ANS-2.9-89)(ANS-2.17-89)

intrusion alarm. A tamper-indicating, electrical, electromechanical, electro-optical, electronic or similar device which will detect intrusion into a building, protected area or vital area, and alert guards or watchmen by means of visible and audible signals. (ANS-3.3-88)

ion exchanger and filter waste. Liquid radioactive wastes generated as a result of backflushing, regeneration, transfer or replacement of filters and ion exchange resins. (ANS-55.6-93) (ANS-55.6-99)

ionizing radiation: Subatomic particles or electromagnetic waves that are energetic enough to detach electrons from atoms or molecules and producing radiation capable of causing damage to cells. (ASME/ANS RA-S-1.3-2016)

irradiation: The exposure to ionizing radiation within the reactor. Irradiation refers to the exposure of the fuel (including burnable absorbers) to neutrons, and the subsequent results of fission and transmutation within the fuel. (ANS-8.27-15)

isolation barrier(s). Mechanical means for preventing passage or release of fluid through fluid systems which penetrate the containment (e.g., valves, closed systems, blind flanges). (ANS-56.2-84)

isolation barrier protection. Protection of the isolation barrier against loss of function from external events such as missiles, pipe whip, jet force, or natural phenomena. (ANS-56.2-84)

isolation pressure. That pressure value below which a selected portion(s) of the air system is automatically isolated from the remainder of the air system to protect the air pressure integrity therein. (ANS-59.3)

isolation valve seal system. A system which provides for control of leakage past the isolation barrier(s). (ANS-56.2-84)

isolation zone. Any area adjacent to a physical barrier that is cleared of all objects which could conceal or shield an individual. (ANS-3.3-88)

isotropic. The properties at any point within a medium are the same in all directions. (ANS-2.9)(ANS-2.17-89)

item. Any plant structure, system, component, or part, including consumable. (ANS-58.14-93) (ANS-58.14-2011)

J.

job task analysis. The analysis process used to determine the performance areas and tasks comprising a particular job. (ANS-3.1-87)

K.

keep-warm oil pump. An electric motor driven pump that circulates warm oil through the engine when the unit is in standby. (ANS-59.52-98)

keep-warm heater. A heater used to warm the lubricating oil to within specified limits while the engine is in standby, to enhance engine starting reliability. (ANS-59.52-98)

kernel density. Kernel density estimation is a non-parametric approach to defining a probability distribution. It is created by centering a kernel density function (e.g., Gaussian distribution) at each data point, then summing and renormalizing these individual density functions to create the composite density function. The smoothness of the final composite density is controlled by the size of the individual kernel densities placed at each data point. Kernel density estimation is used in a seismic hazard evaluation to smooth the mapped distribution of past earthquakes that is used as a predictor of the spatial distribution for future earthquakes. (ANS-2.27-2008)

key assumption: an assumption made in response to a key source of uncertainty in the knowledge that a different reasonable alternative assumption would produce different results, or an assumption that results in an approximation made for modeling convenience

in the knowledge that a more detailed model would produce different results. For the base PRA, the term “different results” refers to a change in the plant risk profile (e.g., release category frequency, the set of initiating events and event sequences that contribute most to the release category frequency) and the associated changes in insights derived from the changes in risk profile. A “reasonable alternative” assumption is one that has broad acceptance within the technical community and for which the technical basis for consideration is at least as sound as that of the assumption being challenged. (ASME/ANS RA-S-1.4-2013)

key safety functions. The minimum set of safety functions that must be maintained to prevent core damage and large early release. These include reactivity control, reactor pressure control, reactor coolant inventory control, decay heat removal, and containment integrity in appropriate combinations to prevent core damage and large early release. (ASME/ANS RA-Sb-2013)

key source of uncertainty: a source of uncertainty that is related to an issue for which there is no consensus approach or model and where the choice of approach or model is known to have an impact on the risk profile (e.g., release category frequency, the set of initiating events and event sequences that contribute most to the frequency of release) or a decision being made using the PRA. Such an impact might occur, for example, by introducing a new functional event sequence or a change to the overall release category frequency estimates significant enough to affect insights gained from the PRA. (ASME/ANS RA-S-1.4-2013)

L.

land use: Parameters used to determine the doses to the public consuming food and residing in areas where radioactive materials have deposited. (ASME/ANS RA-S-1.3-2016)

latent cancer fatalities: Deaths from cancer that were caused by chronic effects of radiation exposure; latent cancer fatalities may occur years after the exposure. (ASME/ANS RA-S-1.3-2016)

latin hypercube sampling (LHS): A method of stratified sampling developed to generate a distribution of plausible collections of parameter values from a multi-dimensional distribution. The sampling method is often applied in uncertainty analysis to obtain a representative sample. (ASME/ANS RA-S-1.3-2016)

leakage rate. The rate at which the contained fluid escapes from the test volume at a specified test pressure. (ANSI/ANS-56.8-02)

L_a (weight%/24 h). The maximum allowable Type A test leakage rate at pressure p_a . (ANS-56.8-02)

L_{am} (weight%/24 h). Estimate of leakage rate, derived as a function of the least squares slope and intercept, for the Type A test at pressure P_a obtained from testing the primary containment system by simulating some of the conditions that would exist under DBA conditions (e.g., vented, drained, flooded or pressurized). (ANS-56.8-02)

L_c (weight%/24 h). The composite primary containment leakage rate measured using the CILRT instruments after L_o is superimposed. (ANS-56.8-02)

L_o (weight%/24 h). The known leakage rate superimposed on the primary containment during verification test. (ANS-56.8-02)

laboratory control sample (LCS). A standard material of known composition, or an artificial sample (created by fortification of a clean material similar in nature to the environmental sample), that is prepared and analyzed in the same manner as the environmental sample. (ANS-41.5-2012)

lag storage. In-process surge storage of fuel units. (ANS-57.9-92)

Lagrangian method: A method of studying atmospheric motions in which one considers volume elements that are carried along within the atmosphere and across whose boundaries material does not flow (ANS-2.15-2013).

lake. As used in this standard, a lake is a natural body of water whose outlet is not controlled. (ANS-2.13-79)

land-water circulation: Coastal winds that flow from land to large bodies of water and vice-versa caused by differential heating of the two areas (ANS-2.15-2013).

large early release. The rapid, unmitigated release of airborne fission products from the containment to the environment occurring before the effective implementation of off-site emergency response and protective actions such that there is a potential for early health effects. (ASME/ANS RA-Sb-2013)

large early release frequency (LERF). Expected number of large early releases per unit of time. (ASME/ANS RA-Sb-2013)

latching or engaging. Physically attaching a tool or grapple to a fuel assembly or control component in a manner to preclude accidental release. (ANS-57.1-92)(ANS-57.3-93)

leachability. A rate constant (or a combination of several rate constants) that describes the leaching of a nuclide from a material under a given set of conditions. (ANS-16.1-03)

leachability index. An index value related to the leaching characteristics of solidified waste materials as measured by the leach test defined in this standard. In this standard, the Leachability Index has an exact theoretical meaning only for homogeneous, chemically inert materials, for which bulk diffusion is the predominant rate-determining process during leaching. (ANS-16.1-03)

leachate. Leachant after use (ANSI/ANS-16.1-2003)

leachant. The liquid that contacts the specimen during the course of a leaching test or contacts a solid waste form at a disposal site (ANSI/ANS-16.1-2003)

leaching interval. The length of time during which a given volume of leachant is in contact with a specimen or solid waste form. (ANS-16.1-03)

leaching rate/leach rate. The amount of the constituent of the specimen or solid waste form that is leached during one time unit (e.g., g/day or $\mu\text{Ci/s}$). It is frequently expressed per unit of exposed surface area [e.g., $\text{gcm}^{-2}(\text{day})^{-1}$]. (ANS-16.1-03)

leach test specimen/leach specimen. The solid body that is immersed into the leachant during the leach test. This body must be representative of the solid that is formed by the combination of waste with the solidification agent. (ANS-16.1-03).

leach test/leaching test. Procedure to be followed for the determination of the Leachability Index. (ANS-16.1-03)

leak. An opening that allows the passage of fluid through it. (56.8-02)

leak before break. The principle that early detection of small leaks in piping will occur and corrective action will be taken well before propagation into a large break. (ANS-54.1-89)

leakage. The quantity of fluid escaping from a leak or leaks. (ANS-56.8-02)

leakage rate. The rate at which the contained fluid escapes from the test volume at a specified test pressure. (ANS-56.8-02)

LERF (Large Early Release Frequency) analysis. Evaluation of containment response to severe accident challenges and quantification of the mechanisms, amounts, and probabilities of subsequent radioactive material releases from the containment. (ASME/ANS RA-Sb-2013)

level 1 analysis. Identification and quantification of the sequences of events leading to the onset of core damage. (ASME/ANS RA-Sb-2013)

licensee. The organization that holds the operating license for the facility. (ANS-58.6-94) (ANS-3.8.2-95) (ANS-3.8.4-95) (3.8.3-95)

Non-preferred variation (1) An individual licensed operator or senior operator. (ANS-3.4-94)

licensee-controlled area. Areas of the plant site that are directly controlled by the nuclear power plant licensee. (ASME/ANS RA-Sb-2013)

licensed duties: The functions of an operator including but not limited to the manipulation of apparatus and mechanisms that directly affect the reactivity, power level, cooling, containment, and other requirements for safe operation of the nuclear power plant during normal and emergency operations. (ANS-3.4-2013)

licensed operator. Any individual who possesses an operator's license pursuant to 10 CFR 55, "Operators' Licenses." (ANS-3.1-2014)

licensed senior operator. Any individual who possesses a senior operator's license pursuant to 10 CFR 55. (ANS-3.1-2014)

licensing basis documentation (LBD) The set of documents that specify the licensing requirements and commitments that form the basis used by the U.S. Nuclear Regulatory Commission (NRC) to license a nuclear power plant or a standard plant design. For example, the LBD may include:

- (1) the latest version of either the Final Safety Analysis Report (FSAR) or the Standard Safety Analysis Report (SSAR);
- (2) NRC safety evaluation reports;
- (3) operating license, combined license, final design approval, or design certification, including the technical specifications;
- (4) correspondence between NRC and the licensee that contains licensing requirements or commitments for the design or operation of the nuclear power plant or standard plant design. (ANS-58.14-2011)

licensing-basis events (LBEs). Events selected from the event sequences modeled PRA to form part of the basis for the derivation of licensing requirements. LBEs include AOOs, DBEs, BDBEs, and deterministically selected DBAs. (ANS-53.1-2011)

licensing commitment. A commitment specified in the plant LBD (e.g., a commitment to apply specific design criteria to an item or to implement the licensing guidance provided by NRC in a Generic Letter or Regulatory Guide). (ANS-58.14-2011)

licensing guidance. A NRC recommendation of an acceptable way to comply with a licensing requirement. (ANS-58.14-2011)

licensing requirement. A regulation or a requirement stemming directly or indirectly from a regulation established by NRC (e.g., the *Code of Federal Regulations*, a license, or order). (ANS-58.14-2011)

lifetime (of a fuel assembly). The period starting at the time of shipment from the fabricator's facility and ending when the assembly is destroyed or dismantled, and in no longer identifiable as an assembly. (ANS-57.8-93)

liftoff. The physical disturbance and re-entrainment of deposited fission product material caused by rapid flows and shear forces during high-rate-of-depressurization events resulting from a large line break or penetration failure in a modular helium-cooled reactor (MHR). (ANS-53.1-2011)

light water reactor (LWR). A reactor with metal-clad core fuel elements cooled principally by light water. (ANS-53.1-2011)

limit. A bounding value of a variable or parameter in design, which is established to ensure that one or more aspects of a functional requirement are satisfied. (ANS-57.5) (ANS-57.5-96)

limited air. The storage atmosphere that limits the inventory of oxygen such that if all the oxygen is assumed to react chemically with the fuel pellets, the fuel rod cladding would not be damaged. (ANS-57.9-92)

limited combustible material. Material not complying with the definition of non-combustible material, which in the form in which it is used, has a potential heat value not exceeding 3,500 Btu per pound (8,141 kJ/kg), and complies with one of the following paragraphs (1) or (2). Materials subject to increase in combustibility or flame spread rating beyond the limits herein established through the effects of age, moisture, or other atmospheric condition shall be considered combustible.

- (1) Materials having a structural base of noncombustible material, with a surfacing not exceeding a thickness of 1/8 inch (3.2 mm) which has a flame spread rating not greater than 50.
- (2) Materials, in the form and thickness used, other than as described in (1) having neither a flame spread rating greater than 25 nor evidence of continued progressive combustion and of such composition that surfaces that would be exposed by cutting -through the material on any plane would have neither a flame spread rating greater than 25 nor evidence of continued progressive combustion. (ANS-59.4-1979W1983)

limited scope simulator. A simulator incorporating limited modeling of a generic plant or subsystem design. Such a simulator demonstrates basic operational principles. (ANS-3.5-85)

limit state. The limiting acceptable deformation, displacement, or stress that a Structure, System, and Component (SSC) may experience during or following an earthquake and still perform its safety function. Four Limit States are identified and used by ANSI/ANS-2.26-2004 [1] and ASCE/SEI 43-05 [2]. (ANS-2.27-2008)

limiting conditions for operation. The lowest functional capability or performance levels of equipment required for continued operation of the facility without undue risk to the health and safety of the public. (From American National Standard Protection Criteria for Systems and Components Important to Safety, N283-1976 ANS-58.3). (ANS-4.1)

limits of detection. The extreme of detection or quantification for the radioactivity of interest by the instrument as a whole or an individual readout scale. The LLD is the minimum quantifiable instrument response or reading. The Upper Limit of Detection (ULD) is the maximum quantifiable instrument response or reading. (ANS-6.8.2-86)

line source: A one-dimensional source of emissions that is defined by its length. Line sources are often used to model emissions from roadways and railroads. Alternatively, an array of pollutant sources along a defined path that can be treated in dispersion models as an aggregate uniform release of pollutants along a line (ANS-2.15-2013).

linear non-threshold (theory): A dose-response model that assumes induction of cancer proportional to dose, no matter how small the dose. (ASME/ANS RA-S-1.3-2016)

liquefaction. The sudden loss of shear strength and rigidity of saturated, cohesionless soils, due to steady state groundwater flow or vibratory ground motion. The term seismic liquefaction (or cyclic mobility) is used in this Standard for liquefaction phenomena associated with seismic motions. (ANS-2.27-2008) (ANS-2.29-2008)

liquid radioactive waste. Aqueous wastes and/or other fluids containing radioactive materials that result from the operation of a nuclear facility. Radioactive contaminated water is the predominant volumetric waste form generated by nuclear facilities, but liquid radioactive waste can include other liquids or be aqueous solutions containing a combination of chemical species. (ANS-40.37-2009)

Non-preferred variation (1) Liquids containing radioactive material resulting from operation of a nuclear power reactor which by design, definition, operating practice, or procedure, are intended to be processed prior to final disposition. (ANS-55.6-99)

local. Any location at or adjacent to the detector. ANS-6.8.1-81)

local leakage rate test (LLRT). The leakage test performed on Type B and Type C components. (ANS-56.8-02)

local redundant system. Is a means of meeting redundancy requirements with local safety-related air supplies. Some examples of local safety-related air sources are stand-by air compressors, isolated reservoirs (i.e., accumulators) operating at system pressure, or high pressure compressed gas bottles. (ANS-59.3)

local control station(s). One or more locations in the plant (e.g., breaker panels) that are separate from the control room and that may be separate from the Alternate Shutdown Station. Such locations have instrumentation and controls that may be used for cool-down of the plant or to supply support functions to plant equipment needed to accomplish an alternate shutdown. (ANS-58.6-92P)

localization. The isolation of related tasks, which perform a well defined function, within a single sub-program. (ANS-10.2-88)

long-term. In the context of the single failure criterion, that period of time that a safety-related system must operate starting at 24 hours following the initiating occurrence, during which its safety-related function is required. For purposes of the emergency core cooling

system and containment spray systems, the long-term might start upon transfer of these systems to the long-term cooling mode. (Note: The concept of short term and long term does not apply to electrical systems or components.) (ANS-58.11-93)

Non-preferred variation (1) Variant form (ANS-56.10.87) (ANS-51.1/ANS-52.1-83) (ANS-56.5-87)(ANS-58.9-94)

loss of reactor coolant (LOCA). The loss of reactor coolant, at a rate in excess of the reactor coolant normal makeup rate, from breaks or openings in the RCPB, up to and including a break equivalent in size to the largest pipe rupture justified in 10 CFR 50 Appendix K [2]—or, in the absence of justification, a double-ended rupture of the largest pipe—in the RCPB. (See 10 CFR 50, Appendix A [3], or Regulatory Guide 1.157, Position 3.1) (ANS-58.14-2011)

Non-preferred variation (1) loss-of-coolant accident (LOCA) - The loss of reactor coolant at a rate in excess of the reactor coolant normal make-up rate from breaks or openings in the reactor coolant pressure boundary up to and including a break equivalent in size to the largest 10 CFR 50 Appendix K justified pipe rupture, or in the absence of justification, a double-ended rupture of the largest, in the reactor coolant pressure boundary (see Appendix A of 10 CFR 50.) (ANS-51.1/52.1-83)

Non-preferred variation (2) Variant form: (ANS-51.2-92) (ANS-56.2-84) (ANS-58.3)

long-wave radiation: A term used loosely to distinguish radiation at wavelengths longer than approximately 4 m, usually of terrestrial origin, from those at shorter wavelengths (shortwave radiation), usually of solar origin (ANS-3.11-2015).

LOCA: loss of coolant accident *It is preferred that the term (loss of reactor coolant (LOCA)) and the associated definition be used in ANS standards*

LOCA: loss of coolant accident. This includes “traditional” full power accident initiators such as pipe break and relief valve opening but also includes maintenance-induced flow diversions, RCS boundary failure due to drain down events and other potential losses of RCS inventory that are unique to shutdown conditions (and typically more likely than pipe breaks when at low system pressure) (ANS/ASME-58.22-2015)

loss of core coolable geometry. The inability to cool the core sufficiently to maintain it in its original core location (i.e., prevent core geometry changes that could significantly affect core flow distributions or increase core reactivity). (ANS-54.1-89)

low-level radioactive waste (LLW). Radioactive waste that is not classified as either high-level radioactive waste, transuranic waste, spent nuclear fuel, or by-product material (uranium or thorium tailings and waste) as defined in Section IIe (2) of the Atomic Energy Act of 1954, as amended [1] and not greater than class C concentration limits as defined under 10 CFR 61. (ANS-40.37-2009)

Non-preferred variation (1) - Radioactive (low level) waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or byproduct material as defined in Section II.e of the Atomic Energy Act (e.g., uranium or thorium tailings and waste). (ANS-55.1-92)

low population zone (LPZ). Primarily the sub-area of the impact area immediately surrounding the exclusion area. See section 3B and 11a of 10 CFR 100. (ANS-2.6-81)

low power: a POS (or set of POSs) during which the reactor is at reduced power, below nominal full-power conditions. In these POSs, the power level may be changing as the

reactor is shutting down or starting up, or the power level may be constant at a reduced level. The power level that distinguishes nominal full power from low power is the power level below which there may be a significant increase in the likelihood of a plant trip; e.g., taking manual control of feedwater level. (ANS/ASME-58.22-2015)

LPSD evolution: a series of connected or related activities, such as a reduction in power to a low level, or plant shutdown, followed by the return to full-power plant conditions. LPSD evolutions are modeled as a series of POSs. Outage types are sub-types of a LPSD evolution, though not all LPSD evolutions involve an outage. A refueling outage is a specific example of a LPSD evolution. Reducing power to 30% in order to conduct maintenance or an operational activity is another example of a low power evolution. LPSD evolutions may be described by a transition down to the POS where the activity is conducted, followed by a transition back to full power. (ANS/ASME-58.22-2015)

low pressure system. Any system or portion of a system connected to or part of the reactor coolant pressure boundary whose design pressure is less than the design pressure of the reactor vessel. (ANS-56.3-86)

low purity waste (e.g., floor drains). Liquid radioactive wastes of normally moderate conductivity (50-200 micro-siemens) and moderate insoluble solids content (20-500 ppm). (ANS-55.6-93)(ANS-55.6-99)

lower bounding (upper bounding). Parameter value assumed for the analysis so that the result will be the minimum (maximum) of the set of values that might reasonably be expected to exist in the configuration to which the analysis is to be applied. (ANS-56.4-83)(ANS-56.10-87)

lube oil cooler. A heat exchanger provides the ability to maintain the lube oil temperature within operating limits while the engine is operating. (ANS-59.52-93)

lube oil heater. A heater that warms the lube oil in order to enhance starting reliability and rapid pressurization of the system following an engine start. (ANS-59.52-93)

lube oil system. The set of equipment which provides warmed, if necessary, filtered oil to the diesel generator engine before operation, during normal and emergency starting, and after operation for the purpose of filling and pressurizing internal oil passages and to recirculate cooled, filtered oil through the engine during operation for lubrication and heat removal. The system may also contain a means for draining used oil from the engine and replacing with clean oil. (ANS-59.52-93)

M.

macroseismicity. Recurring earthquakes having a Richter Scale magnitude of approximately three or greater. (ANS-2.7-82)(ANS-2.19.89)

main run. A pipe run that interconnects terminal ends. (ANS-58.2)

maintenance. Those activities necessary to maintain or restore systems to within specified design limits. Maintenance consists of repair, rework, replacement, adjustment, cleaning or other actions necessary to maintain an item in or restore an item to acceptable conditions. (ANS-3.2-93) (replaced "maintenance and modification procedures")

Managerial and administrative controls. *It is preferred that the term (**administrative controls**) and the associated definition be used in ANS standards*

Managerial and administrative controls. Orders, instructions, procedures, policies, practices, and designation of authority and responsibility. (ANS-3.2-2012)

magnitude. A number that characterizes the size of an earthquake. It is related to the energy released in

the form of seismic waves. Magnitude is based on measurement of the maximum motion recorded by a seismograph. Several scales have been defined, but the most commonly used are: (1) local magnitude (M_L), commonly referred to as "Richter magnitude," (2) surface-wave magnitude (M_s), (3) body-wave magnitude (m_b), and (4) moment magnitude (M_w or **M**). Scales 1 through 3 have limited range and applicability and do not satisfactorily measure the size of the largest earthquakes. The moment magnitude scale, based on the concept of seismic moment, is uniformly applicable to all sizes of earthquakes but is more difficult to compute than the other types. All magnitude scales yield approximately the same value for earthquakes of about magnitude 5, but for larger events, m_b , then M_L , and finally M_s , progressively diverge and increasingly underestimate the size of the earthquake compared to M_w . It is important, therefore, to specify the magnitude scale being referenced, especially for larger earthquakes. (ANS-2.27-2008) (ANS-2;29-2008)

Non-preferred variation (1) A parameter that characterizes the relative size of an earthquake. Magnitude is based on measurement of the maximum motion recorded by a seismograph. Several scales have been defined, but the most commonly used are: (a) *local magnitude* (M_L), commonly referred to as "Richter magnitude", (b) *surface-wave magnitude* (M_S), (c) *body-wave magnitude* (m_b), and (d) *moment magnitude* (M_w or **M**). Scales (a), (b), and (c) have limited range and applicability and do not satisfactorily measure the sizes of the largest earthquakes. The moment magnitude scale, based on the concept of seismic moment, is uniformly applicable to all sizes of earthquakes but is more difficult to compute than the other types. All magnitude scales yield approximately the same value for earthquakes of about magnitude 5; however, for larger events, m_b , then M_L , and finally M_S progressively diverge and increasingly underestimate the size of the earthquake compared to M_w . It is important, therefore, to specify the magnitude scale being referenced, especially for larger earthquakes (ANS-2.30-2015).

make-up. Water added to the circulating water system to replace that lost by evaporation, drift, blowdown, and leakage. (ANS-2.13-79)

malfunction. Failure or degradation in performance of plant equipment. (ANS-3.5-85)

Non-preferred variation (1) A simulator feature or capability that provides for instructor-controlled degradation of performance of simulated plant components, equipment, or systems. Override capability is not considered a malfunction. (ANS-3.5-2009)

manipulation. A discrete element of an action. (ANS-58.8-92)

man-made hazard. A condition involving vehicles, equipment, material, or structures created by man that occurs outside of a unit and has the potential for causing damage to safety related structures, systems, or components of the unit.

Non-preferred variation (1) Variant form (ANS-51.1/52.1-1983)

manual. Operation of an isolation barrier by manual physical force, such as turning a hand wheel on a valve. (ANS-56.2-84)

manual action. An action which is taken, as directed in a written emergency procedure, to initiate, allow or facilitate a system or component to perform a function. (ANS-58.12-85)

manual start. The starting of a diesel engine by operation action. (ANS-59.52-98)

Note 1: Change “operation” to “operator”

margin. A quantitative relationship between a design evaluation result for a given event and a limit associated with a functional requirement. (ANS-57.5) (ANS-57.5-96)

margin of subcriticality: An allowance beyond the calculational margin to ensure subcriticality. (ANS-8.24-07)

Markov Chain Monte Carlo: Various methods, which include random walk Monte Carlo,, based on a class of algorithms for sampling from probability distributions from the construction of a Markov chain that has the desired distribution as its equilibrium distribution. The state of the chain after a large number of steps is then used as a sample from the desired distribution. The quality of the sample improves as a function of the number of steps. (ASME/ANS RA-S-1.3-2016)

marker gas: Marker gases are added to enable odorless gases to be detected by olfactory sensing. An example of a marker gas is the gas ~mercaptans—a sulfur compound! Commercially added to natural gas giving it a “mark” that enables the gas to be smelled. (ANS-3.4-2013)

master logic diagram. Summary fault tree constructed to guide the identification and grouping of initiating events and their associated sequences to ensure completeness. (ASME/ANS RA-Sb–2013)

material-at-risk MAR). The amount of radioactive material available to be acted upon by the physical stresses generated by the accident conditions. (ANS-5.10-98)

mathematical model. A quantitative representation of the relevant flow and transport FEPs that affect subsurface radionuclide transport at the site. The mathematical model can be an algebraic equation for simple, homogeneous systems, or it can be a computer model in more complicated systems. (ANS-2.17-2010)

matrix spike sample (MSS). An aliquot or aliquant of a sample spiked with a known concentration of target analyte(s) prior to sample preparation. The recovery of the target analyte(s) from the MSS is used to determine the bias of the method in the specific sample matrix. (ANS-41.5-2012)

maximum pathway leakage rate (MXPLR) The maximum leakage rate attributed to a penetration leakage path. The MXPLR is the larger, not the total, leakage of the two barriers in series. (ANS-56.8-02)

may. *It is preferred that the terms (**Shall, Should and May**) be provided in a single location at the beginning of the definitions section in a standard. Using the combined definition provided in this glossary.*

Non-preferred variation (1) May Denotes permission, neither a requirement nor a recommendation. (ANS-3.3-88) (ANS-16.1-03)(ANS-58.2-84) (ANS-59.2-85)(ANS-59.2-D92)

Non-preferred variation (2) - Used to state an option to be implemented at the user’s discretion. (ASME/ANS RA-Sb–2013)

mean free path. The average distance that photons of a given energy travel before an interaction in a given medium occurs. It is equal to the reciprocal of the attenuation

coefficient. Thus, the distance x , in ordinary units can be converted into the dimensionless distance ux , the number of "mean-free-path (mfp) lengths." (ANS-6.4.3-91)

Mean Hazard Curve. Corresponds to the mean of the probability distribution of hazard curves. (ANS-2.29-2008)

Median Hazard Curve. Corresponds to a 50%, or the 50th fractile, hazard curve. (ANS-2.29-2008)

measurement quality objective (MQO). Quantitative or qualitative statements of performance objectives or requirements for a particular method performance characteristic such as the method uncertainty, detection capability, range, specificity, ruggedness, etc. The MQOs may be viewed as the analytical portion of the DQOs and are, therefore, project- or program-specific. (ANS-41.5-2012)

measuring and test equipment (M&TE) Devices or systems used to calibrate, measure, gage, test, or inspect in order to control or acquire data to verify conformance to specified requirements. (ANS-3.2-93)

mesoscale: The scale of atmospheric phenomena having overall horizontal dimensions from a few kilometers to several hundred kilometers with time scales from approximately 1 hour to 12 hours and vertical extents from tens of meters to the depth of the troposphere. (ANS-3.11-2015)

metal-water reaction. The amount of hydrogen generated due to the reaction of water or steam with zirconium cladding is a function of time and temperature.(ANS-56.4-83)

meteorological network: A collection of meteorological observations from multiple sites and sources (ANS-2.15-2013).

method blank. A prepared sample of a matrix as similar as practical to the associated samples that is free, to the extent possible, of the radionuclides of interest that is carried through the entire analytical process to evaluate potential contamination from the measurement process for determination of the DL and the MDC. The method blank may also be used to determine the standard deviation of the net blank. (ANS-41.5-2012)

midloop: a POS (or set of POSs) in a PWR during which the water level in the reactor vessel is drained below the top of the hot legs. This evolution occurs to support primary system maintenance, such as steam generator tube inspection during a refueling outage. This is termed "hot" or "early" midloop when it occurs early in an outage prior to fuel offload, with decay heat levels relatively high. This is contrasted with "cold" midloop or "late" midloop which refers to this evolution occurring toward the end of the outage, following fuel reload (ANS/ASME-58.22-2015)

minimum accident of concern. The smallest accident, in terms of fission yield and dose rate, that a criticality alarm system is required to detect. (ANS-8.3-97)

minimum critical power ratio (MCPR). In the BWR, the lowest value of the ratio of critical bundle power (i.e., that bundle power which results in transition boiling) to the bundle power at the same location. (ANS-52.1-92)

minimum delivered flow. The amount of flow that must be delivered to the intact steam generator(s). (ANSI/ANS-51.10-02)

minimum detectable concentration (MDC). The minimum quantity or concentration of a radionuclide required (a priori) to give a stated confidence that the measurement result would be above the DL (detected). For this standard the stated confidence level will be

95%. Correspondingly, the probability of a Type II error (probability of erroneously not concluding a radionuclide is detected in a sample that has the MDC quantity or concentration) is set at 0.05. For this standard the alpha (Type I) and beta (Type II) probabilities are both set at 0.05. (ANS-41.5-2012)

minimum diesel generator capacity. The minimum electrical output from the diesel generators to assure the operation of the minimum plant equipment required to prevent unacceptable consequences for any design basis event including the capacity to power the nuclear safety-related systems and components. (ANS-59.51-95)

minimum pathway leakage rate (MNPLR) The minimum leakage rate that can be attributed to a penetration leakage path (e.g., the smaller of either the inboard or outboard barrier's individual leakage rates). The pathway's MNLPR can be determined by one-half of the total measured leakage rate when tested by pressurizing between the inboard and outboard barriers. (ANS-56.8-02)

minimum recirculation flow. The amount of flow that must be provided at all times that the pump is operating to protect the pump from overheating and accelerated aging. (ANSI/ANS-51.10-02)

minimum required storage capacity. The minimum required quantity of lubricating oil to provide for engine consumption and operating needs during safety-related functions. (ANS-59.52-98)

miscellaneous liquid wastes, Liquid radioactive wastes which may not be readily amenable to processing and reuse as reactor coolant makeup water. (ANS-55.6-93) (ANS-55.6-99)

missile. A mass that has kinetic energy and is unrestrained. (ANS-2.12-78)(ANS-51.1-92)(ANS-52.1-92)(ANS-58.1)(ANS-59.1)

missile barrier. A physical barrier that protects the containment isolation barriers from potential missiles created by, or that could cause an event that would require containment isolation. (ANS-56.2-84)

missile protection. The protection afforded structures, systems or components (SSCs) against missiles (including jet forces and pipe whip) by physical barriers, restraints, or design configuration. (ANS-56.2-84)

mission time. The time period that a system or component is required to operate in order to successfully perform its function. (ASME/ANS RA-Sb-2013)

mitigating SSC: an SSC that performs a function to mitigate the consequences of an event such as by protecting a barrier to radionuclide transport, performing a safety function, or limiting or preventing a release of radioactive material from a source. (ASME/ANS RA-S-1.4-2013)

mixed waste. Waste that meets both the definition of a low-level radioactive waste and the definition of a hazardous waste. (ANS-55.1-92)

Non-preferred variation (1) Low-level radioactive waste that is co-contaminated with hazardous waste as defined in 40 CFR 261, 40 CFR 262, and 40 CFR 268. (ANS-40.37-2009)

mixing depth: The vertical distance between the ground and the altitude to which pollutants are mixed by turbulence caused by convective currents, vertical shear in the horizontal wind, or mechanical mixing (ANS-2.15-2013).

mixing height: The height above ground to which pollutants are mixed by turbulence caused by convective currents, vertical shear in the horizontal wind, or mechanical mixing (ANS-3.11-2015).

mobile low-level radioactive waste processing (MRWP) system. Any radioactive waste processing system or component that is designed to be transportable and that is not considered permanently installed as used in Regulatory Guide 1.143 (RG 1.143), "Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants," Rev. 2. (ANS-40.37-2009)

mode, operating. Definitive configuration of the plant as the plant operates, from defueled to shutdown cooled down, to various startup configurations (auxiliary feedwater), to power operation configurations (synchronized and making electricity). Modes are significant operating points that define operating configurations. Consequently, plant accident analysis depends greatly on the operating state (mode) at the start of an event. (ANS-53.1-2011)

mode: status of plant operation, as defined by plant technical specifications. (ANS/ASME-58.22-2015)

model. Mathematical algorithms that describe the physical processes involved in dose assessments which can be represented as a set of tables, graphs, map overlays, worksheets or computer programs. (ANS-3.8.6-94)

Non-preferred variation (1) A calculation framework for evaluating the behavior of a system or the physical phenomena of interest. (ANS-10.7-2013)

Non-preferred variation (2) A calculation framework for evaluating the behavior of a system or the physical phenomena of interest. A model includes computer software and other information necessary for application of the calculation framework to the specific problem, such as the conceptual, mathematical, and numerical models used; geometrical representations; boundary and initial conditions; spatial and temporal approximations; assumptions included in the software; a procedure for treating the software input and output information; specification of those portions of the analysis not included in the software; and values of parameters, uncertainties, and other information necessary to specify the calculation procedure. (ANS-10.8-2015)

model, mechanistic. Models based on fundamental mechanistic knowledge of process model interactions to constitute system analogs that define the model structure, allowing experiments to be performed to validate the model. In contrast, an empirical model uses a trial-and-error approach based on cause-effect relationships and real data, iteratively adjusting until an acceptable model has been established. Empirical models do not require understanding underlying physical processes but determine structure by the observed relationships among experimental data. (ANS-53.1-2011)

model, phenomenological. A model based on faithfully modeling a phenomenon. Modeling success depends on validating the observed phenomenon with the model. Phenomenological modeling combines elements of both mechanistic and empirical modeling. (ANS-53.1-2011)

model, validation, verification. *It is preferred that the separate terms (**model validation, model verification**) and the associated definition be used in ANS standards rather than combining them into one definition.*

model, validation, verification. Validation is the process of checking if a model satisfies an accuracy criterion. Validation usually addresses meeting the needs of an external

customer or product or service user. Verification is an internal quality process that determines compliance with a regulation or specification. Validation is ensuring that “you built the right product,” and verification is ensuring that “you built the product right.” (ANS-53.1-2011)

model validation. The process of determining the degree to which a verified model is an accurate representation of the real world (e.g., phenomenon, system, process, or problem of interest) from the perspective of the intended uses of the model. (ANS-10.8-2015)

model verification. The process of determining that a computational model accurately represents the underlying mathematical model and its solution. (ANS-10.8-2015)

moderate energy piping system. Any system, or portion of a system, where neither the maximum operating pressure exceeds 275 psig nor the maximum operating temperature exceeds 200°F during normal plant operating conditions. All piping systems not classified as high energy shall be classified as moderate energy piping systems. (ANS-58.2)

moderate-energy line. *It is preferred that the term (**moderate energy piping system**) and the associated definition be used in ANS standards*

moderate-energy line. Any line, or portion of a line, where neither the maximum operating pressure exceeds 275 psig nor the maximum operating temperature exceeds 200°F during normal plant operating conditions. All piping not classified as high energy shall be classified as moderate energy lines.(ANS-56.4-83)(ANS-56.10-87)

moderation. The process of decreasing the energy of neutron through successive collisions with moderator nuclei without appreciable competing capture. (ANS-8.22-97)

moderator. A material that reduced neutron energy by scattering without appreciable capture. Materials of prime concern are those containing light nuclei with larger scattering cross section and relatively low absorption cross section.2 (ANS-8.22-97)

Non-preferred variation (1). A material that reduces the energy of neutrons by scattering them. (Neutron absorption is normally enhanced at lower neutron energies.) (ANS-8.21-95)

moderator control engineered barrier. A physical feature of a system specifically identified and used to limit or control the introduction of moderators for nuclear criticality safety. (ANS-8.22-97)

modification. A change in the physical design or functional characteristic of a component or system. (ANS-3.2-93)

Non-preferred variation (1) Any change to software. (ANS-10.2-88)

modular. Unitized; addable in discrete, repetitious units. (ANS-53.1-2011)

module. A program subset which performs a specific function. (ANS-10.5-79)

monitor. Instrumentation and hardware consisting of an appropriate sampler plus a channel or channels. (ANS-6.8.2-86)

Monin-Obukhov similarity: A relationship describing the vertical behavior of non-dimensional mean flow and turbulence properties within the atmospheric surface layer (the lowest 10% or so of the atmospheric planetary boundary layer). (ASME/ANS RA-S-1.3-2016)

motive power failure. A loss of actuating power. (ANS-56.2-84)

motor-driven clean lube oil transfer pump. The clean lube oil transfer pump delivers oil from the clean lube oil storage tank to the lube oil sump or sump tank. (ANS-59.52-93)

motor-driven keep warm pump. While the diesel generator is in standby, the keep warm pump operates to maintain the engine passages in a warmed and lubricated state. (ANS-59.52-93)

motor driven oil pre-lube pump. A motor driven pump used to supply oil to engine bearing surfaces prior to a planned maintenance or start of surveillance. (ANS-59.52-98)

mountain-valley circulation: Diurnal winds that form in a complex terrain area, consisting of mountain-plain, along-valley, cross-valley, and slope wind systems. Differential heating and cooling of the terrain causes the pressure gradients that create the flow fields (ANS-2.15-2013).

movable storage racks. Structures designed to store spent fuel and capable of being moved while containing stored fuel assemblies. (ANS-57.3)(ANS-57.7-92)

moving squall line. A line or narrow band of active thunderstorms having a pressure jump with the cold front providing the initial piston-like impetus, and a mature instability line that is located in the warm sector of a wave cyclone about 50 to 200 miles in advance of the cold front usually oriented roughly parallel to the cold front and moving in about the same direction and speed as the cold front. (ANS-2.8-92)

MPC-Hours. A concept which sums airborne radioactive concentration times the time that concentration exists. In the case where $f_{MPC}(t)$ is a fraction or multiple of a Maximum Permissible Concentration (MPC) for a given radioisotope at a given time, and dt is the time over which that airborne concentration continues to exist, MPC-hours is given by:

$$\int f_{MPC}(t) dt$$

where: t is the time of interest in hours. For purposes of this standard, MPC's for various isotopes shall be those concentrations as listed in 10 CFR 20, Appendix B, Table 1, Column 1. MPC-hours is not defined for $f_{MPC}(t) < 1$, nor for $t < 0.1$ hour. (ANS-6.8.2-86)

multicompartment fire scenario. A fire scenario involving targets in a room or fire compartment other than, or in addition to, the one where the fire was originated. (ASME/ANS RA-Sb-2013)

multi-person facility. A facility where it is mandatory that more than one qualified individual be present in the control room or other specified control areas when the reactor is operating. (ANS-3.4-87)

multi-(reactor) module plant: a nuclear power plant comprised of multiple reactor units that are designed and constructed using a modular design approach. (ASME/ANS RA-S-1.4-2013)

multi-(reactor) unit plant: a nuclear power plant comprised of multiple reactor units. (ASME/ANS RA-S-1.4-2013)

multiple barriers. More than one barrier to the environmental release of fission products. For a modular helium-cooled reactor (MHR) this includes multiple fuel particle coatings, graphite support matrix, RPV boundary, and building structure (or citadel). (ANS-53.1-2011)

multiple spurious operations. Concurrent spurious operations of two or more equipment items. (ASME/ANS RA-Sb-2013)

mutually exclusive. *It is preferred that the term (**mutually exclusive events**) and the associated definition be used in ANS standards*

mutually exclusive. Two or more events which cannot physically occur simultaneously. (ANS-2.12-78)

mutually exclusive events. A set of events where the occurrence of any one precludes the simultaneous occurrence of any remaining events in the set. (ASME/ANS RA-Sb-2013)

N.

name spread rating. The numbers or classifications obtained according to NFPA 2551972, "Method of Test of Surface Burning Characteristics of Building Materials." (ANS-59.4)

National Warning System (NAWAS). A full period private line voice telephone network designed and maintained to alert the states to a nuclear attack. It is mainly used to disseminate weather threats

Non-preferred variation (1) A full period private line voice telephone network. (ANS-3.7.2-79)

natural hazard. 1 A natural phenomenon that has the potential for causing damage to the safety-related structures, systems, or components (SSC) of a plant. (ANS-51.1/ 52.1-1983);

Non-preferred variation (1) Variant form: {ANS-56.5-97} (ANS-2.12-88)(ANS-2.19-2000)

natural phenomena. Environment conditions external to a plant that are not manmade, some examples of which are earthquakes, tornadoes, flooding, lightning, hurricanes, snow, and ice. (Note: Natural phenomena accommodated by nuclear power plant design criteria are termed natural hazards). (ANS-51.1/52.1-83) (ANS-57.2-99) (ANS-57.3-93)

Non-preferred variation (1) Variant form: (ANS-57.2-93)(ANS-57.3-93)(ANS-59.1-96)

natural uranium. Reference throughout this standard to natural uranium shall be interpreted to mean uranium in which the concentration of the ²³⁵U isotope is equal to or less than 0.71 wt%. (ANS-8.12-87)

negative training. Training on a simulator whose configuration or performance leads the operator to an incorrect response to or understanding of the reference unit.(ANS-3.5-2009)

net radiation: The downward radiation (i.e., direct and diffuse solar radiation) minus the upward radiation reflected and upwelling long-wave radiation emitted from a surface, also known as terrestrial radiation (ANS-3.11-2015).

neurovascular symptoms: Effects arising from the impact of ionizing radiation on the nerves and the blood vessels in the body. (ASME/ANS RA-S-1.3-2016)

neutrons. (1) Fast Neutrons. Neutrons of kinetic energy greater than some specified value. This value can vary over a wide range and will be dependent upon the application. In concrete shield analyses, the specified value is normally 0.1 MeV when calculating tissue doses and 1 MeV when determining radiation damage to materials.

(2) **Intermediate Energy Neutrons.** Neutrons greater in energy than thermal neutrons and less than the energy associated with fast neutrons. This range also includes the resonance neutron energy range in which many nuclides exhibit strong neutron absorption, referred to as resonance absorption.

(3) **Thermal Neutrons.** Very low energy neutrons that are in thermal equilibrium with the atoms, or molecules, of the medium in which they are present at a temperature of 20°C, thermal neutrons having an average velocity of 2,200 meters/second and a corresponding energy of 0.025 eV. (ANS-6.4-2006)

neutron absorber: A neutron-capture material, also referred to as a neutron poison. (ANS-8.14-04)

Variant (ANS-8.21-95)

neutron absorber system. Any combination of fixed neutron absorbers, fixed moderators, and other materials with an assigned nuclear criticality safety function. (ANS-8.21-95)

neutron and gamma-ray cross sections. Cross sections for the interactions of neutrons and gamma rays with matter, including cross sections for the secondary emission of neutrons and gamma rays as well as cross sections for the effects of neutrons and gamma rays on materials (e.g., heating or helium generation). The cross sections may be averaged over energy groups for use in radiation protection analyses. (ANS-6.1.2-2013)

neutron multiplication (multiplication). Neutron multiplication signifies a neutron counting rate that is sensitive to reactivity change. This rate is often normalized to the counting rate that would result if there were no fissions. (In other contexts, this term has a different meaning. Not to be confused with neutron multiplication factor in reactor physics.) (ANS-8.6-2010)

new fuel. A nuclear fuel assembly that has not been used for power generation. It may contain fissile transuranic isotopes. (ANS-57.3-93)

new fuel elevator. Equipment, usually installed in the spent fuel pool, to allow new fuel to be introduced from a shipping container or new fuel storage racks, and lowered for transfer to the fuel storage racks or transfer canal. (ANS-57.1-92)

Non-preferred variation (1) Equipment usually installed in the spent fuel pool to allow new fuel, from either a shipping container or the new fuel storage racks, to be lowered for handling by the fuel handling equipment. (ANS-57.3-93)

Non-preferred variation (2) Variant form: (ANS-57.1)(ANS-57.3)

new fuel storage rack enclosure. The boundary structures of the new fuel storage facility that protects the new fuel from the environment and from damage, theft, and sabotage. It may consist of a vault around the racks, a covered storage room or an open storage pit housed in a building, or an entire building in which the new fuel is being stored. (ANS-57.3-93)

no loss of nuclear safety function. *It is preferred that the term (no loss of safety-related function) and the associated definition be used in ANS standards*

no loss of operability. The capability of unit structures, systems, and components (SSCs) to accomplish nuclear safety functions required to accommodate normal operations or a specified event within applicable nuclear safety criteria. (ANSI/ANS-51.10-02)

no loss of safety function. preferred usage is 'no loss of safety-related function.'

no loss of safety-related function. The capability of an item to accomplish safety-related functions required to accommodate a design basis event within applicable nuclear safety criteria.

Non-preferred variation (1) Variant form: (ANS-51.1/52.2-1983) (ANS-54.1-89) (ANS-51.10-2002)

no solo operations: A license restriction issued when an individual does not meet the minimum requirements of this standard and accommodation is possible with the presence of another licensed operator and or someone capable of summoning assistance. (ANS-3.4-2013)

node volume. The geometric subdivision assumed in the analysis for which pressures and temperatures are computed. (ANS-56.10-87)

non-capable fault. A non-capable fault is one that is not capable of surface rupture. Primary criteria for determining non-capability are that the fault exhibits the following three characteristics:

(1) Has had no displacement at or near the ground surface in the past 35,000 years and no recurring displacements in the past 500,000 years,

(2) has had no directly relatable seismicity of tectonic origin, and, (3) has structural relationship to a capable fault such that displacement on one might be accompanied by displacement on the other. (ANS-2.7-92)

non-combustible material. A material which in the form in which it is to be used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors, when subjected to fire or heat. Material that has passed the test of the American Society of Testing Materials (ASTM) E 136-1973, "Standard Method of Test for Non-Combustibility of Elementary Materials shall be considered a non-combustible material. (ANS-59.4-79W83)

noncompactible solid waste. Solid waste that cannot be compressed by applying external pressure less than 1000 psi. (The 1000 psi value is based on current technology.) (ANS-40.37-2009)

non-conformance. A deficiency in characteristic, documentation, or procedure that renders the quality of an item or activity unacceptable or indeterminate. (ANS-3.2-93)

nonconservative. Unconservative; assumptions or errors in a nonconservative direction increase proximity to margins and thus increase safety risk. (ANS-53.1-2011)

nondetectable failures. Failures that cannot be identified through periodic testing or revealed by alarm or anomalous indication. Assuming adequate design and quality assurance programs, training, control room design, and procedures, nondetectable failures do not include common-mode failures resulting from failures due to external environmental effects or design deficiencies or errors due to manufacturing, maintenance, or operations. (ANS-58.14-2011)

non-essential systems. Those systems which are neither engineered safety feature systems nor systems which accomplish a function similar to an engineered safety feature system. (ANS-56.2-84)

non-fuel-bearing components (NFBC). All components of a spent fuel assembly except the fuel rods (e.g., end fittings, spacer grids, control rod guide tubes, water rods, springs). (ANS-57.10-93)

non-interruptible. Once required to operate, cannot be cut off by an event external of the site. (ANS-57.3)(ANS-57.7-92)

Non-Nuclear Safety (NNS) Classification of structures, systems, or components (SSCs) that are not in Safety Classes 1, 2, or 3. (ANS-51.1/52.1-1988)(ANS-59.2-85)

non-nuclear safety class equipment. Equipment that has been classified as non-nuclear safety based upon the normal plant safety analysis. Equipment classification is not dependent on its use for station blackout. (ANS-58.12-85)

non-nuclear safety-related. Those requirements, not considered to be nuclear safety-related, whose goal is equipment reliability, unit availability, industrial safety, or good engineering practice. (ANS-2.13-79)

non-real-time. Software that produces results that do not have an immediate effect on physical systems. (ANS-10.7-2013) (ANS-10.8-2015)

non-safety-related. Classification applied to an item that is neither safety-related nor supplemental grade. (ANS-50.1) [Developed for ANS-58.14-93]

non-safety-related (N). Classification applied to an item that is not safety-related. (ANS-58.14-2011)

Non-preferred variation (1) non-safety-related to non-nuclear safety-related. Classification of structures, systems, or components (SSCs) that are not in Safety Classes 1, 2 or 3 and, therefore, are not classified as an engineered safety feature. (ANS-59.2-92)

non-safety-related with augmented requirements (A). Classification applied to an item that is not safety-related but that is relied upon during a special event or to which a licensing requirement or commitment applies. (ANS-58.14-2011)

non-tectonic ground disruptions. Ground disruptions due to landslides, subsidence or uplift caused by man's activities, solution activity, differential settlement, or ice shove. (ANS-2.11-78)(ANS-2.19-89)

normal natural phenomena. Conditions that may reasonably be expected to occur during a few plant life times. They include high and low water level, snow and ice, wind, and earthquake. (ANS-56.2)

normal operation. Steady state operation and those departures from steady state operation which are expected frequently or regularly in the course of power operation, refueling, maintenance or maneuvering of the plant It includes conditions such as start-up, normal shutdown, standby, load following, anticipated operational occurrences, limited fuel leakage, operations with specific equipment out of service as permitted by the Technical Specifications, and routine inspection, testing and maintenance of components and systems during any of these conditions, if it is consistent with the Technical Specifications. (ANS-54.1-89)

Non-preferred variation (1) Variant form: (ANS-56.7)

normal plant operating conditions. *It is preferred that (normal operation) and the associated definition be used in ANS standards.*

normal plant operating conditions. Any condition (excluding testing) in the course of system startup, operation in the design power range, hot standby, and system shutdown. (ANS-58.2)

normal radionuclide release. The emission of an effluent containing plant-related, licensed radioactive material. The known, planned, or controlled release of radionuclides to the environment, including controlled releases of low-level radioactive materials. The effluent discharge performed in accordance with RETS. (ANS-2.17-2010)

normal shutdown and cooldown. A shutdown and cooldown in which normal operational systems can be used, the fuel and reactor coolant pressure boundary conditions are within technical specification operational limits, and no automatic actuation of any engineered safety feature is required. (ANS-51.1/52.1-1983)

normalized inputs. The design basis values for a plant of specific power rating. (ANS-55.1-92)

no solo operation. Operation of or directing the operation of the controls, during all modes of operation including emergency conditions with another qualified person present in the control room or in other specified control areas, such as the refueling console. (ANS-3.4-94)

noticeable difference. Any difference in the physical attributes or dynamic response between the simulator and the reference unit that is distinguishable by an observer and confirmed by a subject matter expert. (ANS-3.5-2009)

nuclear accident. An operating event in the beyond-abnormal-operating-occurrence range accompanied by loss of fission product barriers and increased risk of release of radioactive materials to the environment. (ANS-53.1-2011)

Nuclear Air Treatment System (NATS). Synonym for Air Cleaning Systems. A system designed to remove radioactive gaseous (i.e., adsorption) and/or particulate contaminants (i.e., filtration). Such a system contains one or both of the high efficiency gas cleaning components referred to as High Efficiency Particulate Air (HEPA) filters and nuclear-grade absorbers. (ANS-59.2-92)

nuclear criticality safety evaluation (NCSE): A formal, technically reviewed analysis that establishes the technical bases, limits, and controls for the nuclear criticality safety of a given operation. (ANS-8.26-07)

nuclear criticality safety. Protection against the consequences a criticality accident, preferably by prevention of the accident. (ANS-8.1-14)

Non-preferred variation (1) Variant form: (ANS-8.12-87) (ANS-8.14-04) (ANS-8.15-81) (ANS-8.20-91) (ANS-8.21-95) (ANS-8.26-08) (ANS-57.7-92)

nuclear cross-section covariance matrix. A matrix representation providing the uncertainty of the nuclear cross sections and the correlation between the evaluated nuclear cross sections for a set of incident particle/neutron energies. (ANS-6.1.2-2013)

nuclear facility. Any facility that, as a result of its operation, generates waste material containing or potentially containing radioactive materials. This includes, but is not limited to, nuclear power plants, hospitals, fuel fabrication facilities, fuel reprocessing facilities, radioactive waste disposal facilities, industrial facilities, and research facilities. (ANS-40.37-2009)

Non-preferred variation (1) Structures, buildings, and systems provided which utilize or process fissionable material (i.e., nuclear power plant, reprocessing plant). (ANS-57.9-92)

variant form: (ANS-57.7-92]

nuclear power plant. A nuclear power plant is any plant using a nuclear reactor to produce electric power, process heat, or space heating. (ANS-3.4-87)

Non-preferred variation (1) Variant form: (ANS-3.1-2014) (ANS-3.2)

nuclear power plant experience. Applicable work performed in a nuclear power plant (commercial or military) during preoperational, startup testing, construction, or operational activities. . (ANS-3.1-2014)

nuclear power unit. One or more nuclear power reactors and associated equipment necessary for electric power generation, including those structures, systems, and components (SSCs) required to provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the public. (ANS-54.1-89)

Non-preferred variation (1) Variant form: (ANS-3.1-87)

nuclear reactor. Any assembly of fissionable material which is designed to achieve a controlled, self-sustaining neutron chain reaction. (ANS-3.4-87)

nuclear reactor operator. An individual who manipulates the controls or directs others to manipulate the controls. (ANS-3.4-87)

nuclear safety. Safety of the nuclear fuel reactivity and fission product boundary. (ANS-53.1-2011)

nuclear safety function Any function that is necessary to ensure:

- a. The integrity of the reactor coolant pressure boundary,
- b. The capability to shut down the reactor and maintain it in a safe shutdown condition, or
- c. The capability to prevent or mitigate the consequences of Plant Conditions that could result in potential offsite exposures that are comparable to the guideline exposures of 10 CFR 100, "Reactor Site Criteria." (ANS-51.1/52.1)(ANS-56.6-86) (ANS-57.7-92)

Non-preferred variation (1) Variant form: (ANS-54.1-89) (ANS-59.3-92)

Nuclear safety-related (NSR) (see safety-related). Of significance or importance because it applies to:

- a. Structures, systems, or components (SSCs) designed to perform a nuclear safety function,
- b. Drawings, specifications or procedures, analyses, and other documents used to determine or describe parameters affecting structures, systems, or components (SSCs) that are designed to perform a nuclear safety function, or
- c. Services to design, purchase, fabricate, handle, ship, store, clean, erect, install, test, operate, maintain, repair, refuel, and modify structures, systems, or components that are designed to perform a nuclear safety function.

(ANS-51.1/52.1)(ANS-54.1-89) (ANS-59.3-92)

Non-preferred variation (1) Variant form: (ANS-2.13-79)

nuclear safety-related control air system. (see safety-related control air system) Those portions of the control air system which perform a nuclear safety-related function. (ANS-59.3-92)

nuclear safety-related equipment. Equipment that has been classified as safety-related based upon the normal plant safety analysis (e.g., per ANSI/ANS-51.1-1983 or ANSI/ANS-52.1-1983) (ANS-58.12-85).

numerical benchmark. Specification of a set of input quantities (e.g., composition and geometry of bulk material and radiation sources) and of reference calculated output quantities relevant to the benchmark (e.g., spatial and energy dependence of neutron or gamma-ray fluence profiles) in detail sufficient to determine the accuracies of a specified calculational method when applied to modeling of the same input specifications. Such determinations are usually made by comparison to a reference output that is an analytic solution. (ANS-6.1.2-2013)

O.

objective evidence. Any documented statement of fact, other information, or record, either quantitative or qualitative, pertaining to the quality of an item or activity, based on observations, measurements, or tests which can be verified. (ANS-3.2-93)

off-normal condition procedures. Written procedures which specify operator actions for restoring an operating variable to its normal controlled value when it departs from its range or to restore normal operating conditions following a transient. Such actions are invoked following an operator observation or an annunciator alarm indicating a condition which, if not corrected, could degenerate into a condition requiring action under an emergency procedure. (ANS-3.2)

offsite All areas not onsite. (ANS-3.7.1-95)(ANS-3.8.1-93) (ANS-3.8.2-93) (ANS-3.8.3-93) (ANS-3.8.4-93) (ANS-3.8.5-92) (ANS-3.8.6-94) (ANS-3.8.2-95) (ANS-3.8.4-95) (3.8.3-95)

Non-preferred variation (1) Variant form: (ANS-3.7.2-79)

Non-preferred variation (2) The geographical area that is beyond the site boundary. (ANS-15.16-2015)

offsite personnel. Those personnel providing technical and operational support but not reporting directly to the Plant Manager. These personnel may be located onsite or offsite. (ANS-3.1-87)

oily radioactive waste. Liquid and slurry wastes that contain more than 5% oil, grease, and other immiscible organic liquids³⁾ by weight and radioactive materials resulting from the operation of a nuclear facility. Footnote: (3) For guidance, see EPA Procedure SW-846 [7]. (ANS-40.37-2009)

once through circulating water system. A system in which water is used one time before it is returned to the environment. (ANS-2.13-79)

onsite. That area surrounding the reactor in which the licensee has the authority to control all activities including exclusion or removal of personnel and property. (ANS-3.7.1-95)(ANS-3.8.1-93)(ANS-3.8.2-93) (ANS-3.8.3-93)(ANS-3.8.4-93) (ANS-3.8.5-92)(ANS-3.8.6-94) (ANS-3.8.2-95) (ANS-3.8.4-95) (ANS-3.8.3-95)

Non-preferred variation (1) The geographical area that is within the site boundary (ANS-15.16-2015)

Non-preferred variation (2) Areas within the exclusion area. (ANS-3.7.1-92)(ANS-3.7.2-79)

onsite experience Applicable work performed at the plant for which the individual seeks qualification (ANS-3.1-2014)

onsite operating organization. Onsite personnel concerned with operation, maintenance and certain technical services. (ANS-3.2)

onsite personnel. Those personnel that are assigned to the site as their normal work location reporting to the Plant Manager. (ANS-3.1-87)

on-the-job training. Participation in nuclear power plant startup, operation, maintenance, or technical services as a trainee under the direction of experienced personnel. (ANS-2.13-W98)

operable. (See operational). Having the capability of performing the safety function(s) specified for a system or component. Implicit in this definition shall be the assumption that all necessary attendant instrumentation, controls, normal and emergency electric power sources, cooling or seal water, lubrication, or other auxiliary equipment that are essential for the system or component to perform its safety function(s) are also capable of performing their related support functions. (ANS-58.4-W90)

operating. Performing an intended action in the required manner. (ANS-51.1/52.1;)

Non-preferred variation (1) Variant form. (ANS-4.1)

operating activities. Work functions associated with normal operation and maintenance of the plant, and technical services routinely assigned to the onsite operating organization. (ANS-3.2)

operating basis earthquake (OBE). (1) The earthquake that, considering the regional and local geology and seismology, and specific characteristic of local subsurface material, could reasonably be expected to affect the plant site during the operating life of the plant. It is that earthquake that produces the vibratory ground motion for which those safety-related items of the nuclear power plant, necessary for subsequent operation without undue risk to the health and safety of the public are designed to remain functional. (ANS-51.1/52.1) (ANS-57.2-99)

Non-preferred variation (1) Variant form:(ANS-56.6-86)(ANS-57.2-92) (ANS-57.3-93)(ANS-2.10-90) (ANS-2.12-78)(ANS-2.2-02)

Non-preferred variation (2) That earthquake for which those features of the nuclear power plant necessary for continued operation without undue risk to health and safety are designed to remain functional. In the past, the OBE was commonly chosen to be one-half of the safe shutdown earthquake (SSE). (ASME/ANS RA-Sb-2013)

operating conditions. Normal conditions of service falling within operation limits for parameters like temperature, pressure, O₂ concentration, speed of operation, load, and stroke as well as other stated conditions. (ANS-53.1-2011)

operating floor. For BWR's, this term is defined as the refueling floor for MKIII containment and the grating level at the personnel hatch just above the drywell floor for MKI containment. For PWR's this term is defined as the floor at the same level as the personnel hatch. (ANS-56.5)

operating organization. The onsite organization concerned with operation, maintenance, and certain technical services. This organization includes offsite personnel who provide operational support. (ANS-3.1-2014)

operating procedures. (Written procedures defining the normal method, means and limits of operation of a nuclear power plant, a plant system or systems, or processes, including actions to be taken by operating personnel for removal from and return to service of equipment on which maintenance is to be or has been performed (see also maintenance and modification procedures). (ANS-3.2-06)

Non-preferred variation (1) Controlled copies of procedures, including normal, abnormal, off-normal, emergency, surveillance, and alarm response procedures of the reference unit. (ANS-3.5-2009)

operating range. The range of values over which a parameter, indicative of environmental conditions, is stated to vary during the expected life of a material as it performs its intended function. (ANS-6.4.2-85)

operational. *It is preferred that the term (**Operable**) and the associated definition be used in ANS standards*

operational. Capable of performing intended action upon command from measured variables or operator action. (ANS-4.1)

Variant: (ANS-56.5-87)

operational environment. The system and environment (including all supporting software components intended to be present during software execution) on which the software is intended to be used, to the extent it can be replicated in the development environment. (ANS-10.7-2013)

Non-preferred variation (1) The system and environment (including all supporting software components intended to be present during software execution) in which the software is intended to be used. (ANS-10.8-2015)

operational phase. That period of time during which the principal activity is associated with normal operation of the plant. This phase of plant life is considered to begin formally with commencement of fuel loading, and to end with plant decommissioning. However, this standard recognizes that certain operational type activities begin prior to fuel loading. (ANS-3.2-93)

operational procedures. Detailed instructions for the setup, execution, and use of results for a given software. (ANS-10.7-2013)

operational transient. Transients included in the Conditions of Design I and II groupings. Condition of Design II is also defined in Section 2, "Definitions," and Table 3-1 of ANSI/ANS-52.1. (ANS-56.7-Historical)

operating floor. For BWR's, this term is defined as the refueling floor for MKIII containment and the grating level at the personnel hatch just above the drywell floor for MKII containment. For PWR's this term is defined as the floor at the same level as the personnel hatch. (ANS-56.5-87)

operating time. Total time during which components or systems are performing their designed function. (ASME/ANS RA-Sb-2013)

operations boundary: The area within the site boundary such as the reactor building (or the nearest physical personnel barrier in cases where the reactor building is not a principal physical personnel barrier) where the reactor chief administrator has direct authority over all activities. The area within this boundary shall have prearranged evacuation procedures known to personnel frequenting the area. (ANS-15.16-2015)

operator A licensed operator, or a senior licensed operator, or a person in training to be a licensed operator or senior licensed operator. (ANS-3.5-2009)

Non-preferred variation (1) An individual licensed under 10 CFR 55 to manipulate the controls of a facility and to direct the licensed activities of licensed operators.

(ANS-3.4-94)

operator error. In the context of the single failure criterion, a human error comprised of a single incorrect or omitted manipulation by a human operator attempting to perform a necessary action in response to an initiating occurrence. (ANS-51.1/52.1-1983)

Non-preferred variation (1) In the context of the single failure criterion, a single incorrect or omitted action by a human operator attempting to perform a nuclear safety-related manipulation in response to an initiating occurrence. (ANSI/ANS-51.10-02)

Non-preferred variation (2) Variant form: (ANS-58.8-92) (ANS-51.10)(ANS-58.9-94)

optimal (optimum) moderation. The moderation condition that yields the highest effective multiplication factor. (ANS-57.3-93)

ordinary concrete. There are many different types of ordinary concrete. The differences are due to a variation in the mix proportions and elemental composition of the cement, sand, coarse aggregate and water. In the context of this standard, ordinary concrete means Type 04 concrete having a theoretical density of 2.35 g/cm^3 . This type of designation is based on the elemental composition as defined in ANL-6443. Type 04 ordinary concrete is described in Section 5, Characterization of concrete. Argonne National Laboratory compilation ANL 6443 "A Summary of Shielding Constants for Concrete", describes other types of ordinary concrete as well. (ANS-6.4-85)

orderly shutdown and cooldown. A shutdown and cooldown in which the fuel and reactor coolant pressure boundary conditions are within technical specification operational limits. Automatic actuation of an engineered safety feature may be required. (ANS-51.1/52.1-W1983) (ANSI/ANS-51.10-2002);

Non-preferred variation (1) Variant form (ANS-59.1-W1996)

original seismic design bases. The seismic design criteria for which the plant was actually designed. Included, for example, are allowable seismic stress levels, seismic displacements, seismic loads, peak accelerations, etc. (ANS-2.10-03)

other defined basis. A method of meeting the requirements of the General Design Criteria 55 and 56 for specific classes of lines where the arrangements differ from the explicit requirements of the General Design Criteria. (ANS-56.2-84)

other operator actions Operator actions that are not required by plant emergency procedures following a DBE. Such actions also include those that do not improve safety performance, but that may be performed by the operator to improve a safety-related system's performance beyond the acceptable minimum. (ANS-58.8-92)

outdoor controlled area wastes. Liquids from diked areas outside plant buildings but within the controlled area of the plant. (ANS-55.6-93)(ANS-55.6-99)

outage: the entire set of POSs with the plant subcritical. This term is used interchangeably with the term "shutdown" (see discussion under "shutdown"). (ANS/ASME-58.22-2015)

outage types: term used to describe the general cause of the plant being subcritical. Different outage types result from maintenance and refueling requirements that necessitate different LPSD evolutions and resulting POSs. For example, a "refueling" outage type leads to cold shutdown with some or all of the fuel elements transferred out of the reactor pressure vessel; whereas a "maintenance" outage conducted at cold shutdown to repair steam piping would be a different outage type. (ANS/ASME-58.22-2015)

outer zone. That portion of the impact area outside the low population zone. (ANS-2.6-81)

overall integrated leakage rate. The total leakage through all tested leakage paths including containment welds, valves, fittings and components that penetrate the primary containment, expressed in units of weight percent of contained air mass at test pressure per 24 hours. (ANS-56.8-02)

override. To interrupt or modify the input/output (I/O) data transfer between the simulator mathematical models and the panel instrumentation.(ANS-3.5-2009)

owner. The holder as defined in 10 CFR 50.2 "Definitions," of a construction permit or the holder of an operating license as defined in 10.35, "Issuance of Construction Permits" or 10 CFR 50.57, "Issuance of Operating License." (ANS-2.10-90)

owner-controlled area. The area external and contiguous to a protected area which may be controlled by the owner organization for security purposes. (ANS-3.3-88)

owner organization. The organization, including the onsite operating organization, which has overall legal, financial, and technical responsibility for the operation of one or more nuclear power plants. (ANS-3.1-2014)

owner organization. The organization, including the onsite operating organization, which has overall legal, financial, and technical responsibility for the operation of one or more nuclear power facilities (ANS 3.2-2012)

P.

P_a (psig or kPa). The calculated peak containment internal pressure related to the design-basis loss-of-coolant accident (LOCA). (ANS-56.8-02)

packaging. Any material or structure covering the surface of a waste such as a plastic bag, drum, concrete cask, etc., but exclusive of a coating or surface treatment. (ANS-16.1-03)

packer test. A method of isolating a section of a borehole by inserting one or more expandable glands (i.e., packers) in order to measure hydraulic conductivity or water quality in the section. (ANS-2.9-89)

paleoseismic. Referring to the history of seismic events that is determined by looking at the layers of rock and soil beneath the surface or landforms at the surface and how they have been shifted by earthquakes that have occurred in the past. (ANS-2.27-2008)

(2) Referring to the evidence for seismic events, determined by analysis of geologic or geomorphic conditions resulting from or affected by prehistoric earthquakes (ANS-2.30-2015).

parameter. 1 As used in this standard, a parameter is a set or part of a set of physical properties whose values determine the characteristics or behavior of a system. (ANS-2.11-78)(ANS-2.19-89);

Non-preferred variation (1) Any specific parameter or value affecting or describing the theoretical or measurable characteristics of a unit being considered which behaves as an independent variable or which depends upon some functional interaction of other quantities in a theoretically determinable manner.(ANS-3.8.1-93)(ANS-3.8.2-93);(ANS-3.8.2-95)

part. A basic element of a structure, system, or component (SSC) that ordinarily cannot be, or would not be, disassembled further for procurement or maintenance purposes, and might have a part-level plant unique identification code. (ANS-58.14-2011)

Non-preferred variation (1) A basic element of an SSC that ordinarily cannot be, or would not be, disassembled further for procurement or maintenance purposes (and might have a part-level plant-unique identification code). (ANS-58.16-2014)

particle fluence. The quotient of dN by da where dN is the number of particles incident on a sphere of cross-sectional area da .

$$\Phi = dN/da$$

The area da must be perpendicular to each particle's direction. A sphere arranges this in the simplest manner. Alternatively, may be defined as particle track length per unit volume, or, in the case of neutrons, as nvt , where n is the (volume) density of neutrons, v is their velocity, and t is the time of passage through the volume. (ANS-6.1.1-91)

participation. Active performance in the duties and responsibilities relative to the function for which the candidate is being considered. Nonstructured observation is not considered participation. (ANS-3.1-2014)

partition coefficient. The dimensionless ratio of the iodine concentration in the liquid phase to the iodine concentration in the gaseous phase at equilibrium based on volume. (ANS-56.5-87)

Pasquill-Gifford: A technique to type turbulence into discrete atmospheric dispersion categories. (ASME/ANS RA-S-1.3-2016)

passive component. A component that is not an active component (e.g., pipe, resistor and heat tracing) (ANS-51.1/52.1-W1983) (ANS-56.1-1985)

Non-preferred variation (1) Variant form: (ANS-56.2-1984) (ANS-56.5-1987)

Non-preferred variation (2) A passive component has no moving parts and, for example, only experiences a change in pressure, temperature, or fluid flow in performing its

functions. In addition, certain components that function with very high reliability based on irreversible action or change may be assigned to this category. (ANS-53.1-2011)

passive failure. The blockage of a process flow path or failure of a component to maintain its structural integrity or stability, such that it cannot provide its intended nuclear safety function upon demand. (ANSI/ANS-51.10-02)

Non-preferred variation (1) A failure that is not an active failure (e.g., the blockage of a process flowpath or failure of a component to maintain its structural integrity or stability, such that it cannot provide its intended function upon demand). (ANS-58.11-93)

Non-preferred variation (2) Variant form: (ANS-56.1-85)(ANS-56.5-87) (ANS-57.7-92)(ANS-56.4-83)(ANS-56.10-87) (58.9-94)

Non-preferred variation (3) A failure of a component or system that does not become evident until the affected component or system is called upon to function.(ANS-3.5-2009)

passive function. A function that is not an active function (e.g., the pressure-retaining function of a valve that is not required to change its position or an instrumentation and control component that is not required to change output state). (ANS-58.14-2011)

Non-preferred variation (1) A function that is not an active function (e.g., the pressure-retaining function of a valve, a structural element, pipe support, cable, etc., that is not required to change position in order to perform its design function). (ANS-58.16-2014)

passive malfunction. (It is preferred that (**non-detectable failures**) and the associated definition be used in ANS standards)

passive malfunction. Those failures which do not become evident to the control room operator until the affected system is called upon to function. (ANS-3.5-85)

passive SSC: an SSC that performs one or more safety functions either fully or partially via passive means (i.e., relying on natural physical processes such as natural convection, thermal conduction, radiation, gravity, or pressure differentials, or depending on the integrity of a pressure boundary or structural component). Examples include piping systems that are used to maintain an inventory of fluid and deliver flow along a fluid path, and structural supports for SSCs. (ASME/ANS RA-Sb-2013)

part-task simulator. A simulator incorporating detailed modeling of a limited number of specific reference plant components or subsystems. Such a simulator demonstrates expected response of those components or subsystems. (ANS-3.5-85)

pathway. A leakage path from the primary containment. Note: An individual penetration can have more than one pathway. (ANS-56.8-02)

PC frequent. (See plant condition II).

PC infrequent. (See plant conditions III and IV).

PC limiting. (See plant condition V)

PC normal. (See plant condition I)

P_d (psig or kPa). The containment design pressure. ANS-56.8-02)

peak accelerograph. An instrument requiring no power source, having the capability of permanently recording peak acceleration. (ANS-2.10-90)

peak ground acceleration (PGA). Maximum absolute value of acceleration displayed on an accelerogram; the largest ground acceleration produced by an earthquake at a site. (ANS-2.29-2008)

peak ground displacement. The largest ground displacements produced by an earthquake at a site. (ANS-2.29-2008)

Peak Ground Velocity. The largest ground velocity produced by an earthquake at a site. (ANS-2.29-Rev.8)

peer review. The review and concurrence of the basis and findings of a document or paper by more than one individual recognized as knowledgeable in the specific technical area. (ANS-5.10-98)

penetration assembly. An assembly that allows fluid lines or electric circuits to pass through a single aperture (e.g., nozzle or other opening) in the containment. (ANS-56.2-84)

perched water. Subsurface water collecting on low-permeability geologic materials that are separated from an underlying main body of groundwater by an unsaturated zone. Water located above the water table whose water gauge pressure is greater than zero. (ANS-2.17-2010)

performance assessment. A systematic analysis that addresses the types and likelihood of abnormal radionuclide releases, their resulting impacts, and how these impacts compare to regulatory standards. (ANS-2.17-2010)

Non-preferred variation (1) Assessment based on performance goals, in contrast with assessments of historical documentation, processes used to achieve performance, or other indirect outcome assessments. (ANS-53.1-2011)

performance-based. An approach to design or regulation that relies upon the desired, measurable results or performance outcomes based on objective criteria rather than a prescriptive process, technique, or procedure. Performance-based regulation differs from a traditional, prescriptive regulatory approach by emphasizing what is to be achieved rather than how desired results and outcomes are obtained.

performance-based regulation. Regulations that are outcome oriented rather than procedure oriented. An approach to regulatory practice that establishes performance and results as the primary basis for decision making. Performance-based regulations have the following attributes: (a) measurable, calculable, or objectively observable parameters exist or can be developed to monitor performance; (b) objective criteria exist or can be developed to assess performance; (c) licensees have flexibility to determine how to meet the established performance criteria in ways that will encourage and reward improved outcomes; and (d) a framework exists or can be developed in which the failure to meet a performance criterion, while undesirable, will not in and of itself constitute or result in an immediate safety concern. (ANS-2.17-2010)

performance-based test interval. Type A, Type B, or Type C test interval whose duration is determined in part by the performance history of the containment or the component. (ANS-56.8-02)

performance check. A check of the response (efficiency, energy, and/or background) of a detection system to determine if changes have occurred since the last time the system was calibrated. (ANS-41.5-2012)

performance criteria. The established level of quality (bias, precision, detection sensitivity, etc.) and operational commitments (turnaround times, reporting protocol, etc.) that are (a) agreed upon between the service laboratory and the customer (or intergovernmental agencies or intracompany entities) with written analytical specifications and (b) established by the service laboratory and documented within the operational or QA program manual of the laboratory. (ANS-41.5-2012)

performance indicator. An observable hydrologic (e.g., water content, water flux, water quality parameter) or radiologic (e.g., tritium) parameter, the value (or change in value) of which is used to determine whether a performance objective is achieved. (ANS-2.17-2010)

performance objective. A targeted outcome or goal desired to achieve a successful end result (e.g., a goal to meet a defined level of environmental quality). (ANS-2.17-2010)

performance shaping factor (PSF). A factor that influences human error probabilities as considered in a PRA's human reliability analysis and includes such items as level of training, quality/availability of procedural guidance, time available to perform an action, etc. (ASME/ANS RA-Sb-2013)

performance threshold. A quantitative criterion for each performance indicator that defines when performance objectives are, or are not, being met. (ANS-2.17-2010)

performance testing. Testing conducted to verify a simulator's performance as compared to actual or predicted reference unit performance. (AMS 3.5-2009)

performance testing (PT) sample. Reference materials or samples of known composition used to evaluate the performance of the laboratory. (ANS-41.5-2012)

permanent ground deformation (PGD): Inelastic movement of the ground surface resulting from displacement on a fault, either expressed at the surface or at depth, including (but not limited to) discrete (or distributed) fault displacement or offset ("faulting") and simple to complex changes in geometry of surface and near-surface materials ("tilting" or "folding") (ANS-2.30-2015).

permanent medical condition: An injury or condition that impairs the physical and or mental ability of an operator to meet the specific minimum requirements in this standard and is, as evaluated by the examining physician, expected to extend beyond 90 days. (ANS-3.4-2013)

personnel monitoring. The means by which dose rate and estimation of the effective dose equivalent of ionizing radiation which an individual has received is determined, usually through use of survey instruments, dosimeters or personnel monitoring badges. (ANS-3.7.1-95)

personnel monitoring badge. A device worn by personnel containing film, thermoluminescent, or other material used to evaluate the dose equivalent which a person has received. (ANS-3.7.1D92)

phased isolation. The sequential isolation of groups of fluid systems penetrating the reactor containment. The actuation of containment isolation is by different values of, or different combinations of measured parameters based on the ability of their fluid system to mitigate the consequences of an accident or their usefulness in maintaining the plant in safe configuration. (ANS-56.2-84)

phenomenological event: an observable event that occurs if governing physical and chemical phenomena proceed in a particular, but possibly uncertain, way. Such events are

typically defined within the context of known (or assumed) initial and boundary conditions concerning the status of SSCs and actions of the operating crew. Uncertainties in such processes or events are typically governed by epistemic uncertainty in governing processes, or in the fidelity of analytical models to accurately calculate the behavior of known physical/chemical processes. (ASME/ANS RA-S-1.2-2015)

photoneutron. Neutron released from an atomic nucleus in a photonuclear reaction with a gamma ray of sufficiently high energy. The threshold energy required of the gamma ray is approximately 2 Mev for beryllium and deuterium, but greater than 8 Mev for other elements. (ANS-6.4.2-85)

phreatic surface (water table). Boundary between the zone of saturation and the zone of aeration where the pressure is atmospheric. (ANS-2.19-89)

phreatic zone. The region below the water table where water gauge pressure is greater than or equal to zero. (ANS-2.17-2010)

physical analysis units. The spatial subdivisions of the plant upon which the fire PRA is based. The physical analysis units are generally defined in terms of flood or fire areas and/or flood or fire compartments under the plant partitioning technical element. (ASME/ANS RA-Sb-2013)

physical barrier.

(1) fences constructed of No. 11 American wire gauge, or heavier wire fabric, topped by three or more horizontal strands of barbed wire or similar material on brackets angled upward and outward between 30° and 45° from the vertical with an overall height of not less than eight feet including a one-foot barbed topping.

(2) building walls constructed of stone, brick, cinder block, concrete, steel or comparable material (e.g., openings in which are secured by grates, doors, or covers of construction and fastening of sufficient strength such that the integrity of the wall is not compromised by any opening), not a part of a building, provided with a barbed topping described in (1), with a total height of not less than eight feet (a seven-foot wall with one foot of barbed topping).

(3) ceilings and floors constructed to offer resistance to penetration equivalent to that of building walls described in [2].

(4) any other physical obstruction constructed in a manner and of materials suitable for the purpose for which the obstruction is intended. (ANS-3.3-88)

physical fidelity. The degree of similarity between the simulator and the reference unit, such as physical location of panels, equipment, instruments, controls, labels, and related form and function. (ANS-3.5-2009)

physical security plan. A document prepared pursuant to requirements of 10 CFR 50, "Domestic Licensing of Production and Utilization Facilities," Section 50.34(c) that describes the means by which the owner organization shall establish a security program with the objective of high assurance protection against radiological sabotage. (ANS-3.3-88)

piezometer. A nonpumping well generally of small diameter or device (tube or pipe) for measuring the elevation of a water table. (ANS-2.27-2008)

pipe rupture. The loss of pressure integrity of a piping run in the form of a circumferential break, longitudinal break or through-wall crack. (ANS-58.2)

pipe rupture whip. The dynamic movement of a pipe due to postulated pipe rupture forces. (ANS-58.3)

pipe whip. Uncontrolled motion of a ruptured pipe. (ANS-58.2)

pipe whip restraint. A device, including its anchorage, utilized for preventing a pipe whip, or otherwise controlling the pipe motion within acceptable bounds following a pipe rupture. (ANS-58.2)

pipeline accident. Rupture of a pipeline carrying a gas or liquid under pressure which can explode or ignite or create a toxic gas cloud or environment which incapacitates personnel or degrades equipment operation. (ANS-2.12-78)(ANS-2.19-89)

plain. Excluded are surfaces or zones along which there has been displacement related to surficial or near surface processes such as glacial-shove features, landslides, karst terrain, or related to activities of man such as mining, or withdrawal or addition of subsurface fluids. (ANS-2.19)

plant. A general term used to refer to a nuclear power facility (for example, “plant” could be used to refer to a single unit or multiunit site). (ASME/ANS RA-Sb–2013)

plant area. All areas of the plant, except the containment, within the exclusion area as defined for the purpose of 10 CFR 100, “Reactor Site Criteria”. (ANS-5.6.1-90)

plant condition (PC) Categorization of design basis events in terms of their likelihood of occurrence. (ANS 58.11-1993)

Non-preferred variation (1) Variant form: (ANS-51.1/52.1-W1983) (ANS-58.9-1992)

Non-preferred variation (2) The purpose of categorizing Plant Conditions (PC) is to provide a means of establishing design requirements to satisfy operational and safety criteria of the facility. These are: defined by normal operation (PC 1), classified on the basis of expected frequency of occurrence (PC II and III), or postulated because their occurrence may result in the maximum potential impact on the immediate environs (PC IV and V). Evaluation of the consequences of any such event can then be used to specify the performance requirements of the systems and subsystems within the facility.

1. plant condition I

a. Definition. PC I events are those events that are expected to occur regularly or frequently in the course of normal operation at the facility.

b. Examples

(1) Fuel handling

(2) Spent fuel shipping

(3) Storage of leaking fuel that resulted in up to ten percent of the Technical Specification limit for Reactor Coolant activity during power operation.

(4) Inspection of fuel within the storage facility

(5) Storage of new fuel in the spent fuel facility.

2. plant condition II

a. Definition. PC II events are those events with a best estimate of frequency of occurrence $(F) > 10^{-1}$ /reactor year.

b. Examples

(1) Loss of a pump in the spent fuel pool cooling system

- (2) Spurious operation of an active element; e.g. relief valve, control valve.
 - (3) Single error of an operator
 - (4) Full core removal
 - (5) Single failure in the electrical or control system
 - (6) Loss of normal spent fuel cooling up to eight (8) hours
 - (7) Storage of leaking fuel that resulted in up to 25 percent of the Technical Specification limit for Reactor Coolant activity during power operation
 - (8) Minor pool liner leakage in an amount that can be handled by the radwaste system on a continuous basis.
- c. The facility shall be designed so that a PC II event shall not cause a loss of function of the reactor coolant system, reactor containment barriers or any other engineered safety features system or component.

3. plant condition III

- a. Definition. PC III events are those events with a best estimate frequency of occurrence (F) such that $10^{-1} > F \geq 10^{-2}$ /reactor year
- b. Examples.
- (1) A passive failure of a radioactive liquid retaining boundary that prevents the affected system from performing its design function
 - (2) A loss of offsite power for up to eight (8) hours
 - (3) Drop of a fuel assembly with its associated handling tool onto the racks from its normal operating height
 - (4) Storage of leaking fuel that resulted in up to 100% of the Technical Specification limit for Reactor Coolant activity during power operation
 - (5) Overfilling of the pool
 - (6) Loss of non-Seismic Category I portion of the Spent Fuel Pool Cooling System
 - (7) Loss of air supply to seals on gates, resulting in leakage from the pool
 - (8) Operating Basis Earthquake (OBE)
 - (9) Drop of the spent fuel cask from controlled normal height.

4. plant conditions IV and V

- a. Definition. PC IV and V consist of that set of possible events that are not expected to occur during the life of the facility, but are postulated because their consequences would include the potential for the release of significant amounts of radioactive material. These faults are the most severe that must be designed against, and thus represent the limiting design case. Best estimate frequency of occurrence (F) per year is $10^{-2} > F > 10^{-6}$
- b. Examples
- (1) Rupture of all fuel rods in a spent fuel assembly
 - (2) Inadvertent opening of a gate (cask loading isolation or transfer canal isolation) when the adjoining area is empty resulting in reduced shielding
 - (3) Effect of facility design basis natural phenomena

- (4) Drop of the spent fuel cask from maximum achievable height
- (5) Safe Shutdown Earthquake (SSE)
- (6) Loss of offsite power for up to seven (7) days. (ANS-57.2-D92) (ANS-57.2-99)

Non-preferred variation (3) a measureable or observable parameter related to plant system state; e.g., RCS temperature, core decay heat level, Mode 4, SI secured, train A RHR running, or head off. A specific set of plant conditions is used to define the plant operating state modeling elements, and a larger set of plant conditions is used to define plant configurations. (ANS/ASME-58.22-2015)

plant configuration: the status of a specific set of plant conditions which includes all those used to define a plant operating state plus specific equipment alignments and equipment outages. These plant conditions include mode, primary system conditions (e.g., temperature, pressure), primary system status (e.g., midloop operation; vessel level during shutdown), equipment alignment (e.g. number of pumps operating, number of pumps in standby) and equipment out of service for test and maintenance. For configuration risk management, other conditions external to the plant may be defined; e.g. weather, grid-related activities, etc. One or more plant configurations may occur within the same plant operating state because they are defined in terms of more plant conditions. (ANS/ASME-58.22-2015)

plant damage state (PDS). Group of accident sequence end states that have similar characteristics with respect to accident progression, and containment or engineered safety feature operability. (ASME/ANS RA-Sb-2013)

plant equipment. Equipment within the plant normally presumed to be operable. (ANS-53.1-2011)

plant (nuclear). *It is preferred that the term (station (nuclear)) and the associated definition be used in ANS standards.*

plant-level safety-related function. Plant-level safety-related functions are functions performed by a system that directly supports one or more of the three basic safety-related functions during a DBE. For example, the ECCS provides the plant-level safety-related function of reactor inventory control during a LOCA, which is a safe shutdown function. (ANS-58.14-2011)

plant operating organization. Site personnel responsible for operation, maintenance, and certain technical and support services. (ANS-3.2-93)

plant operating state (POS): is a standard arrangement of the plant during which the plant conditions are relatively constant, are modeled as constant, and are distinct from other configurations in ways that impact risk. POS is a basic modeling device used for a phased-mission risk assessment that discretizes the plant conditions for specific phases of a LPSD evolution. Examples of such plant conditions include: core decay heat level, primary water level, primary temperature, primary vent status, containment status, and decay heat removal mechanisms. Examples of risk impacts that are dependent on POS definition include the selection of initiating events, initiating event frequencies, definition of accident sequences, success criteria, and accident sequence quantification. (ASME/ANS RA-S-1.2-2015), (ANS/ASME-58.22-2015)

Non-preferred variation (1) . A standard configuration of the plant during which the plant conditions are relatively constant, modeled as constant, and distinct from other configurations in ways that impact risk (e.g., core power level; HPB open/closed status, temperature, and pressure; reactor building status; and status of decay heat removal systems). A plant operating state can be a steady state or represent a transition between steady states. In a PRA model, each plant operating state provides a unique set of boundary conditions for selecting initiating events for the PRA event sequence analysis. (ANS-53.1-2011)

plant response model: a logic model, including the event trees and fault trees and the various SSC and human failures, that is used to delineate and evaluate the CDF/LERF accident sequences conditional on the occurrence of a hazard event (or hazard group). (ASME/ANS RA-Sb-2013)

plant-specific data. Data consisting of observed sampled data from the plant being analyzed. (ASME/ANS RA-Sb-2013)

plateout. Deposit of lower-volatility fission products on lower-temperature surfaces. A form of physical volatile precipitation induced by temperature and pressure states. (ANS-53.1-2011)

Pleistocene. The time period between about 10,000 years before present and about 1,800,000 years before present. As a descriptive term applied to rocks or faults, it marks the period of rock formation or the time of most recent fault slip, respectively. (ANS-2.27-2008)

Non-preferred variation (1) The geologic epoch between 11,700 and 2,600,000 years before present (ANS-2.30-2015).

plume: An amount of material continually released over a period of time. (ASME/ANS RA-S-1.3-2016)

plume meander: Plume spreading from the centerline due to large low-frequency oscillations of the horizontal wind direction (ANS-2.15-2013).

plume EPZ. An area of approximately 10-mile radius surrounding a nuclear power plant where the principal exposure sources would be whole body external exposure to gamma radiation from the plume and deposited material, and inhalation exposure from the passing radioactive plume. (ANS-3.8.2-93)(ANS-3.8.3-93) (ANS-3.8.5-92)(ANS-3.8.6-94) (ANS-3.8.2-95)

point estimate. Estimate of a parameter in the form of a single number. (ASME/ANS RA-Sb-2013)

point source: A single, identifiable, stationary source of emission that can be elevated or ground level. A point source has no geometric dimension and is often used to represent the geographic location of a plume's origin (ANS-2.15-2013).

pool. A single isolable body of water with a free surface. Examples are the spent fuel storage pool, the cask handling pool, the fuel transfer canal, and reactor refueling cavity (or well). (ANS-57.1-92)(ANS-57.2-93) (ANS-57.3-93) (ANS-57.2-99)

population dose: The total dose summed over the population exposed to the radiological release expressed in person-rem or person-sievert. (ASME/ANS RA-S-1.3-2016)

population projection. A population projection is a calculation of the future size of a population if a given set of assumptions such as the behavior of births, deaths, and migration hold. (ANS-2.6-81D)

pore velocity, seepage velocity (LT^{-1}) The average rate of flow in the pores of a given medium. This is approximated by dividing the flux by the effective porosity. (ANS-2.17-89)

porosity. (1)The property of containing interstices(radionuclides). Total porosity is expressed as the ratio of the volume of interstices to total volume. Effective porosity refers to the porosity through which flow occurs. (ANS-2.9-89)(ANS-2.17-89)

porosity. (1)The property of containing interstices The ratio of the volume of pores, fractures, or voids in soil or rock to the total volume (solid plus pore volumes). (ANS-2.17-2010)

Non-preferred variation (1) The property of containing interstices. Total porosity is expressed as the ratio of the volume of interstices to total volume. Effective porosity refers to the porosity through which flow occurs. (ANS-2.9-89)(ANS-2.17-89)

portability. The ability of a computer program to be transferred from one hardware/software configuration and implemented on another with little or no modification, such that the capability of the program is not altered during the transfer. (ANS-10.2-88)

positive acting check valve. A check valve which can also be remote manually closed when isolation is required. (ANS-56.2-84)

post-accident environment. In the context of this standard, the temperature, pressure, humidity, radiation, chemistry, and contamination levels of a containment after an accident (ANS-56.5-87)

post-initiator human failure events. Human failure events that represent the impact of human errors committed during response to abnormal plant conditions. (ASME/ANS RA-Sb-2013)

postulated accidents. Those events which, although not expected to occur, are selected, in addition to normal and anticipated operational occurrences, for establishing design bases of systems, components and structures or selection of Exclusion Distance and Low Population Zone for the reactor site, or both, as defined in the 10 CFR 100.11, "Determination of Exclusion Area, Low Population Zone, and Population Center Distance". They represent bounding events which envelop variations in the types of accidents considered and are the upper bound design basis events. Postulated accidents together with normal operation, including anticipated operational occurrences, represent the total spectrum of design basis events. (ANS-54.1-89)

postulated pipe rupture. A postulated circumferential break, longitudinal break, through-wall crack, or leakage crack. These definitions are explained in detail in ANS-58.2-1988. (ANS-56.11-88)

potentiometric surface. An imaginary surface representing the static head of ground water and defined by the level to which water will rise in a series of wells.(ANS-2.11-W99)

An imaginary surface representing the static head of ground water in a confined aquifer and defined by the level to which water will rise in a well. (ANS-2.19-89)

power failure. A loss of actuating (i.e., motive) power. (ANS-56.2)

power conversion. Conversion from thermal to mechanical and electrical power or vice versa. (ANS-53.1-2011)

power level. The power level is the power production in units of thermal megawatts. In the context of this standard, the user is cautioned pertaining to scaling by power level in that specific sources of gamma radiation may not exhibit a linear relationship with power level, because of the influence of other parameters such as coolant flow rate. (ANS-6.6.1-2015)

power operated valve. A valve actuated by means of a power operator. (ANS-56.2-84)

power operator. A device which uses air (i.e., air operator), electric (e.g., motor or solenoid operator), hydraulic power or spring force for mechanical actuation of the valve. (ANS-56.2-84)

power plant experience. Experience acquired in the testing, operation, and maintenance of power generating facilities, including non nuclear facilities. (ANS-3.1-2014)

power plant staff. A manager, supervisor, or staff member responsible for the coordination and implementation of any of the following: plant equipment controls, integrated operations procedures, operations, maintenance, radiological support, modifications, maintenance planning, work control, chemistry, accredited training. (ANS-3.1-2014)

PRA application. A documented analysis based in part or whole on a plant-specific PRA that is used to assist in decision making with regard to the design, licensing, procurement, construction, operation, or maintenance of a nuclear power plant. (ASME/ANS RA-Sa-2009)

practical sustained yield. The rate at which ground water can be continuously withdrawn without lowering water levels to critical stages or causing undesirable changes in water quality. (ANS-2.9-89)

PRA event sequence. *It is preferred that the term (event sequence) and the associated definition be used in ANS standards*

PRA event sequence. The event sequence defined by PRA for developing event families and evaluating top-level outcomes from initiating events. (ANS-53.1-2011)

PRA, full scope. A PRA that accounts for all known plant operating states, initiating events and their causes including those from internal and external plant hazards, and event sequences whose end states are sufficiently developed to support and include an estimation of mechanistic source terms and off-site radiological consequences. Full-scope PRAs include a definition of event sequences, quantification of sequence frequencies and consequences, and quantification of uncertainties in the frequency and consequence estimates that is sufficient to account for all risk-significant contributions to each modeled end state. (ANS-53.1-2011)

PRA maintenance. The update of the PRA models to reflect plant changes such as modifications, procedure changes, or plant performance (data). (ASME/ANS RA-Sb-2013)

PRA upgrade. The incorporation into a PRA model of a new methodology or significant changes in scope or capability that impact the significant accident sequences or the significant accident progression sequences. This could include items such as new human error analysis methodology, new data update methods, new approaches to quantification or truncation, or new treatment of common cause failure. (ASME/ANS RA-Sb-2013)

precipitation: The amount, usually expressed in millimeters or inches of liquid water depth, of the water substance that has fallen at a given point over a specified period of time (ANS-3.11-2015).

precision. The degree of agreement of repeated measurements of a variable. (ANS-6.8.1-81)(ANS-6.8.2-86)

Non-preferred variation (1) The degree of agreement or central tendency of repeated measurements of the same parameter. A measurement with small random uncertainties is said to have high precision. (ANS-41.5-2012)

preferred power supply. That power supply which is preferred to furnish electric energy under accident or post-accident conditions. (From IEEE Standard Criteria for Class IE Electric Systems for Nuclear Power Generating Stations, IEEE Std. 308-1974). (ANS-4.1 - Historical)

pre-initiator human failure events. Human failure events that represent the impact of human errors committed during actions performed prior to the initiation of an accident (e.g., during maintenance or the use of calibration procedures). (ASME/ANS RA-Sb-2013)

preoperational testing Tests conducted following completion of construction and construction related inspections and tests, but prior to fuel loading, to demonstrate, to the extent practical, the capability of structures, systems, and components to meet specific performance requirements to satisfy the design criteria (ANS-3.1-2014)

pressure boundary. Those portions of closed systems, components, or structures that are designed to contain a fluid and prevent or limit its leakage. (ANS-56.4-3) (ANS-58.9-92)

pressure suppression. A means to reduce containment pressure by condensation of the steam through contact with water, ice, or other cooling surfaces. (ANS-56.5-87)

pressurized gas storage tank system. A system using tanks, operating at pressures above 1.5 atmospheres absolute, for the holdup of gaseous radioactive waste prior to release or reuse. (ANS-55.1-92) (ANS-55.4-93) (ANS-55.4-99)

pressurized water reactor coolant pressure boundary. *It is preferred that (**reactor coolant pressure boundary**) and the associated definition be used in ANS standards*

pressurized water reactor coolant pressure boundary. The reactor coolant pressure boundary is defined as:

- 1) The reactor vessel indicating control rod drive mechanism housing
- 2) The reactor coolant side of the steam generators used to transfer reactor coolant system heat to the secondary system
- 3) Reactor coolant pumps
- 4) A pressurizer including heating and cooling provisions
- 5) Relief piping up to and including relief and safety valves (piping and associated tanks to receive discharges are considered outside the reactor coolant pressure boundary)
- 6) The piping, valves, and fittings needed between the principal components listed above in order to provide appropriate interconnections and flow control
- 7) Portions of the piping, fittings, and valves, leading to connecting systems up to and including: the outermost reactor containment isolation valve in system piping which penetrates the reactor containment; and the second of two valves normally closed during normal reactor operation in system piping which does not penetrate the reactor containment. (ANS-56.3-86)

primary calibration. A procedure which is followed on each area radiation monitor channel using sources or instruments, or both, that have been standardized, using a measurement system traceable to National Institute of Standards and Technology (NIST) to ensure that the response of the channel is accurate within certain prescribed limits.

Non-preferred variation (1) A procedure which is followed on each area monitor channel using sources or instruments, or both, that have been standardized, using a

measurement system traceable to NIST to ensure that the response of the channel is accurate within certain prescribed limits. (ANS-6.8.1-81)

primary containment. The principal enclosure that acts as a barrier, after the RCPB, to control the release of radioactive material from the fuel in the reactor core. This boundary includes the following:

- (1) the primary containment structure and its access closures, penetration closures, and appurtenances;
- (2) those valves, pipes, closed systems, and other pressure-retaining components used to effect isolation of the primary containment atmosphere from the external environment;
- (3) those systems or portions of systems that, by their system functions, extend the primary containment boundary (e.g., the connecting steam and feedwater piping and isolation valves). (ANS-58.14-2011)

Non-preferred variation (1) The principal enclosure that acts as a leakage barrier, after the reactor coolant pressure boundary, to control the release of radioactive material from the fuel in the reactor core under DBA conditions. It consists of:

- (1) the primary containment structure, including access closures, penetration closures, and appurtenances;
- (2) those valves, pipes, closed systems, and other pressure-retaining components used to effect isolation of the primary containment atmosphere from the outside environs;
- (3) those systems or portions of systems that, by their system functions, extend the primary containment structural boundary.

This does not include the “secondary containment,” “containment enclosure building,” or “reactor building” surrounding some containment systems, whose function is to control primary containment leakage. (ANS-56.1-85) (ANS-58.14-93)

Variant form: (ANS-56.4-83) (ANS-56.6-86)(ANS-56.8-02)(ANS-51.1/52.1)

primary containment atmosphere. The portion of the net free volume contained within the primary containment pressure boundary made up of steam and non-condensable gases and, following an accident, water droplets. (ANS-56.4-83)

primary coolant boundary (PCB) (Applicable to gas cooled reactors only) The pre-stressed concrete reactor vessel (PCR) liner, including all cavity and penetration liners which are exposed to primary coolant, in conjunction with the pre-stressed concrete structure, forms the primary coolant boundary and includes:

1. All primary closures that seal penetrations in the PCR liner.
2. All system piping within the PCR liner cavity that contains primary coolant and penetrates the PCR liner or PCR closures, up to and including the second isolation valve.
3. All system piping within the PCR liner cavity that is exposed to primary coolant and is not covered in 2.
- 4) The PCR overpressure protection system, up to and including the second pressure relief device (e.g., rupture disc or relief valve).

5) Coolant retaining parts of mechanical components, such as shaft seals on helium circulators. (58.4-1979)

primary criticality control (See primary method of criticality control) A control parameter on which principal reliance is placed in assuring that sub-critical conditions are maintained. (ANS-57.7-1992);

Non-preferred variation (1) Variant form: (ANS-8.5-86)

primary design function. A principle function of a structure, system or component (SSC) for which it was included in the plant design. (i.e., the emergency core cooling systems are included in the plant design to perform the primary design function of providing coolant to the reactor vessel during or following a LOCA.) [Developed for ANS-58.14-93]

primary heat transport system. Heat transport within the primary coolant boundary or the primary means of heat removal from the core. (ANS-53.1-2011)

primary method of criticality control. (See primary criticality control) A control parameter on which principal reliance is placed in assuring that sub-critical conditions are maintained. (ANS-8.10-83)

primary reactor containment. *It is preferred that the term (Primary containment) and the associated definition be used in ANS standards*

primary reactor containment. (See primary containment) The preferred term is primary containment. (ANS-51.1/52.1-W1983)

Non-preferred variation (1) The design feature, that acts as the principal leakage barrier, after the reactor coolant pressure boundary, to prevent the release under all conditions of design, of quantities of radioactive material that would have undue radiological effect on the health of the public. The system is composed of:

- (1) the containment structure, including access openings, penetrations, and appurtenances;
- (2) those valves, pipes, closed systems, and other components used to effect isolation of the containment atmosphere from the outside environs; and,
- (3) those systems or portions of systems that by their functions, extend the containment structure boundary to include their system boundary. This does not include the "secondary containment," "containment enclosure building," or "reactor building" surrounding some containment systems, whose function is to control containment system leakage. (ANS-56.8-2002)

Variant form: (ANS-56.1-85)(ANS-56.5-87)(ANS-56.7) (ANS-56.10-87)

primary shielding. The primary shielding is the shielding provided to attenuate the neutron and gamma-ray radiation emanating from the reactor pressure vessel. (ANS-6.3.1-87)

primary source. An assured source of water capable of supplying water throughout a hot standby period of at least four hours, during which time a decision regarding the necessity of cooldown is reached, plus a cooldown period sufficient to reduce plant temperature to levels where low-temperature low-pressure decay heat removal equipment can be used assuming the concurrent loss of off-site power. This source may consist of more than one structure. Where hot standby is required to be maintained for extended periods, the primary source shall have additional capacity to meet this requirement. (ANS-51.10-08)

primary test instrumentation. Instruments whose recorded values are used directly in the calculation of any values compared against test acceptance criteria. (ANS-56.8-02)

prior distribution (priors). In Bayesian analysis, the expression of an analyst's prior belief about the value of a parameter prior to obtaining sample data. (ASME/ANS-RA-Sb-2013)

probabilistic risk assessment (PRA). A qualitative and quantitative assessment of the risk associated with plant operation and maintenance that is measured in terms of frequency of occurrence of risk metrics, such as core damage or a radioactive material release and its effects on the health of the public [also referred to as a probabilistic safety assessment (PSA)]. (ASME/ANS RA-Sb-2013) (ANS-53.1-2011)

probabilistic seismic hazard analysis (PSHA). A procedure used to develop seismic hazard curves and uniform hazard response spectra for determining the ground motion at a site to be used for seismic design. Aleatory variability and epistemic uncertainty are captured in a PSHA. Criteria and guidance for conducting a PSHA are provided in ANS-2.29-2008. (ANS-2.27-2008)

probability of exceedance. The probability that a specified level of seismic hazard will be exceeded at a site or in a region during a specified exposure time. (ANS-2.29-2008)

Non-preferred variation (1) (as used in seismic hazard analysis). The probability that a specified level of ground motion for at least one earthquake will be exceeded at a site or in a region during a specified exposure time. (ASME/ANS RA-Sb-2013)

probability of nonsuppression. Probability of failing to suppress a fire before target damage occurs. (ASME/ANS RA-Sb-2013)

probability of occurrence. The mean annual rate of occurrence of a hazard parameter within a range of values. The limits of this range are indicated by the definition of the event. These limits can be specified to consistently cover the entire spectrum of parameter values as illustrated in Appendix A. For example, a 100-year wind means the probability of exceeding this wind speed in a year is 1/100. For purposes of this standard, all hazards have their parameter values¹ divided into segments which are characterized by discreet design events (e.g., Safe Shutdown Earthquake [SSE]). Parameter value characterizes an event as to its intensity, e.g. wind velocity for a tornado, or elevation of a flood. (ANS-2.12-78)

probable maximum flood (PMF). The hypothetical flood (i.e., peak discharge, volume, and hydrograph shape) that is considered to be the most severe reasonably possible, based on comprehensive hydrometeorological application of probable maximum precipitation and other hydrologic factors favorable for maximum flood runoff such as sequential storms and snow melt. (ANS-2.8-92)

probable maximum gradient wind. A probable gradient wind of a designated duration above the surface friction layer, of which there is virtually no risk of being exceeded. The event may be considered to have a probability of occurrence comparable to that of a probable maximum precipitation. (ANS-2.8-92)

probable maximum hurricane (PMH) A hypothetical hurricane having that combination of characteristics that makes it the most severe that can reasonably occur in the particular region involved. The hurricane approaches the point under study along a critical path and at an optimum rate of movement which results in most adverse flooding. (ANS-2.8-92)

Variant form: (ANS-2.13-79)

probable maximum precipitation (PMP). The estimated depth of precipitation for a given duration, drainage area, and time of year for which there is virtually no risk of exceedance. The probable maximum precipitation for a given duration and drainage area approximates the maximum that is physically possible within the limits of contemporary hydrometeorological knowledge and techniques. (ANS-2.8-92)

probable maximum windstorm (PMWS). A hypothetical extratropical cyclone that might result from the most severe combination of meteorological storm parameters that is considered reasonably possible in the region involved. The windstorm approaches the point under study along a critical path and at an optimum rate of movement which will result in most adverse flooding. (ANS-2.8-92)

Variant form: (ANS-2.13-79)

probable minimum flow. The hypothetical minimum rate of stream flow that can occur from the most severe combination of reasonably possible hydrometeorological and geomorphic factors. (ANS-2.13-79)

probable station blackout response facilities. The added capability beyond the assured capability to withstand station blackout, which are identified in developed response scenarios and emergency procedures. These facilities might serve as alternative contingency methods of providing station blackout response functions, or extend capabilities beyond the time frame for which complete application of this standard is justified. (ANS-58.12-85)

probit: Probability unit function, defined as the inverse cumulative distribution function. (ASME/ANS RA-S-1.3-2016)

procedure. A document that specifies or describes how an activity is to be performed. (ANS-3.2-88)

process conditions: The identifying characteristics of a process that have an effect on nuclear criticality safety (e.g., parameters, environment, and operations). (ANS-8.10-15)

process control program (PCP). (1) A set of procedures used to ensure a consistent waste form is produced that meets all applicable regulatory and disposal site requirements. (ANS-55.1-92)

Non-preferred variation (1) A systematic procedure for providing reasonable assurance that the final waste form is in accordance with disposal facility acceptance criteria. (ANS-40.37-2009)

process evaluation. A document that identifies and defines all known criticality safety concerns; documents criticality safety assumptions, requirements, limits, and controls; and demonstrates subcriticality. The process evaluation is often referred to as a Nuclear Criticality Safety Evaluation (NCSE). (ANS-8.22-97)

process monitor. Instrumentation used to determine the level of radioactivity in a stream for the purpose of evaluating the status and performance of selected plant processes. (ANS-6.8.2-86)

process piping. Piping used to collect process and discharge liquid radioactive wastes. This does not include instrumentation and sampling lines beyond the first root valves. (ANS-55.6-93) (ANS-55.6-99)

procurement document. Purchase requisitions, purchase orders, drawings, contracts, specifications, or instructions used to define requirements for purchase. (ANS-3.2-88)

prognostic models: Models that explicitly forecast conditions into the future based on an initial state and time-dependent equations of motion (ANS-2.15-2013).

program development. The processes which are involved in producing a computer program and its documentation. They are:

Problem definition;

Model development;

Algorithm formulation;

Program design;

Programming;

Verification;

Validation; and,

Modification. (ANS-10.5-2006)

programmable digital computer. A device that can store instructions and is capable of the execution of a systematic sequence of operations performed on data that is controlled by internal stored instructions. (ANS/IEEE 7.4.3.2-2000)

proponent expert. An expert who advocates a particular hypothesis or technical position. (ASME/ANS RA-Sb-2013)

protected area. An area encompassed by physical barriers to which access is controlled. (ANS-3.3-88)(ANS-59.51-89) (ANS-59.52-93)

Non-preferred variation (1) The area within the site security fence and controlled under the security plan. (ANS-3.8.2-95) (ANS-3.8.6-95)

protection. The design of plant features such as distance, orientation, barriers, enclosures, restraints and hardening, in order to limit the consequences of a particular event/hazard to within acceptable limits for that event/hazard. (ANS-58.3)

protection system. That part of the sense and command features involved in generating those signals used for the reactor trip system and engineered safety features. (ANS-51.1-94)(ANS-52.1/50.1)

Variant form: (ANS-4.1) (ANS-56.2-84)

protective action. An action taken to avoid or reduce projected dose to individuals. (ANS-3.8.1-87)(ANS-3.8.6-94) (ANS-3.8.2-95) (ANS-3.8.4-95)

Non-preferred variation (1) Protective actions: Actions taken by the public to mitigate the impacts of radiological releases. (ASME/ANS RA-S-1.3-2016)

Variant form: (ANS-3.7.2-79)(ANS-4.1)

protective action guide (PAG). Those specified dose levels which, if projected to be exceeded for individuals in the population, cause pre-established protective actions to be recommended. (e.g., see Environmental Protection Agency (EPA) Manual EPA-520/1-75.001, 21 CFR 1090, "Food and Drugs," EPA Manual of Protective Action Guides and Protective Actions for Nuclear Incidents, EPA 400-R-92-001. (ANS-3.8.6-94)

(e.g., see EPA 400R-92-001 [1] and Title 21, “Food and Drugs” Code of Federal Regulations, Part 1090, “Accidental Radioactive Contamination of Human and Animal Feeds” [2]). (ANS-3.8.1-1995) (ANS-3.8.2-95)

Non-preferred variation (1) A document that sets forth specific dose levels which, if projected to be exceeded for individuals in the population, require pre-established protective actions to be recommended (e.g., see *Manual of Protective Action Guides and Protective Actions for Nuclear Incidents*, EPA-400[1]¹ and Title 21, “food and Drugs,” Code of Federal Regulations, Part 1090, “Accidental Radioactive Contamination of Human and Animal Feeds” (21 CFR 1090) [2]) (ANS-3.8.6-95) (ANS-3.8.3-95)

Non-preferred variation (2) Variant form: (ANS-3.8.1-87)

Non-preferred variation (3) protective action guides: Projected radiological dose or dose commitment values to individuals that warrant protective action following a release of radioactive material. *Protective actions would be warranted provided the reduction in individual dose expected to be achieved by carrying out the protective action is not offset by excessive risks to individual safety in taking the protective action. The projected dose does not include the dose that has occurred prior to the assessment.* (ANS-15.16-2015)

protective active recommendation (PAR) A recommendations to implement protective actions. (ANS-3.8.6-94) (ANS-3.8.2-95)

Protected area. The area within the site security fence and controlled under the security plan. (ANS-3.8.1-1995)

protective function. The function necessary to limit the safety consequences of a design basis event (e.g., rapid reduction of reactor power, isolation of the reactor coolant system from possible leak paths, removal of heat from the core). (ANS-4.1)

protective (mitigating) features. Passive and active features used to limit the effects of flooding to ensure all required functions are maintained. (ANS-56.11-88)

public: For the purposes of this standard, all individuals outside a geographic boundary within which public access is controlled and activities are governed by the operator of a nonreactor nuclear facility. (ANS-58.16-2014)

puff: An amount of material released over a short, almost instantaneous, period of time. (ASME/ANS RA-S-1.3-2016)

Q.

QHO risk metric: Quantitative Health Objectives of NRC’s Safety Goal Policy Statement that define goals for the average individual risk of early fatality and latent cancer fatality arising from accidents at nuclear power plants. (ASME/ANS RA-S-1.3-2016)

Quantitative Health Objectives (QHOs): U.S. Nuclear Regulatory Commission term for numerical criteria for the acceptable levels of risk to public health and safety in the population surrounding nuclear power plants that satisfy NRC’s reactor safety goals. These QHOs are expressed in terms of the annual average individual probability of death due to acute radiation syndrome within one mile of the site boundary and the annual average individual

probability of death due to latent cancer per year within ten miles of the site boundary of a nuclear power plant and these are set at less than 0.1% of the levels due to non-nuclear causes. (ASME/ANS RA-S-1.4-2013)

qualification. The combination of knowledge, skill and ability required to meet specific job performance criteria. (ANS-3.1-87)

Non-preferred variation (1): The combination of education, experience, special requirements (e.g., a license), and training required to meet specific job performance criteria. (ANS-3.1-2014)

qualified nonlicensed operator. Qualified for all power block and safety systems operations. Time as a qualified nonlicensed operator counts from the day the last such power block or safety system operation watch station qualification is attained. (ANS-3.1-2014)

qualified seal system. A system that is capable of sealing the leakage with a liquid at a pressure no less than $1.1 P_a$ for at least 30 days following the DBA. (ANS-56.8-02)

quality assurance (QA) (1) All those planned and systematic actions necessary to provide adequate confidence that a structure, system, or component (SSC) will perform satisfactorily in service. (ANS-3.2-93)

Non-preferred variation (1) Variant form: (ANS-56.7-W1997)(ANS-59.1-W1996)

Non-preferred variation (2) All those planned and systematic actions necessary to provide adequate confidence that an analysis, measurement, or surveillance program is of the type and quality needed and expected.(ANS-41.5-2012)

quality assurance project plan (QAPP). A document that contains or references the QA elements established for an activity, group of activities, scientific investigation, or project and describes how conformance with such requirements is to be ensured for the activities. (ANS-41.5-2012)

quality control. *It is preferred that the term (quality assurance) and the associated definition be used in ANS standards*

quality control. Those actions that control and measure the attributes of the analytical process, standards, reagents, measurement equipment, components, system, or facility according to predetermined quality requirements. (ANS-41.5-2012)

quality control chart. A chart developed to evaluate the response of an instrument or process to predetermined, statistically based control limits. The predetermined statistical limits are not typically developed using the overall quality performance (bias and precision) parameters for an analytical technique. (ANS-41.5-2012)

quality factor (Q). A factor that approximately accounts for the effect of the microscopic distribution of absorbed energy on biological detriment. It is defined as a function of the collision stopping power (L) in water at the point of interest. Values of Q as a function of L can be obtained from a full logarithmic interpolation of data in Table 1. The data given in this standard are based on the L-Q relationship given in Table 1. They do not account for the position taken by the ICRP in its Statement from the 1985 Paris Meeting of the International Commission on Radiological Protection, ICRP Publication 45, in which an immediate increase by a factor of two is recommended in the quality factor for neutrons. This recommendation is under review by national and international commissions on radiation protection and is subject to change during the projected life of this standard. (ANS-6.1.1-91)

quantitative health objectives (QHOs). Numerical criteria for the acceptable levels of risk to public health and safety in the population surrounding plants that satisfy the national nuclear regulator's reactor safety goals. In the United States, the QHOs are expressed in terms of the annual average individual probability of death due to acute radiation syndrome within 1 mile of the site boundary and the annual average individual probability of death due to latent cancer per year within 10 miles of the site boundary of a plant, and these acceptance levels are set at <0.1% of the levels due to all manmade nonnuclear causes. (ANS-53.1-2011)

Quaternary. The geologic period comprising about the past 1,800,000 years.(ANS-2.27-2008)

Non-preferred variation (1) The geologic period between about 2,600,000 years before present and today. The Quaternary period includes the Pleistocene and the Holocene geologic epochs (ANS-2.30-2015).

R.

raceway. Any channel that is designed and used expressly for supporting or enclosing wires, cable, or busbars. Raceways consist primarily of, but are not restricted to, cable trays and conduits. (ANS-59.4-79W83)

Non-preferred variation (1) An enclosed channel of metal or nonmetallic materials designed expressly for holding wires, cables, or bus bars, with additional functions as permitted by code. Raceways include, but are not limited to, rigid metal conduit, rigid nonmetallic conduit, intermediate metal conduit, liquid-tight flexible conduit, flexible metallic tubing, flexible metal conduit, electrical nonmetallic tubing, electrical metallic tubing, underfloor raceways, cellular concrete floor raceways, cellular metal floor raceways, surface raceways, wireways, and busways (RG 1.189) . (ASME/ANS RA-Sb-2013)

rack. A structure supporting an assembly of cells. (ANS-56.3)(ANS-57.2-93)(ANS-57.3-93)(ANS-57.2-99)

radiation area. Any area, accessible to personnel, in which there exists radiation at such levels that major portion of the body could receive in any one hour a dose equivalent in excess of five mrem, or in any five consecutive days a dose equivalent in excess of 100 mrem. (ANS-6.8.1-81)

radiation base point (RBP). Radiation base points (RBPs) are numbered locations at which measurements are to be made and always recorded throughout the test programs. (ANS-6.3.1-87)

radioactive materials. Radioactive fission products, activation products, and concentrated naturally occurring radioactive substances. (ANS-40.37-2009)

radiological emergency response plan(Plan). *It is preferred that the term (emergency response plan) and the associated definition be used in ANS standards*

radiological emergency response plan(Plan). A licensing document that describes the licensee's overall emergency response functions, organization, facilities, and equipment,{as well as appropriate government agency plans. The radiological emergency response plan is implemented by specific procedures} (3.8.6-95) as well as

emergency response plan. It is implemented by specific procedures. (ANS-3.8.1-93)(ANS-3.8.2-93) (ANS-3.8.3-93)(ANS-3.8.4-93) (ANS-3.8.6-94)

Non-preferred variation (1) A licensing document that describes the licensee's overall emergency response functions, organization, facilities, and equipment, as well as appropriate government agency plans. The radiological emergency response plan is implemented by specific procedures. (ANS-3.8.2-95) (ANS-3.8.4-95) (ANS-3.8.3-95)

radiological sabotage. Any deliberate act directed against a plant or component of a plant that could directly or indirectly endanger the public health and safety by exposure to radiation. (ANS-3.3-88)

radionuclide. An isotope of an element that is radioactive. (ANS-41,5-2012)

radionuclide group: a set of radionuclides that are treated as a single representative species for the purposes of calculating release from fuel and transport to the environment. Physical and transport properties for the single representative species are assumed to apply to all other radionuclides within the group. The group is usually composed of all nuclides of a common element and all nuclides of other elements that have similar physical and chemical properties. A delineation of radionuclide groups used in many severe accident computational models can be found in NUREG-1465. (ASME/ANS RA-S-1.2-2015)

radionuclide release category: see *release category*. (ASME/ANS RA-S-1.2-2015)

radionuclide transport barrier. A passive SSC designed to retain radionuclides and/or mitigate the radionuclide release source term during an accident sequence. Such barriers include physical barriers such as the fuel barrier, reactor coolant (e.g., helium) pressure boundary, and reactor building. For modular helium-cooled reactors (MHRs) such barriers normally include the coated particle fuel, graphite or carbon fuel matrix, internal HPB surfaces, the HPB itself, and the reactor building associated barriers. (ANS-53.1-2011)

radionuclide transport barrier: a passive SSC that is designed to retain radionuclides and/or to mitigate the radionuclide release source term during an event sequence. Such barriers include the physical barriers such as the fuel barrier, reactor coolant pressure boundary, and reactor building, as well as provide for time delays for radioactive decay, deposition, and revaporization of the released material within and between the respective physical barriers. (ASME/ANS RA-S-1.4-2013)

raising or lowering (hoisting). Motion in a vertical direction. (ANS-57.1-92)(ANS-57.3-93)

randomness. See "aleatory uncertainty."(ANS-2.27-2008) (ANS-2.29-2008)

Non-preferred variation (1) ((as used in seismic-fragility analysis). The variability in seismic capacity arising from the randomness of the earthquake characteristics for the same acceleration and to the structural response parameters that relate to these characteristics. (ASME/ANS RA-Sb-2013)

rankine vortex. A two-dimensional circular flow in which a circular region about the origin is in solid rotation:

$$V/R = \text{constant.}$$

Where: V is the tangential speed and R the distance from the origin; and the region outside is free of vorticity, the speed being inversely proportional to the distance from the origin,

$$VR = \text{constant.}$$

(ANS-2.3-83)

Rankine combined vortex. A two-dimensional circular flow in which a circular region about the origin is in solid rotation, i.e.,

$$\frac{V_{tr}}{R} = \text{constant} \quad (1)$$

where, V_{tr} is the tangential tornado wind speed and R the radial distance from the origin; and the region outside is free of vortex motion, the speed being inversely proportional to the radial distance from the origin, i.e.,

$$V_{tr} R = \text{constant} \quad (2)$$

(ANS-2.3-2011)

rare event. One that might be expected to occur only a few times throughout the world nuclear industry over many years (e.g., $<1E-4/\text{reactor-yr}$). (ASME/ANS RA-Sb-2013)

raschig ring (ring). A small, hollow, borosilicate-glass cylinder having approximately equal length and diameter. (ANS-8.5-86)

rate. The first time derivative of the current value. (ANS-4.5-1980)

raw wastes. Waste as received by an MRWP (mobile low-level radioactive waste processing) system. (ANS-40.37-2009)

reactivity. A quantity proportional to $k_{\text{eff}}-1/k_{\text{eff}}$, where: k_{eff} is the effective neutron multiplication factor. The reactivity of a sub-critical fissile assembly is a negative quantity indicating the degree of sub-criticality. The reactivity of a critical assembly is zero. (ANS-8.6-83)

reactivity addition. A modification of a fissile assembly that results in a positive incremental change of reactivity. (ANS-8.6-83)

reactor building. The building immediately surrounding the RPV and HPB that provides structural integrity of the core, RPV, and HPB; physical protection from internal and external events to SSCs that perform safety functions; and a barrier to radionuclides that may be released from the HPB. (ANS-53.1-2011)

reactor containment. *It is preferred that (Primary Containment) and the associated definition be used in ANS standards*

reactor containment. (Also, primary containment; primary reactor containment: the preferred term is primary containment). (ANS-51.1/52.1-1983);

reactor containment. The principal design feature of a unit that acts as the principal barrier, after the reactor coolant pressure boundary or primary coolant boundary, to control the release of radioactive material under all plant conditions. It includes: (1) the containment structure and its access openings, penetrations and pertinences; (2) those valves, pipes, closed systems and other components used to effect isolation of containment atmosphere from the environment; and (3) those systems or portions of systems that, by their functions, extend the containment structure boundary (e.g., in a PWR, the boundaries of the secondary side of the steam generator and the connecting steam and feed water piping). (ANS-59.1)

Variant form: (ANS-56.2-1984) (ANS-54.1-89)

reactor characteristics, inherent. Intrinsic features to the type of reactor before considering safety features. Examples of inherent characteristics of modular helium-cooled reactors (MHRs) include the material properties of silicon carbide and graphite, and the thermodynamic and chemical properties of graphite and helium. (ANS-53.1-2011)

reactor coolant boundary. Those components which form a leak tight barrier against the release of reactor coolant up to and including the second of two valves normally closed (a freeze seal might be shown to be acceptable as an alternate to one of the closed valves) or capable of automatic actuation during normal reactor operation. (ANS-54.1-1989)

reactor coolant normal makeup. Makeup to the reactor coolant pressure boundary by the system(s) relied upon to maintain reactor coolant inventory during normal operation. (ANS-51.1/52.1-W1983)(ANS-56.4-1983)

reactor coolant pressure boundary (RCPB). All pressure-containing components of light water reactor nuclear power plants, such as pressure vessels, piping, pumps, and valves, which are:

- (1) part of the reactor coolant system; or
- (2) connected to the reactor coolant system up to and including any or all of the following:
 - a) the outermost primary containment isolation valve in system piping that penetrates the primary containment;
 - (b) the second of two valves normally closed during normal reactor operation in system piping that does not penetrate primary containment; or
 - (c) the reactor coolant system safety and relief valves.

For a direct-cycle boiling water reactor, the reactor coolant system extends to and includes the outermost primary containment isolation valve in the main steam and feed water piping. (See 10 CFR 50.2) (ANS-58.14-93) (ANS-58.14-2011)

Non-preferred variation (1) Variant form:(ANS-58.4-1979)(ANS-56.4-83)(ANS-59.1)(ANS-51.1/52.1-W1983)(ANS-56.2-84)(ANS-56.7-W1997)

reactor coolant pressure boundary (RCPB) breach: a breach in the reactor coolant pressure boundary that would result in a loss of reactor coolant system pressure and/or loss of coolant inventory. In light water reactors, RCPB are referred to as Loss of Coolant Accidents (LOCAs). (ASME/ANS RA-S-1.4-2013)

reactor coolant pressure boundary (RCPB) breach, excessive: a breach in the reactor coolant pressure boundary that is beyond the capacity of the mitigating systems either due to its size or location. (ASME/ANS RA-S-1.4-2013)

Reactor Coolant System (RCS). Those items relied upon to (1) for a pressure-retaining boundary to contain the reactor coolant; (2) transfer heat during normal operation from the reactor core to the power conversion system or to the shutdown heat removal systems; or (3) provide system pressure relief.

For a boiling water reactor (BWR), the RCS might include:

- (a) the reactor vessel including appurtenances such as nozzles and control rod drive housings;

- (b) main steam and feed water lines out to and including the outermost primary containment isolation valve;
- (c) safety and relief valves;
- (d) recirculation piping, pumps, and valves;
- (e) other components, such as the relief valve discharge piping and the main steam drain lines out to and including the outermost primary containment isolation valves, and
- (f) supports of other RCS components.

For a pressurized water reactor (PWR), the RCS might include:

- (a) the reactor vessel including appurtenances such as nozzles and the control rod drive mechanism housings;
- (b) the primary side of the steam generators used to transfer reactor heat to the power conversion system;
- (c) reactor coolant loop piping, pumps, and valves;
- (d) the pressurizer, including heating and cooling provisions;
- (e) relief piping including relief and safety valves and associated tanks that receive discharges;
- (f) the piping, valves, and fittings needed between the principal components in order to provide appropriate flow paths and flow control; and
- (g) supports of other RCS components. (ANS-58.14-93)

Non-preferred variation (1) Variant form: (ANS-54.1-89)

1st paragraph only included as definition of RCS (ANS-58.14-2011)

reactor cover gas boundary. Those components which form a leak-tight barrier against the release of reactor cover gas up to and including the second of two valves normally closed or remotely isolable during normal reactor operation. (ANS-54.1-89)

reactor makeup quality wastes. Liquids, which originate from reactor or reactor auxiliary closed systems, and are normally processed and reused as reactor coolant makeup. (ANS-55.6-1993) (ANS-55.6-1999)

reactor-operating-state-year. An equivalent calendar year of operation in a particular plant operating state. See Note (1) in Table 2-2.1-4. (ASME/ANS RA-Sb–2013)

reactor protection. That function which is performed by systems designed to: initiate automatically the operation of appropriate systems including the reactivity control systems, to assure that specific acceptable fuel design limits are not exceeded as a result of anticipated operational occurrences; and sense accident conditions and initiate the operation of systems and components important to safety. (See 10 CFR 50, "Licensing of Production and Utilization Facilities: Appendix A, General Design Criteria for Nuclear Power Plants." (ANS-58.3)

reactor trip system (RTS). The principal system credited in the LBD for shutdown of the reactor. (ANS-58.14-2011)

reactor-year. (One calendar year per nuclear power reactor unit.) (ANS-51.1/52.1-W1983)

Non-preferred variation (1) A calendar year in the operating life of one reactor, regardless of power level. See Note (1) in Table 2-2.1-4 of ASME/ANS RA-Sb–2013. (ASME/ANS RA-Sb–2013)

real-time. Simulation of dynamic performance in the same time base relationships, sequences, durations, rates and accelerations as the dynamic performance of the reference plant. (ANS-3.5-85) (ANS-3.5-2009)

real-time measurements: Observations that are available on the order of a reading's averaging time (ANS-2.15-2013-2013).

rebar. The reinforcing steel bars placed in concrete to increase the structural strength. American National Standard Code Requirements for Nuclear Safety Related Concrete Structures, ANSI/ACI 349-1980 includes a discussion of this reinforcing steel. Owing to the fact that it is not homogeneously spaced throughout the shield, but rather is made up of discrete steel bars, it would require complicated shielding analysis and hence is not usually considered as part of the attenuating property of the shield. Rebar is, however, considered as a potential source of secondary gamma radiation when the shield is a combined neutron and gamma-ray shield. (ANS-6.4-85)

receptor. An individual located in an unrestricted area (e.g., off-site) that might receive a radionuclide exposure via subsurface transport. (ANS-2.17-2010)

rechannelling. Removal and replacement of fuel channels for BWR fuel assemblies. (ANS-57.192)(ANS-57.3-93)

recharge. The process of water addition to the saturated zone or the volume of the water added by this process. (ANS-2.9-89)(ANS-2.17-89)

recirculation: Plume movement by vertical or horizontal eddies where material follows a curved path through the atmosphere back to regions previously impacted (ANS-2.15-2013).

recirculation mode. In the context of this standard, that configuration of the containment spray system, in which water is taken from a containment sump and returned to the containment atmosphere. (ANS-56.5-87)

recombiner. Equipment designed to accomplish the controlled reaction of hydrogen and oxygen by catalytic or thermal means. (ANS-55.4-93) (ANS-55.4-99)

recorded data. The output from a time-history accelerograph, a peak accelerograph, or a response spectrum recorder. (ANS-2.10-90)

recorder. An instrument capable of recording the data versus time from acceleration sensor or sensors. (ANS-2.2-2002)

recovery. Actions taken after the plant has been brought to a stable or shutdown condition,(ANS-3.8.6-94) including those taken to mitigate the emergency and ultimately return the plant to normal operation. (ANS-3.8.1-93) (ANS-3.8.4-95)(ANS-3.8.3-93)(ANS-3.8.4-93)

Non-preferred variation (1) Restoration of a function lost as a result of a failed SSC by overcoming or compensating for its failure. Generally modeled by using HRA (Human Reliability Analysis) techniques. (ASME/ANS RA-Sb–2013)

recovery action. An action taken to return to the normal situation. {ANS-3.7.2-79}

recovery period. The period of time from when either offsite power or onsite emergency AC power is recovered, to when normal safe shutdown is achieved. (ANS-58.12-1985)

recurrence interval. The mean time period between earthquakes of a given magnitude. (ANS-2.27-2008)

Non-preferred variation (1) The time period between earthquakes of a given magnitude, fault offset of a given amount, or deformation of a given measure (ANS-2.30-2015).

recycled fuel. A new fuel assembly containing, in whole or in part, fissile material from reprocessed fuel. Its chemical composition may consist of mixed oxides of uranium and plutonium. (ANS-57.3-93)

redundant component, system or subsystem. *It is preferred that (**Redundant Structure, System or Component**) and the associated definition be used in ANS standards*

redundant component, system or subsystem. (See also redundant structure, system or component) A component, system or subsystem that independently duplicates the essential function of another identical component, system or subsystem. (ANS-57.2-93)(ANS-59.1) (ANS-59.3-93)(59.4-79)

variant form: (ANS-56.7)

Non-preferred variation (1) A component, system or subsystem that independently duplicates the function of another component, system or subsystem. (ANS-57.2-1999)

redundant equipment or system. *It is preferred that (**Redundant Structure, System or Component**) and the associated definition be used in ANS standards.*

redundant equipment or system. Equipment or system(s) that duplicate(s) the essential function of other equipment or system(s) to the extent that either may perform the required function regardless of the state of operation or failure of the other.(ANS-59.3)

Non-preferred variation (2) Equipment or system that duplicates the essential function of another piece of equipment or system to the extent that either may perform the required function regardless of the state of operation or failure of the other. (ANS-58.16-2014)

redundant structure, system, or component. A structure, system or component (SSC) that independently duplicates the function of another component, system, or subsystem. (ANS-56.5-87)(ANS-51.1/52.1-W1983) (ANS-59.4) (ANS-58.14-2011)

Non-preferred variation (1)Variant form:(ANS-56.2-84)(ANS-54.2-85)(ANS-57.1-92)

redundant system. (See redundant structure, system or component; and redundant component, system or subsystem).

reference data. Published, peer-reviewed, and readily available tabulations of values and associated uncertainties of physical constants as determined by state-of-the-art methods. In order to minimize transcription errors, these data should be made available in electronic form. (ANS-6.1.2-2013)

reference plant. The specific nuclear power plant from which the simulator control room configuration, system control arrangement and simulator data base is derived. (ANS-3.5-85)

reference material (standard). A material or substance one or more properties of which are sufficiently well established (within specified uncertainty limits) to be used for the calibration of an apparatus, assessment of a measurement method, or assigning of values to materials. (ANS-41.5-2012)

reference unit. The specific nuclear power plant unit, identified by a unique docket number, from which the simulator control room configuration, system control arrangement, and simulator design database are derived.(ANS-3.5-2009)

reflection. A process in which radiation enters a region through a surface and partially returns through the same surface. (ANS-6.4-85)

refueling machine. Any equipment operating over the reactor refueling cavity, or well, and fuel transfer canal and designed for handling fuel and control components. (ANS-57.1-92)

refueling shutdown. The cold shutdown condition in which the reactor coolant system is depressurized for the purpose of replacing fuel, consistent with technical specification operational limits. (ANS-51.1/52.1-1983] (ANS-58.6-92)

refueling outage: an outage type that occurs on a periodic basis, during which a portion of the spent nuclear fuel is replaced with new (unburned) fuel. (ANS/ASME-58.22-2015)

regression testing. Systematic repetition of testing to verify that only desired changes are present in modified software. (ANS-10.7-2013)

Non-preferred variation (1) Selective testing to detect errors introduced during modification of computer software or to verify that modified computer software still meets its specified requirements. (ANS-10.8-2015)

related experience Experience in performing job duties similar to that for which the individual seeks qualification, and may or may not be at a nuclear power plant (ANS-3.1-2014)

related science. Related science programs include course work in the physical, mathematical, or engineering sciences (ANS-3.1-2014)

related technical training. Formal training beyond the high school level in technical subjects associated with the position in question, such as acquired in training schools or programs conducted by the military, industry, utilities, universities, vocational schools, or others. Such training programs shall be of a scheduled and planned length and include text material and lectures. (ANS-3.1-1999)

release category. A grouping of event sequences into an event sequence family based on a common potential for release of radioactive material as characterized by its mechanistic source term. This common potential is based on common initiating events, combination of successful and failed safety functions, release magnitude, release timing and location, and radionuclide species that are released from the plant as a result of an event sequence. A release category may comprise one or more licensing basis events(LBEs). (ANS-53.1-2011)

release category (RC): a group of accident progression sequences that would generate a similar source term to the environment. Similarity in this context depends on the level of fidelity of the analysis and the number of release categories used to span the entire spectrum of possibilities. Similarity is generally measured in terms of the overall (cumulative) release of activity to the environment, the time at which the release begins and (in

certain applications) other physical characteristics of the source term. (ASME/ANS RA-S-1.2-2015)

release, accidental. A release of radioactivity that is uncontrolled and unplanned. (ANS-2.17-89)

release fraction. The “release fraction” or R/B as used in this standard is defined as the fraction of the non-decayed inventory that resides in the pellet-cladding gap (i.e., free volume outside of the fuel pellet but inside of the fuel rod cladding). The R/B for a fuel rod is determined from the sum of each radial node i for each axial node m and then the sum of each axial node as per Equation 2. For stable nuclides, this fraction is the total release divided by the total production; for radioactive nuclides, decay shall be taken into account in terms of both amount released, R , as well as produced, B . The following equations for R/B take into account decay with the decay constant, λ . (ANS-5.4-2011)

release, routine. A release of radioactivity that is either continuous (e.g., leakage from a cooling pond containing trace quantities of radioactivity), or a periodic controlled release of low-level radioactive liquids. (ANS-2.17-89)

reliability. The probability that a device or system will perform a required function under stated conditions during a stated period of time. (ANS-4.1-Historical)

Non-preferred variation (1) The complement of unreliability. (ASME/ANS RA-Sb-2013)

relied upon. Dependence on the successful functioning of the SSCs in the following manner:

(1) for DBEs: the SSCs that are necessary and sufficient (i.e., the minimal subset of SSCs) to assure each of the three basic safety-related functions in the presence of a postulated single failure plus any other coincident occurrence assumed in the safety analysis;

(2) for special events: the SSCs that are necessary and sufficient (i.e., the minimal subset of SSCs) to assure required functions in the presence of postulated failures (e.g., common cause) related to the specific special event.(ANS-58.14-2011)

relief pressure. That pressure value above which the air system or portion thereof is relieved to the atmosphere for protection of system pressure integrity. (ANS-59.3-02)

relocatable components. A generic term meant to include items within the reactor vessel, excluding the vessel internals, which must be handled or shifted in position during, preparing for or recovering from fuel loading or refueling. Some examples are: control rods, flow limiting orifices, and shields. (ANS-54.2-85)

remaining fraction. Unity minus cumulative fraction leached (i.e., the fraction still remaining with the specimen or waste form after leaching) assuming no decay of the radioactivity. (ANS-16.1-03)

remote. Any location not at or adjacent to the detector. (ANS-6.8.1-81)

remote indicating instrument. Instrument whose output is transmitted to a location separate from the sensor. (ANS-2.2-02)

remote manual actuation. Initiation of a power operated component by a discrete manual action such as operation of a control switch predominantly in response to intelligence or signals indicating requirement of such action. (ANS-56.2-84)

repair. (1) The process of restoring a non-conforming characteristic to a condition such that the capability of an item to function reliably and safely is unimpaired, even though that item still does not conform to the original requirement. (ANS-3.2-93)

Non-preferred variation (1) Restoration of a failed SSC by correcting the cause of failure and returning the failed SSC to its modeled functionality. Generally modeled by using actuarial data. (ASME/ANS RA-Sb-2013)

repair or adjustment. Any action performed on the primary containment that affects its leakage characteristics. (ANS-56.8-02)

repair time. The period from identification of a component failure until it is returned to service. (ASME/ANS RA-Sb-2013)

repeatability. The closeness of agreement among a number of consecutive measurements of the output for the same value of the input under the same operating conditions, approaching from the same direction for full range traverses. (ANS-56.8-02)

Non-preferred variation (1) The capability of the simulator to have successive tests of its dynamic performance conducted in the same time base relationships, sequences, durations, rates, and accelerations that, in turn, produce the same results within the limits required by this standard.(ANS-3.5-2009)

replay. The recording of a simulator training session in such a way that all or a portion of a simulator training exercise can be played back.(ANS-3.5-2009)

replicate. One of multiple aliquots or aliquants of a sample taken during the first stage of the analytical process. (ANS-41.5-2012)

required detection level (RDL). The minimum detection capability for a method required by the MQOs and/or SOW. (ANS-41.5-2012)

required function. A function which, following any initiating event resulting in flooding, is necessary to assure safe plant shutdown, maintain core cooling capability consistent with the minimum requirements of Appendix A, "General Design Criteria for Nuclear Power Plants," of 10 CFR 50, "Domestic Licensing of Production and Utilization Facilities," or maintain offsite radiological consequences below the guide-line exposures of 10 CFR 100.

required structures, systems, and components (SSCs). Those structures, systems, and components (SSCs) which are used to accomplish the required functions following postulated flooding events. These include the protective and mitigating features, such as detection, isolation, barriers, sumps and pumps. (from ANSI/ANS-58.2-1988 and equivalent to NUREG-0800 Sections 3.6.1 and 3.6.2) (ANS-56.11-88)

required time. The time needed by operators to successfully perform and complete a human action. (ASME/ANS RA-Sb-2013)

research reactor: A device designed to support a self-sustaining neutron chain reaction for research, developmental, educational, training, or experimental purposes and that may have provisions for production of nonfissile radioisotopes. (ANS-15.16-2015, ANS-15.21-2012)

reserve lubricating oil storage tank. A vessel which supplies a reserve supply of lubricating oil for one or more EDG engines. (ANS-59.52-98)

reserve lubricating oil transfer pump. A motor driven pump used to transfer oil from the clean lubricating oil storage tank to the lubricating oil sump or sump tank. (ANS-59.52-98)

Non-preferred variation (1) A designated area to which personnel access is controlled. (ANS-59.52-98)

Variant form: (ANS-3.8.1-87) (ANS-3.8.6-94)

reservoir. As used in this standard, a reservoir is an artificial impoundment or a lake with a controlled outlet. (ANS-2.13-79)

resident population. Those persons whose usual place of abode, as defined by the U.S. Bureau of the Census, is in the area. In general, this is the place where the persons live or sleep most of the time and is not necessarily the same as the place of legal residence. (ANS-2.6-81)

residual heat The total heat source remaining in a shutdown reactor, including after-heat (i.e., heat from radioactive decay of fuel plus heat stored in structural components). (ANS-58.3-1998)

residual liquid. Free liquid present in the specimen container at the time the specimen is removed from the container. (ANS-16.1-2003)

resolution. The degree to which equal values of a quantity can be discriminated by the device. (ANS-56.8-02)

respirable fraction (RF). The fraction of material made airborne, present in particulate form, that could be transported through the air, inhaled, and be deposited in the deep lung. (ANS-5.10-98)

resource expert. A technical expert with knowledge of a particular technical area of a PRA. (ASME/ANS RA-Sb-2013)

response. A reaction to a cue for action in initiating or recovering a desired function. (ASME/ANS RA-Sb-2013)

response force. An onsite team that includes guards, and may include other armed response individuals, with the duty to provide initial response, follow-up response or reinforcement for the purpose of neutralizing a security threat. (ANS-3.3-88)

response spectrum. A curve calculated from an earthquake accelerogram that gives the value of peak response in terms of acceleration, velocity, or displacement of a damped linear oscillator (with a given damping ratio) as a function of its period (or frequency). (ANS-2.27-2008) (ANS-2.29-2008) (ASME/ANS RA-Sb-2013)

response spectrum recorder. An instrument having the capability of sensing motion and permanently recording the spectral acceleration at specified frequencies and damping. (ANS-2.10-90)

response spectrum switch. An instrument having the capability of providing a signal that specified pre-set spectral accelerations have been exceeded. (ANS-2.10-90)

response time. The time required for the output to reach 90 percent of the final output value in response to a step input. (ANS-4.5-1980)

responsible nuclear power plant experience. Responsible nuclear power plant experience for a licensed senior operator is having actively performed as a licensed operator, a qualified nonlicensed operator or as power plant staff involved in day to day activities at a commercial nuclear plant facility (ANS-3.1-2014)

restoration models: representation of pre-initiator actions for returning systems or components back to an operational readiness state following tests, maintenance, calibrations or other causes of unavailability according to procedures. (ASME/ANS RA-S-1.4-2013)

Restricted area. *It is preferred that (**Radiation area**) and the associated definition be used in ANS standards*

Restricted area. An area to which public access is controlled for the purpose of protection of individuals from exposure to radiation and radioactive materials. (ANS-8.10-15)

Non-preferred variation (1):An area, access to which is limited by the licensee for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials. Restricted area does not include areas used as residential quarters, but separate rooms in a residential building might be set apart as a restricted area. (ANS-2.17-2010)

retaining structure failure. Failure of a dam, levee, breakwater, seawall, or similar confining structure, due to causes other than flood, earthquake or tsunami (since the retaining structure failure consequences must be included in the consideration of these natural hazards). (ANS-2.12-78) variant form: (ANS-2.19.89)

return period: The inverse of annual frequency of exceedance; see frequency of exceedance (ANS-2.30-2015).

reusable products. Software products such as component libraries, mathematical function libraries, graphics libraries and tools, parallel message-passing libraries, etc., developed by third-party software vendors or by open-source development teams. They may also include reusable software modules for applications, such as processing input, formatting, or displaying output. (Usually, the development, maintenance, and support for reusable products are provided by a central group or by an external organization. Care should be taken to ensure that any licensing restrictions are adhered to when using reusable products.) (ANS-10.7-2013)

review level earthquake (RLE). An earthquake larger than the plant SSE and is chosen in seismic margin assessment (SMA) for initial screening purposes. Typically, the RLE is defined in terms of a ground motion spectrum. (ASME/ANS RA-Sb-2013)

NOTE: A majority of plants in the eastern and midwestern U.S. have conducted SMA reviews for an RLE of 0.3g PGA anchored to a median NUREG/CR-0098 spectrum

rework. The process by which an item is made to conform to original requirements by completion or correction. (ANS-3.2-93)

Richardson number: A dimensionless number that expresses the ratio of potential to kinetic energy. (ASME/ANS RA-S-1.3-2016)

risk. Frequency and consequences of an event that answer the three fundamental safety questions. (1) What can go wrong? (2) How likely is it? (3) What are the consequences if it occurs? In PRA, risk is defined by a comprehensive set of event sequences, a quantitative assessment of the event sequence frequencies and their consequences, and an evaluation of the uncertainties in the assessments. (ANS-53.1-2011)

Non-preferred variation (1) Probability and consequences of an event, as expressed by the “risk triplet” that is the answer to the following three questions:

(a) What can go wrong?

(b) How likely is it?

(c) What are the consequences if it occurs?

(ASME/ANS RA-Sb–2013)

risk achievement worth (RAW) importance measure. For a specified basic event, risk achievement worth importance reflects the increase in a selected figure of merit when an SSC is assumed to be unable to perform its function due to testing, maintenance, or failure. It is the ratio or interval of the figure of merit, evaluated with the SSC's basic event probability set to one, to the base case figure of merit. (ASME/ANS RA-Sb–2013)

risk factors. Parameters related to a radiological risk assessment, e.g., proximity of a member of the public to a facility with subsurface contamination, interconnection between an aquifer and the facility's subsurface contamination, groundwater transport rates, direction of flow, dilution factors from local surface water bodies and/or groundwater flow, etc. (ANS-2.17-2010)

risk-informed approach. An approach to regulatory decision making represents a philosophy whereby risk insights are considered together with other factors to establish requirements that better focus licensee and regulatory attention on design and operational issues commensurate with their importance to health and safety. This approach enhances the traditional approach by (a) allowing explicit consideration of a broader set of potential challenges to safety; (b) providing a logical means for prioritizing these challenges based on risk significance, operating experience, and/or engineering judgment; (c) facilitating consideration of a broader set of resources to defend against these challenges; (d) explicitly identifying and quantifying sources of uncertainty in the analysis; and (e) leading to better decision making by providing a means to test the sensitivity of the results to key assumptions. Where appropriate, a risk-informed regulatory approach can also be used to reduce unnecessary conservatism in deterministic approaches or can be used to identify areas with insufficient conservatism and provide the bases for additional requirements or regulatory actions. (ANS-2.17-2010)

risk-informed decision process. A process that uses risk information and insights from PRA with traditional deterministic approaches and judgments to inform decisions. (ANS-53.1-2011)

risk-relevant consequences. The fire-induced failure of any risk-relevant target, or the fire-induced creation of environmental conditions that may complicate or preclude credited postfire operator actions. (ASME/ANS RA-Sb–2013)

risk-relevant damage targets. Any equipment item or cable whose operation is credited in the fire PRA plant response model or whose operation may be required to support a credited postfire operator action. (ASME/ANS RA-Sb–2013)

risk-relevant ignition source. Any ignition source considered in the fire PRA fire scenario definitions that could cause a fire that might induce a plant initiating event or adversely affect one or more damage targets. (ASME/ANS RA-Sb–2013)

risk significant equipment. Equipment associated with a significant basic event. (See also significant basic event.) (ASME/ANS RA-Sb–2013)

rock quality designation (RQD). An expression in percentage of intact core recovered during drilling operation. Rock quality designation (RQD) as defined by Deere (1963), p. 16.

RQD in % = 100 x length of core in pieces

4 in. and longer
length of core run

RQD (%)
Exceeding 90
90-75
75-50
50-25
less than 25

Quality Description
Excellent
Good
Fair
Poor
Very poor

Breakage due to drilling techniques or exposure to air should not be considered as natural breaks. (ANS-2.11-1989) (ANS-2.19-90)

rod. Those items of a spent fuel assembly which are long, thin walled tubes closed by end caps. A rod may either contain fuel (e.g., uranium, plutonium and fission products) or non-fuel material. (ANS-57.10-93)

rod consolidation. The process of reducing the spacing between rods. (ANS-57.9-2000) (See also rod reconfiguration) (ANS-57.10-2000)

rod removal. Pulling or pushing a rod out of a spent fuel assembly. Rods can be removed from a spent fuel assembly singularly, in groups, in rows, or all simultaneously. (ANS-57.10-2006)

root-sum-square uncertainty combination. A mathematical uncertainty calculation based on the error stack equal to the sum of the extreme tolerances. This rule greatly overestimates the stackup if the errors are truly statistical; thus, taking assumed tolerances, squaring each, summing them, and taking the square root produce a statistical tolerance. (ANS-53.1-2011)

rotation. Angular motion about a fixed axis. (ANS-57.1-92)

route of exposure. A specific scenario or pathway by which an individual or human receptor might be exposed to ionizing radiation or radioactive material. For the ingestion exposure pathway, the routes of exposure might include the ingestion of leafy vegetables, milk, water, fish, etc. (ANS-2.17-2010)

routine releases: Releases of pollutants that occur as part of normal facility operation and are not associated with unplanned events (ANS-2.15-2013).

run. The controlled resumption of simulation. (ANS-3.5-2009)

S.

safeguard (See engineered safety feature; the preferred term is engineered safety feature).
(G)

safeguards information. Information not otherwise classified as National Security Information or Restricted Data which specifically identifies an owner organization or applicants detailed (1) security measures for the physical protection of special nuclear material, or (2) security measures for the physical protection and location of certain plant equipment vital to the safety of production or utilization facilities. (ANS-3.3-88)

safe operation, safety. Actions and activities that pose no immediate hazard to the public or facility personnel. This specifically excludes “safety related” as detailed in 10 CFR 50. (ANS-40.37-2009)

safe shutdown. A unit shut-down with: (1) the reactivity of the reactor kept to a margin below criticality consistent with technical specifications; (2) the core decay heat being removed at a controlled rate sufficient to prevent core or reactor cool-ant system thermal design limits from being exceeded; (3) radioactive material releases controlled to keep doses within prescribed limits; and (4) items necessary to maintain these conditions, operating within their design limits. (ANS-58.14-93) (ANS-51.1/52.13)

Variant form: (ANS-5.6.1-90) (ANS-58.9-94)(ANS-56.11-88) (ANS-58.2)(ANS-58.3-1992) (ANS-59.1-1986) (ANS-59.4-W83)(ANS-58.6-91) (ANS-58.14-2011)

safe shutdown earthquake (SSE). An earthquake that is based upon evaluation of the maximum earthquake potential, considering regional and local geology and seismology and specific characteristics of local sub-surface material. It is the earthquake that produces the maximum vibratory ground motion for which safety-related structures, systems, and components (SSCs) are designed to perform their safety-related function. (ANS-51.1/52.1-1983)

Non-preferred variation (1) Variant form: (ANS-56.6-86) (ANS-57.1-92) (ANS-57.2-93) (ANS-57.2-99) (57.3-93) (ANS-56.6-86) (ANS-2.9-89) (ANS-2.13-79) (ANS-2.12-78)

Non-preferred variation (2) That earthquake for which certain SSCs are designed to remain functional. In the past, the SSE has been commonly characterized by a standardized spectral shape anchored to a PGA value. (ASME/ANS RA-Sb–2013)

safety. In the context of nuclear power plant design practice and standards, the quality of averting or not causing undue radiological effect on the health of the public. (ANS-56.10-87)

safety category (SC): For the purposes of this standard, three SCs are specified (SC-1, SC-2, and SC-3). SC-2 and SC-3 invoke specific design codes and standards that are intended to enhance the reliability and dependability of SSCs and SACs to which they are designed. SC-1 represents SSCs and SACs that are identified in hazard analysis but for which the unmitigated DBE consequences do not rise to the level of SC-2 or SC-3. (ANS-58.16-2014)

safe shutdown equipment list (SSEL). The list of all SSCs that require evaluation in the seismic-margins-calculation task of an SMA. Note that this list can be different from the seismic equipment list (SEL) used in a seismic PRA. (ASME/ANS RA-Sb–2013)

safe stable state. A plant condition, following an initiating event, in which RCS conditions are controllable at or near desired values. (ASME/ANS RA-Sb–2013)

safety analysis. (1) An analysis that simulates the integrated response of the plant to a design basis event (DBE) in order to confirm the functions of structures, systems and components are accomplished within their design basis and the nuclear safety criteria and safety analyses acceptance requirements are satisfied for the DBE.

Non-preferred variation (1) Variant form:(ANS-58.4-W90)(ANS-58.8-92)

Non-preferred variation (2) An analysis to confirm the adequacy of design once basic parameters including fundamental technology, TLSC, and reasonably likely events based on PRA have been developed. (ANS-53.1-2011)

safety class (SC). Classification structures, systems, or components (SSCs) based on their nuclear safety function. (ANS-51.1-1983/ANS-52.1-1983-1983) (56.2-89)

Non-preferred variation (1) Variant form: (ANS-56.4-83) (ANS-59.2-85)(ANS-59.3) (ANS-2.9-89)(ANS-2.17-89)(G)

safety classification. *It is preferred that the term (safety class) and the associated definition be used in ANS standards*

Non-preferred variation (1) Components shall be classified as Safety Class 3 or as Non-Nuclear Safety (NNS) in accordance with definitions set forth in section 3.3 of American National Standards Nuclear Safety Criteria for the design of Stationary Pressurized Water Reactor Plants, ANSI/ANS-51.1-1983[1], and Nuclear Safety Criteria for the Design of Stationary Boiling Water Reactor Plants, ANSI/ANS-52.1-1983 [2]. (ANS-57.2-99)

Non-preferred variation (2) Variant form: (ANS-57.1-92) (ANS-57.2-D93)(ANS-57.3-93)

Non-preferred variation (3) Components shall be classified as Safety 2, Safety Class 3, or as Non-Nuclear Safety (NNS) in accordance set forth in American National Standards Nuclear Safety Criteria for the design of Stationary Pressurized Water Reactor Plants, ANSI/ANS-51.1-1983[1], and Nuclear Safety Criteria for the Design of Stationary Boiling Water Reactor Plants, ANSI/ANS-52.1-1983 [2]. A single system may have components in more than one class. (ANS-57.3-93)

safety criteria. Criteria that are to be met to conform to top level design criteria (TLDC) during a design-basis accident (DBA), based on safety analysis. (ANS-53.1-2011)

safety division. The terms division, train, and separation group, when used in this context, are interchangeable. The designation applied to a given system or set of nuclear safety-related components that enable the establishment and maintenance of physical, electrical, and functional independence from other components. (ANS-59.4-79W83)

safety features. *It is preferred that the term (Engineered Safety Feature) and the associated definition be used in ANS standards*

safety features. Active and passive design features that are provided in the design of a plant specifically to perform a safety function. Active safety features involve mechanical action or motion to perform the safety function that requires application of external motive power such as electric or hydraulic power. Passive safety features perform their safety function without any active SSCs or externally applied motive power. Some safety features involve a combination of passive safety features and inherent reactor characteristics. In modular helium-cooled reactors (MHRs), examples of passive safety features normally include a negative coefficient of reactivity and a capability to remove decay

heat via conduction, convection, and radiation heat transfer principles. Examples of active safety features include forced circulation core cooling systems and electrically powered reactor building filtration systems. (ANS-53.1-2011)

safety features: Design features of a reactor that are provided specifically to support one or more safety functions or to support another SSC that provides a safety function. (ASME/ANS RA-S-1.4-2013)

safety features, engineered: Safety features applied in the design of reactor systems in addition to the selection of materials and design characteristics of the reactor fuel, reactor coolant, and moderator (if any) that support one or more safety functions. Engineered safety features may involve the use of active and/or passive SSCs. (ASME/ANS RA-S-1.4-2013)

safety features, inherent: Reactor safety features applied in the design of a reactor that are fundamental to the selection of materials and design characteristics of the reactor fuel, reactor coolant, and moderator (if any) and that support one or more safety functions and thereby support the integrity of one or more radionuclide transport barriers. (ASME/ANS RA-S-1.4-2013)

safety function *It is preferred that the term (**nuclear safety function**) and the associated definition be used in ANS standards*

Non-preferred variation (1) Any function that is necessary to assure: (1) the integrity of the reactor coolant pressure boundary or primary coolant boundary, (2) the capability to shut down the reactor and maintain it in a safe shutdown condition, or (3) the capability to prevent or mitigate the consequences of conditions of design which could result in potential offsite exposures that are a significant fraction of 10 CFR 100, "Reactor Site Criteria", guideline exposures. (Footnote references ANS-51.1/52.1 for functions associated with each safety class) (G)(ANS-2.9-89)(ANS-2.17-89) (ANS-56.6)(ANS-58.2) (ANS-58.9-94)

Non-preferred variation (2) Functions provided in the design to prevent and mitigate accidents and assure that top-level regulatory criteria (TLRC) are met under all conditions. Those functions necessary and sufficient to assure that the top-level safety criteria (TLSC) are met in the design-basis event (DBE) portion of the frequency – consequence (F-C) curve and regulatory dose limits for deterministically selected design-basis accidents (DBAs) are met. (ANS-53.1-2011)

Non-preferred variation (3) Function that must be performed to control the sources of energy in the plant and radiation hazards. (ASME/ANS RA-Sb–2013)

Non-preferred variation (4) For the purposes of this standard, the function of an SSC, SAC, or a part that is relied upon, during or following a DBE, to ensure the following are met:

- the integrity of the engineered safety system or administrative control;
- the capability to place and maintain the facility in a safe condition; or
- the capability to prevent or mitigate the consequences of accidents that could result in potential exposures comparable to the guideline exposures in regulatory requirements. (ANS-58.16-2014)

safety, non-nuclear. (see non-nuclear safety [NNS]).

safety-related (Q). *It is preferred that the term (nuclear safety-related) and the associated definition be used in ANS standards*

Non-preferred variation (1)

Classification applied to:

- (1) an item relied upon to remain functional during or following a design basis event to ensure a safety-related function; or
- (2) documented information that specifies or establishes parameters required to ensure a safety-related function of an item; or
- (3) services (to design, purchase, fabricate, handle, ship, store, clean, erect, install, inspect, test, operate, maintain, repair, refuel, and modify) that ensure a safety-related function of an item. (ANS-58.14-2011)

Variant form: (ANS-2.9-89)(ANS-2.11-78)(ANS-2.17-89) (ANS-57.1-92) (ANS-57.2-93) (ANS-57.3-93) (ANS-59.2-89) (ANS-59.3) (G)

Non-preferred variation (2) Applies to a function, SSC, or part that is relied upon during or following a DBE to ensure these functions⁵⁾:

- (1) the integrity of the RCPB;
- (2) the capability to shut down the reactor and maintain it in a safe shutdown condition; or

Non-preferred variation (3) the capability to prevent or mitigate the consequences of accidents that could result in potential off-site exposures comparable to the guideline exposures in 10 CFR 50.34(a)(1) [7], 10 CFR 50.67(b)(2) [8], or 10 CFR 100.11 [9], as applicable. To avoid confusion, only the term “safety-related” is used in this standard. The term “safety” is not to be used as a synonym for “safety-related” but is to be used in a broader sense only when necessary.

Footnote: (5) Parts (1), (2), and (3) are the three basic safety-related functions.

(ANS-58.14-2011)

Non-preferred variation (4) Classification for plant SSCs relied on to perform safety functions for design-basis accidents(DBAs). (ANS-53.1-2011)

safety-related control air system. *It is preferred that term (**safety-related control air**) and the associated definition be used in ANS standards*

safety-related air-operated device. An air-operated device which is relied upon to ensure or support the operation of safety systems as defined in N18.2-1973, Section 2.2 additional guidance on definitions of safety systems has been formulated and exists in draft form. (ANS-59.3)

safety-related control air system. An air supply system which distributes instrument quality control air to Type "A" safety related devices. Safety-related air-operated devices are here further categorized by: (1) Type "A"--Those safety-related air operated devices which require the continued presence of supply air in order to accomplish their safety-related function;(2) Type "B"--Those safety-related air operated devices which do not require the continued presence of supply air in order to accomplish their safety-related function. These devices are fail safe relative to the loss of the air supply. A safety-related air-operated

device is further defined to include the operator, i.e., diaphragm, air motor, cylinder, and accessories such as tubing, solenoid pilot, etc. (ANS-59.3)

safety-related intake. An intake which is part of the system that delivers water from the ultimate heat sink to the plant. (ANS-2.13-79)

safety-related function. *It is preferred that preferred term (**nuclear safety function**) and the associated definition be used in ANS standards*

safety-related function. A function that is relied upon during or following a design basis event to ensure¹:

(1) the integrity of the reactor coolant pressure boundary;

(2) the capability to shut down the reactor and maintain it in a safe shutdown condition; or

(3) the capability to prevent or mitigate the consequences of accidents that could result in potential off-site exposures comparable to the guideline exposures of 10 CFR 100.11. (See 10 CFR 21, 10 CFR 50.49, and Appendix A of 10 CFR 100.) (¹) Parts (1) and (2) and (3) are the three basic safety-related functions. (ANS-58.11-93) (ANS-51.1/52.1-93)(58.14-93)

Variant form: (ANS-56.2-84)(ANS-58.8-92)

safety-related operator action. A manual action required by plant emergency procedures that is necessary to cause a safety-related system to perform its safety-related function during the course of any DBE. A safety-related operator action can involve one or more discrete manipulations or steps. In addition, its successful performance can require that the discrete steps be performed in a specific order. An example of a safety-related operator action is the initiation of safety-related cooling water flow. An example of a safety-related operator action that requires more than one discrete manipulations or steps to be accomplished in a specific order is the initiation of safety-related cooling water flow to an isolated heat exchanger for which operation is required to accomplish a safety-related function. (ANS-58.8-93)

safety supporting systems. Safety supporting systems are those systems which provide the services necessary to a safety-related fluid system to enable that system to complete its intended safety function. Examples of safety supporting systems for the emergency core cooling system include the component and process cooling system, the electric power supply system, and the emergency core cooling system equipment ventilation system. (ANS-58.9-04)

Variant form: (ANS-4.1)

safety system. Systems that provide one or more safety functions. (ANS-53.1-2011)

Non-preferred variation (1) Those systems that are designed to prevent or mitigate a design-basis accident. (ASME/ANS RA-Sb-2013)

Non-preferred variation (2)

safety systems (IEEE Std 603) Those systems that are relied upon to remain functional during and following design basis events to ensure: (i) the integrity of the reactor coolant pressure boundary; (ii) the capability to shut down the reactor and maintain it in a safe shutdown condition; or, (iii) the capability to prevent or mitigate the consequences of

accidents that could result in potential offsite exposures comparable to the 10 CFR 100 guidelines.

NOTE: In this standard, safety systems are equivalent to the definition of safety related systems as defined in ANSI/ANS-51.1-1983 and ANS-52.1-1983,

(ANS-7-4.3.2)

sample. A single item or specimen from a larger whole or group taken for the purpose of estimating properties or composition of the larger whole or group. (ANS-41.5-2012)

sampler. That portion of the monitoring system that provides a representative sample of the fluid stream for the detector to monitor. (ANS-6.8.2-86)

sampling. The process of obtaining representative samples and/or measurements of a subset of a population. (ANS-41.5-2012)

Non-preferred variation (1) A method of choosing a representative number or amount from a larger number or amount. (ASME/ANS RA-S-1.3-2016)

sampling station radioactive waste. Liquids originating from operation of centralized reactor and reactor auxiliary system sampling stations. (ANS-55.6-93) (ANS-55.6-99)

saturated zone. The zone in the subsurface where the pores are filled with water (phreatic zone plus capillary zone). (ANS-2.17-2010)

scattered gamma rays. The term scattered gamma rays is used to describe all gamma rays which have undergone scattering interactions in transit between the source volume and receptor locations. This category includes air scattering, ground scattering, and scattering through or off any intervening structures or shields. (ANS-6.6.1-2015)**scenario.** Any set of simulator operations performed in accordance with a lesson plan or guide for the purpose of familiarization, training, or examination of operators.

SCRAM. Safety Control Rod Axe Man – a sudden shut down of a reactor, typically by the rapid insertion of control rods. (For information only; not defined in ANS standards to date)

screening. A process that eliminates items from further consideration based on their negligible contribution to the probability of an accident or its consequences. (ASME/ANS RA-Sb-2013)

screening criteria. The values and conditions used to determine whether an item is a negligible contributor to the probability of an accident sequence or its consequences. (ASME/ANS RA-Sb-2013)

sealed closed isolation valve. A valve that is in a closed position by administrative controls by any of the following methods:

- (1) A mechanical device sealing or locking the valve in the closed position; and,
- (2) A normally closed valve with a seal or lock on any manual override if present and a seal or lock on the power breaker or power source in a manner that prevents power from being supplied to the valve. (ANS-56.2-84)

seasonal population. The seasonal population of an area consists of those people occupying "seasonal housing units" as defined by the U.S. Bureau of the Census. Briefly, these are units intended for occupancy only during a season of the year. (ANS-2.6-81)

secondary alarm station (SAS). A continuously manned station, not necessarily on site, equipped with alarm monitoring and communications equipment that provide a backup capability for the central alarm station functions. (ANS-3.3-88)

secondary calibration. A procedure which is followed periodically after a primary calibration on each area monitor channel to ensure that the response of the channel remains accurate within certain prescribed limits. (ANS-6.8.1-81)

secondary combustible. Combustible or flammable materials that are not a part of the fire ignition source that may be ignited if there is fire spread beyond the fire ignition source. (ASME/ANS RA-Sb-2013)

secondary containment. The structure, or structures, that acts as a barrier, after the primary containment, so that radioactive material leakage from the primary containment or engineered safety features during or following design basis accidents can be collected and processed before release to the external environment. It might include the reactor building, access closures, and penetrations of systems that directly communicate with the secondary containment atmosphere. (ANS-58.14)

Variant form: (ANS-56.4-83) (ANS-2.2-88)(ANS-51.1/52.1-93) (ANS-58.14-2011)

secondary containment atmosphere. The gaseous portion of the net free volume contained within the secondary containment pressure boundary and outside the primary containment pressure boundary. (ANS-56.4-83)

secondary criticality control. A method of criticality control that supplements a primary criticality control and provides backup for the unlikely case where the primary control fails. (ANS-8.5-86)

secondary design function. A function of a structure, system or component (SSC) that is not a primary design function but is required because of its position within the plant design. (e.g., a system that was included in the plant design to perform a primary design function such as emergency core cooling might also be required to perform secondary design functions such as reactor coolant pressure boundary integrity and primary containment isolation.) (ANS-58.14-93)

secondary reactor containment. *It is preferred that preferred term (**secondary containment**) and the associated definition be used in ANS standards* (ANS-51.2/52.1-93)

Non-preferred variation (1) The structure surrounding the primary reactor containment that acts as a further barrier to control the release of radioactive material. (ANS-2.2-88) (ANS-51.1)(ANS-52.1)(ANS-56.4-83) (G)

Variant form: (ANS-56.7)

secondary shielding. The secondary shielding is the shielding in the reactor building provided to attenuate the gamma-ray radiation and neutron radiation, if present, emanating from the primary coolant system external to the reactor vessel. The secondary shielding typically includes the crane wall in pressurized water reactors (PWRs) the drywell wall in boiling water reactors (BWRs) and the reactor building walls. (ANS-6.3.1-87)

secondary system. Equipment in the condensate, feedwater, and steam cycle of the plant. Secondary system does not include condenser cooling water systems. (ANS-55.6)

secondary waste. Waste generated as a byproduct from operation of the MRWP, or separated from the raw waste, which must be handled, processed, and disposed of in

accordance with local and federal regulations (e.g., concentrates, wet waste, dry active waste, and toxic chemicals). (ANS-40.37-2009)

secure development environment. The condition of having appropriate physical, logical, and programmatic controls during the system development phases (i.e., concepts, requirements, design, implementation, and testing) to ensure that unwanted, unneeded, and undocumented functionality (e.g., superfluous code) is not introduced into digital safety systems. (ANS-10.8-2015)

secure operating environment. The condition of having appropriate physical, logical, and administrative controls within a facility to ensure that the reliable operation of digital safety systems is not degraded by undesirable behavior of connected systems and events initiated by inadvertent access to the system. (ANS-10.8-2015)

security force. An onsite subentity of the security organization, which includes guards and may include watchmen and armed response individuals, directly responsible for performing operational requirements pursuant to the physical security plan. (ANS-3.3-88)

security organization. Personnel who perform physical security management or operational requirements pursuant to the physical security plan. (ANS-3.3-88)

segmented plume model: A model in which the plume is separated into segments downwind that enable spatial and temporal changes in trajectory and dispersion. (ASME/ANS RA-S-1.3-2016)

seiche. Oscillations of enclosed or semi-enclosed water bodies in response to a disturbing force such as pressure changes, wind stress and seismic motions. (ANS-2.19-89)

Non-preferred variation (1) Variant form:(ANS-2.12-78)(ANS-2.13-79)

seismically-analyzed piping. Piping, which is not required to be Seismic Category I, but has been determined to be able to accommodate seismic loadings. (See also definition of "seismically analyzed B31.1 piping" in ANSI/ANS-58.2-1988.) (ANS-56.11-88)

seismic Category I. The classification of an item that is designed to perform at least one function (i.e., safety-related or non-safety-related) during or following a safe shutdown earthquake (SSE)² (ANS-58.14-93) (ANS-58.14-2011)

Footnote: (2) See EPRI ALWR Utility Requirements Document and Regulatory Guide 1.29.

(ANS Standards currently use different approaches in different standards. A single approach needs to be agreed up at the SB/CC level).

Non-preferred variation (1) The category of nuclear safety related structures, systems, and components that are required to perform their nuclear safety function during or after an SSE as necessary to accommodate any event involving an SSE. (ANS-57.2-99)

Non-preferred variation (2) The category of structures, systems, and components that are designed to perform at least one function during or after a safe shutdown earthquake (SSE).

Non-preferred variation (3) Variant form:(ANS-2.9-89)(ANS-2.13-79)(ANS-51.1/52.1)(ANS-54.2-85) (ANS-56.1-85)(ANS-56.5-87)(ANS-56.6-86)(ANS-56.7)(ANS-57.1-92)(ANS-57.2-93) (ANS-58.2)(ANS-59.2-92)

seismic category I structure. A structure that is designed to remain functional during and following the safe shutdown earthquake (SSE).(ANS-58.3)

(ANS Standards currently use different approaches in different standards. A single approach needs to be agreed up at the SB/CC level)

seismic category II. The classification of an item that is not Seismic Category I but whose failure mode could prevent a safety-related function during or following a SSE. (ANS-58.14-2011) *(ANS Standards currently use different approaches in different standards. A single approach needs to be agreed up at the SB/CC level)*

Non-preferred variation (1) The classification of an item that is not Seismic Category I but is designed to prevent at least one failure mode during or following an SSE³. **Non-preferred variation (2)** Footnote:) See EPRI ALWR Utility Requirements Document and Regulatory Guide 1.29; (ANS-58.14-93)

seismic data retrieval. An instrument having the capability of sensing motion and permanently recording the spectral acceleration at specified frequencies and damping. (ANS-2.10-90)

seismic design category (SDC). A category assigned to an SSC that is a function of the severity of adverse radiological and toxicological effects of the hazards that may result from the seismic failure of the SSC on workers, the public, and the environment. SSCs may be assigned to SDCs that range from 1 to 5. For example, a conventional building whose failure may not result in any radiological or toxicological consequences is assigned to SDC 1; a safety-related SSC in a nuclear material processing facility with a large inventory of radioactive material may be placed in SDC 5. In this Standard, the term SDC has a different meaning than in the International Building Code. ANSI/ANS-2.26-2004[1] provides guidance on the assignment of SSCs to SDCs. (ANS-2.27-2008) (ANS-2.29-2008)

(ANS Standards currently use different approaches in different standards. A single approach needs to be agreed up at the SB/CC level)

Non-preferred variation (1) A category assigned to an SSC that is a function of the severity of adverse radiological and toxicological effects of the hazards that may result from the seismic failure of the SSC on workers, the public, and the environment. SSCs may be assigned to SDCs that range from 1 through 5. For example, a conventional building whose failure may not result in any radiological or toxicological consequences is assigned to SDC-1; a safety-related SSC in a nuclear material processing facility with a large inventory of radioactive material may be placed in SDC-5. In this standard, the term SDC has a different meaning than in the International Building Code. ANSI/ANS-2.26-2004 (R2010) [2] provides guidance on the assignment of SSCs to SDCs (ANS-2.30-2015).

seismic equipment list (SEL). The list of all SSCs that require evaluation in the seismic-fragilities task of a seismic PRA. Note that this list can be different from the SSEL (Safe Shutdown Equipment list) used in an SMA (Seismic Margin Assessment). (ASME/ANS RA-Sb-2013)

seismic margin. Seismic margin is expressed in terms of the earthquake motion level that compromises plant safety, specifically leading to severe core damage. The margin concept can also be extended to any particular structure, function, system, equipment item, or component for which “compromising safety” means sufficient loss of safety function to contribute to core damage either independently or in combination with other failures. (ASME/ANS RA-Sb-2013)

seismic margin assessment (SMA). The process or activity to estimate the seismic margin of the plant and to identify any seismic vulnerabilities in the plant. This is described further in Part 10 and Nonmandatory Appendix 10-A. (ASME/ANS RA-Sb–2013)

seismic source. Faults or volumes within the earth where future earthquakes are expected to occur. In a PSHA, all seismic sources with a potential to contribute significantly to the hazard are considered. (ANS-2.27-2008) (ANS-2.29-2008)

Non-preferred variation (1) A general term referring to both seismogenic sources and capable tectonic sources. A seismogenic source is a portion of the Earth assumed to have a uniform earthquake potential (same expected maximum earthquake and recurrence frequency), distinct from the seismicity of the surrounding regions. A capable tectonic source is a tectonic structure that can generate both vibratory ground motion and tectonic surface deformation such as faulting or folding at or near the Earth's surface. In a probabilistic seismic hazard analysis (PSHA), all seismic sources in the site region with a potential to contribute to the frequency of ground motions (i.e., the hazard) are considered. (ASME/ANS RA-Sb–2013)

seismic source characteristics. The parameters that characterize a seismic source for PSHA, including source geometry, probability of activity, maximum magnitude, and earthquake recurrence. (ANS-2.27-2008) (ANS-2.29-2008) (ANS-2.30-2015)

seismic spatial interaction. An interaction that could cause an equipment item to fail to perform its intended safety function. It is the physical interaction of a structure, pipe, distribution system, or other equipment item with a nearby item of safety equipment caused by relative motions from an earthquake. The interactions of concern are

- (a) proximity effects
- (b) structural failure and falling
- (c) flexibility of attached lines and cables (ASME/ANS RA-Sb–2013)

seismic switch. An instrument capable of providing a signal that a specified preset acceleration has been exceeded. Seismic switches set at low g levels (i.e., 0.01 - 0.02 g) are used to activate time-history accelerographs; in this function they are referred to as seismic triggers. (ANS-2.10-90)

seismic trigger (S/T). A device that starts the time-history accelerograph (T/A) after a preset acceleration has been exceeded. (ANS-2.2-02)

seismogenic crust. The brittle portion of the earth's crust capable of generating earthquakes. (ANS-2.27-2008) (ANS-2.29-2008)

seismotectonic. Rock-deforming processes and resulting structures and seismicity that occurs over large sections of the earth's crust and upper mantle. (ANS-2.27-2008) (ANS-2.29-2008)

Non-preferred variation (1) The role of seismicity in tectonics, including regionally significant geologic structures generated by earthquakes and the time/space variations in the processes or structures (ANS-2.30-2015).

seismotectonic province. A region characterized by a relative consistency of geologic structures and associated earthquake activity. (ANS-2.19-89)

semi-infinite medium. A body of which the outer boundary is considered to be effectively at an infinite distance from the inner region. (ANS-16.1-03)

Senior Seismic Hazard Analysis Committee SSHAC. A committee sponsored by the NRC, DOE and EPRI to assess the amount and origins of differences between various PSHA methods of analysis. SSHAC [1] concluded that most of the differences were consequences of differences in the process of elicitation of the information from experts. SSHAC made recommendations on the process, which are now almost uniformly adopted by analysts worldwide. (ANS-2.29-2008)

senior operator. An individual licensed under 10 CFR 55 to manipulate the controls of a facility and to direct the licensed activities of licensed operators. (ANS-3.4-94)

sensitivity.

(1) The capability of sensor to respond to change.

(2) The ratio of the change in output magnitude to the change of the input which causes it after the steady state has been reached. It is expressed as a ratio with the units of measurement of the two quantities stated (e.g., cpm/ μ Ci/ml). The ratio is constant over the range of a linear device. For a nonlinear device, the applicable input level must be stated. (ANS-6.8.2-86)

sensor accuracy: The accuracy of the sensor used to make a meteorological measurement. Sensor accuracy can be based on manufacturer specifications, test results, or direct comparison with a standard (i.e., calibration) (ANS-3.11-2015).

service conditions. The combination of normal and abnormal operations and the design basis events for which the control air system is relied upon to provide, or maintain its capability to provide, its nuclear safety function. (ANS-59.3-83)

service environment. The aggregate of conditions (e.g., temperature, pressure, humidity, radioactivity, and chemical) surrounding the components while performing functions as required by the conditions of design. (ANS-56.6-86)

service life. The total accumulated operating time of a system or component including all occurrences that are part of its design basis such as testing and maintenance or transient conditions. (ANS-56.1-D85)

severe accident. An accident that involves extensive core damage and fission product release into the reactor vessel and containment, with potential release to the environment (ASME/ANS RA-Sb-2013)

severe accident management guidelines: guidelines developed to provide steps that can be taken to mitigate accident progression after transition from the emergency operating procedures because of more severe conditions, e.g., core damage. (ASME/ANS RA-S-1.2-2015)

severe environmental load. Load that could infrequently be encountered during the operating life of a nuclear power plant. (ANS-2.12-78)

severe natural phenomena. Those conditions postulated as the most severe that can reasonably be derived from the history and properties of the site and surroundings (e.g., probable maximum flood, probable maximum hurricane, tornado, tsunami, seiche, earthquake, minimum water availability). (ANS-56.2-84)

severity factor. Severity factor is the probability that fire ignition would include certain specific conditions that influence its rate of growth, level of energy emanated, and duration (time to self-extinguishment) to levels at which target damage is generated (ASME/ANS RA-Sb-2013)

Shall. *It is preferred that the term (**Shall, Should and May**) be defined in a single definition at the beginning of the definitions section in ANS standards.*

shall, should and may. The word "shall" is used to denote a requirement; the word "should" to denote a recommendation; and the word "may" to denote permission, neither a requirement nor a recommendation. (ANS-2.2-02)(ANS-2.9-89) (ANS-2.10-90) (ANS-2.17-2010) (ANS-2.21-2012) (ANS-2.27-2008) (ANS-2.29-2008) (ANS-3.1-87) (ANS-3.2-93)(ANS-3.4-87) (ANS-3.4-94)(ANS-3.5-85) (ANS-3.5-2009) (ANS-3.7.1-95) (ANS-3.7.2-79) (ANS-3.7.3-79) (ANS-3.8.2-95) (ANS-3.8.4-95) (ANS-5.1-2014) (ANS-5.4-2011)(ANS-5.6.1-D90) (ANS-5.10-98) (ANS-3.11-00) (ANS-6.1.2-2013) (ANS-6.6.1-2015) (ANS-6.7.1 85) (ANS-10.7-2013) (ANS-10.8-2015) (ANS-15.16-2015) (ANS-15.21-2012) (ANS-40.37-2009) (ANS-41.5-2012) (ANS-53.1-2011) (ANS-54.1-89) (ANS-55.4-93) (ANS-55.4-99) (ANS-55.6-93) (ANS-55.6-99)(ANS-56.11-88) (ANS-57.5) (ANS-57.5-96) (ANS-58.4-W90) (ANS-58.3) ANS-58.3-98) (ANS-58.6-94) (ANS-58.9-94) (ANS-58.14-2011) (ANS-59.52-93) (ANS-59.52-98) (Note: For the ANS-8 Standards: ANS-8.1, 8.5, 8.10, 8.15, 8.19, 8.20, 8.22, 8.23, 8.24, 8.26, and 8.27 all have the preferred wording. ANS-8.3, 8.6, 8.7, 8.12, 8.14, 8.17, and 8.21 have the variant form with the "To conform" phrase. It is the intent of NCSCC to have all of the ANS-8 standards move to the preferred wording. This will be done as they are revised.)

Non-preferred variation (1)

shall. Denotes a requirement. (ANS-56.2-84)(ANS-3.3-88) (ANS-16.1-03) (ANS-57.8-93) (ANS-58.8) (ANS-58.2)

Variant form: **shall.** Used to state a mandatory requirement. (ASME/ANS RA-Sb-2013)

Non-preferred variation (2) Included: In order to comply with this standard, the design shall conform to its requirements, but not necessarily with its recommendations. (ANS-57.2-99) (ANS-57.3-93)

Variant form: (ANS-55.1-92)(ANS-54.2-85) (ANS-57.2-92)(ANS-6.6.1-79) (ANS-6.3.1-87)(ANS-6.8.1-81) (ANS-8.3-91)(ANS-8.5-86) (ANS-8.6-83)(ANS-8.7-75) (ANS-8.10-83) (ANS-56.8-02) (ANS-57.1-92) (ANS-57.3-93) (ANS-55.1-92) (ANS-55.6)(ANS-56.2)(ANS-57.9-92)(ANS-58.3-92)(ANS-58.11-93) (ANS-58.14-93)(ANS-59.3-83)(ANS-57.7-92)(ANS-57.10-93) (ANS-51.1/52.1-93)(ANS-59.3-83) (ANS-3.8.1-93) (ANS-3.8.2-93)(ANS-3.8.3-93) (ANS-3.8.4-93)(ANS-3.8.5-D92) (ANS-2.11-78)(ANS-2.17-89) (ANS-4.1)(51.1)(ANS-56.3-86) (ANS-56.6-86)(ANS-56.8-02) (ANS-59.1) (ANS-59.3)(ANS-59.4-79W83)(ANS-2.6-81D) (ANS-59.4)(ANS-2.8.92) (ANS-58.12-85)(ANS-59.51-89) (ANS-56.10-87)(ANS-2.19-89) (ANS-2.7-89)(ANS-2.13-79)

short-lived isotopes. Radionuclides with half-lives of less than eight days. (ANS-55.1-92)

sheltering: Response to an emergency at a facility involving the recommendation that part of the population surrounding the facility remain indoors with the windows closed for the time during which the plume of material is passing through the location. (ASME/ANS RA-S-1.3-2016)

shielding: Protection from radiation exposure afforded by a structure. Shielding for gamma shine from the passing cloud of material, for gamma shine from material deposited on the ground, or for inhalation of material are possible avenues of protection (ASME/ANS RA-S-1.3-2016)

short term. In the context of the single failure criterion, that period of time that a safety-related system must operate up to 24 hours following the initiating event. For purposes of design of the emergency core cooling and containment spray systems, the short term might terminate upon transfer of these systems from the short term cooling mode. The concept of short term and long term does not apply to electrical systems or components. (ANS-51.1/52.1-93)

Variant form: (ANS-51.7)(G) (ANS-56.5-87) (ANS-56.10-87) (ANS-58.9-94)

Should *It is preferred that the term (**Shall, Should and May**) be defined in a single definition at the beginning of the definitions section in ANS standards.*

Non-preferred variation (1)

should. Denotes a recommendation. (ANS-16.1-03) (ANS-57.8-93) (ANS-56.2-84) (ANS-3.3-88) (ANS-58.8-92)

Variant form: **should.** Used to state a recommendation. (ASME/ANS RA-Sb–2013)

shutdown. The procedure of making a nuclear reactor sub-critical (i.e., shutdown) or the state of a nuclear reactor after being made sub-critical (i.e., shutdown). (ANS-51.1/52.1-93)(ANS-59.1)

Non-preferred variation (1) the collection of POSs during which the reactor is subcritical. This term is interchangeable with the term outage. (Also see the related term, “controlled shutdown”). (ANS/ASME-58.22-2015)

shutdown heat removal system. A system that removes residual decay and sensible heat from the reactor coolant system when the reactor is shutdown. (ANS-58.11-93)

shut down the reactor. *It is preferred that term (**Shutdown**) and the associated definition be used in ANS standards*

shut down the reactor. Insert negative reactivity into the reactor core to make it sub-critical. (ANS-58.14-93) (ANS-58.14-2011)

shutdown, safe. It is preferred that the term (**safe shutdown**) and the associated definition be used in ANS standards.

sigma phi: The standard deviation of the vertical wind direction (ANS-3.11-2015).

sigma theta: The standard deviation of the horizontal wind direction (ANS-3.11-2015).

signature: a unique characteristic of the physical response of the plant to a particular accident scenario. Signatures can take many different forms, but the most common is a time-dependent plot of a calculated parameter from an integrated severe accident analysis computer code. For example, the calculated, time-dependent pressure of the reactor pressure vessel is a unique “signature” of the accident sequence. (ASME/ANS RA-S-1.2-2015)

significant. A level of anticipated impact on or change of a parameter or result which is or would be sufficient to prompt a change in facility design or operation because the integrity, reliability, function, or sufficiency of a system, component, or structure would not fulfill its intended purpose. (ANS-56.10-87)

Variant form: (ANS-56.4-83)

Significant Accident Progression sequence. *It is preferred that the term (**significant accident sequence**) and the associated definition be used in ANS standards*

Significant Accident Progression sequence. One of the set of accident sequences contributing to large early release frequency resulting from the analysis of a specific hazard group that, when rank-ordered by decreasing frequency, sum to a specified percentage of the large early release frequency, or that individually contribute more than a specified percentage of large early release frequency for that hazard group. For this version of the Standard,³ the summed percentage is 95% and the individual percentage is 1% of the applicable hazard group. (See Part 2 Requirements LE-C3, LE-C4, LE-E5, LE-C10, LE-C12, LE-D1, LE-D4, LE-D5, LE-D7, and LE-E2.) For hazard groups that are analyzed using methods and assumptions that can be demonstrated to be conservative or bounding, alternative numerical criteria may be more appropriate, and, if used, should be justified.

Footnote: (3) Alternative criteria may be appropriate for specific applications. In particular, an alternative definition of “significant” may be appropriate for a given application where the results from PRA models for different hazard groups need to be combined.

(ASME/ANS RA-Sb–2013)

(For this and subsequent definitions, Part 2 and the alphanumeric index numbers refer to ASME/ANS RA-Sb–2013 which make the definition unique to this standard)

significant accident sequence. One of the set of accident sequences resulting from the analysis of a specific hazard group, defined at the functional or systematic level, that, when rank-ordered by decreasing frequency, sum to a specified percentage of the core damage frequency for that hazard group, or that individually contribute more than a specified percentage of core damage frequency. For this version of the Standard,³ the summed percentage is 95% and the individual percentage is 1% of the applicable hazard group. (See Part 2 Requirements IE-B3, HR-H1, QU-B2, QU-C1, QU-D1, QU-D5, and QU-F2.) For hazard groups that are analyzed using methods and assumptions that can be demonstrated to be conservative or bounding, alternative numerical criteria may be more appropriate, and, if used, should be justified

Footnote: (3) Alternative criteria may be appropriate for specific applications. In particular, an alternative definition of “significant” may be appropriate for a given application where the results from PRA models for different hazard groups need to be combined.

(ASME/ANS RA-Sb–2013)

(For this and subsequent definitions, Part 2 and the alphanumeric index numbers refer to ASME/ANS RA-Sb–2013 which make the definition unique to this standard)

significant basic event. A basic event that contributes significantly to the computed risks for a specific hazard group. For internal events,³ this includes any basic event that has an FV importance greater than 0.005 or a RAW importance greater than 2. (See Part 2 Requirements DA-C13, DA-D1, DA-D3, DA-D5, DA-D8, HR-D2, and HR-G1.) For hazard groups that are analyzed using methods and assumptions that can be demonstrated to be conservative or bounding, alternative numerical criteria may be more appropriate, and, if used, should be justified.

Footnote 3 applies.(ASME/ANS RA-Sb–2013)

(For this and subsequent definitions, Part 2 and the alphanumeric index numbers refer to ASME/ANS RA-Sb–2013 which make the definition unique to this standard)

significant containment challenge. A containment challenge that results in a containment failure mode that is represented in a significant accident progression sequence. (ASME/ANS RA-Sb–2013)

significant contributor. In the context of

(a) an internal events accident sequence/cutset, a significant basic event or an initiating event that contributes to a significant sequence

(b) accident sequences/cutsets for hazard groups other than internal events, the following are also included: the hazard source, hazard intensity, and hazard damage scenario; for example, for fire PRA, fire ignition source, physical analysis unit, or fire scenario that contributes to a significant accident sequence would also be included

(c) an accident progression sequence, a contributor that is an essential characteristic (e.g., containment failure mode, physical phenomena) of a significant accident progression sequence, and if not modeled would lead to the omission of the sequence. (ASME/ANS RA-Sb–2013)

significant cutset. One of the set of cutsets resulting from the analysis of a specific hazard group that, when rank ordered by decreasing frequency, sum to a specified percentage of the core damage frequency (or large early release frequency) for that hazard group, or that individually contribute more than a specified percentage of core damage frequency (or large early release frequency). For this version of the Standard,³ the summed percentage is 95% and the individual percentage is 1% of the applicable hazard group. Cutset significance may be measured relative to overall CDF (or LERF) or relative to an individual accident sequence CDF (or LERF) of the applicable hazard group. (See Part 2 Requirements QUA2, QU-B2.) For hazard groups that are analyzed using methods and assumptions that can be demonstrated to be conservative or bounding, alternative numerical criteria may be more appropriate, and, if used, should be justified. (ASME/ANS RA-Sb–2013)

significant plant operating state (POS): one of the set of accident classes specified by a given POS and hazard group that, when rank ordered by decreasing frequency, sum to a specified percentage of core damage frequency, or large early release frequency for that hazard group, or that individually contribute more than a specific percentage of core damage frequency or large early release frequency for that hazard group. For this version of the Standard, the summed percentage is 95% and the individual percentage is 1% of the applicable hazard group CDF or LERF

Note that the evaluation of significance in terms of CDF or LERF for each specific hazard group that is to be combined over all LPSD evolutions and all POSs is also implicitly required in the definitions for the following terms from Reference [4] but that are not repeated here; i.e., significant accident progression sequence, significant containment challenge, significant accident progression sequence, and significant cutset. (ANS/ASME-58.22-2015)

significant radionuclide release category: one of the set of radionuclide release categories contributing to LRF/LERF or to the overall radionuclide release frequency that, when rankordered by decreasing frequency, sum to 95% of the LRF/LERF or overall release frequency (excluding design basis leakage RCs); or individually contribute more than 1% of LRF/LERF or 5% of the overall release frequency. (ASME/ANS RA-S-1.2-2015)

significant release category sequence: one of the set of accident sequences contributing to a radionuclide release category frequency resulting from the analysis of a specific hazard group that, when rank-ordered by decreasing frequency, sum to a specified percentage of the release category frequency, or that individually contribute more than a specified percentage of the release category frequency for that hazard group. For this version of the standard, the summed percentage is 95% and the individual percentage is 1% of the applicable hazard group. For hazard groups that are analyzed using methods and assumptions that can be demonstrated to be conservative or bounding, alternative numerical criteria may be more appropriate, and, if used, should be justified. (ASME/ANS RA-S-1.2-2015) (Note: *May be unique to ASME/ANS RA-S-1.2-2015*)

simple check valve. A valve which closes upon reverse fluid flow only. (Note: Includes testable check valves.) (ANS-56.2-84)

simple terrain: Any site where terrain effects on meteorological measurements are non-significant (ANS-2.15-2013).

simulated components. Hardware/software components that are integrated with the simulator process via simulator inputs/outputs that perform their functions parallel to, and either independently of or synchronized with, the simulation process.(ANS-3.5-2009)

simulator data base. The "simulator data base" may be predicted data, plant design data, or it may include actual reference power plant performance data. (ANS-3.5)

single failure. (1) A random failure (e.g., single component failure or operator error) and its consequential effects, in addition to an initiating occurrence, which result in the loss of capability of a component to perform its intended function.

Fluid and electrical systems are considered to be designed against an assumed single failure if neither: (1) a single failure of any active component (assuming passive components function properly), nor (2) a single failure of any passive component (assuming active components function properly) results in a loss of the capability of the system to perform its nuclear safety function(s). For functional clarification, refer to ANSI/ANS-58.9-1981 (R1987) (ANS-51.1/52.1) (ANS-56.6-86)(ANS-59.2-92) (ANS-58.16-2014)

Non-preferred variation (1) Variant form:(ANS-54.1-89)(ANS-51.10)(ANS-51.1/52.1-93)(ANS-58.11-93)(ANS-51.7)(ANS-56.7)(ANS-56.10-87)(ANS-56.4-83)(ANS-58.3)(ANS-58.9-94)(ANS-59.1)(ANS-59.3)(G)

Non-preferred variation (1) A random failure and its consequential effects, in addition to an initiating occurrence, that result in the loss of capability of a component to perform its intended safety-related function (or functions). Fluid and electrical systems are considered to be designed against an assumed single failure if neither (a) a single failure of any active component (assuming passive components function properly) nor (b) a single failure of any passive component (assuming active components function properly) results in a loss of the capability of the system to perform its safety-related function. (ANS-58.14-2011)

single failure criterion. *It is preferred that the term (**single failure**) and the associated definition be used in ANS standards.*

single failure criterion The basis of design founded on the assumption of "...an occurrence which results in the loss of capability of a component to perform its intended safety functions. Multiple failures resulting from a single occurrence are considered to

be a single failure. Fluid and electric systems are considered to be designed against an assumed single failure if neither:

- (1) a single failure of any active component (assuming passive components function properly) nor;
- (2) a single failure of a passive electrical component (assuming active components function properly), results in a loss of the capability of the system to perform its safety functions. ("10 CFR 50, "Licensing of Production and Utilization Facilities," Appendix A, "General Design Criteria for Nuclear Power Plants.") Criteria on single failure as applied to safety related PWR plant systems, have been formulated and exist in American National Standard "Single Failure Criteria for PWR Fluid Systems," N658-1976/ANS-51.7. Criteria on a single failure as applied to Class IE electrical systems have been formulated and exist in IEEE Standard, "Application of the Single Failure Criterion To Nuclear Power Generating Station Class IE Systems," IEEE Std. 379-1977 (ANS-58.4-W90)

variant form: (ANS-59.51)

site. The property on which the nuclear power plant structures are to be built or are built. (ANS-2.11-78)

Non-preferred variation (1) The property on which the ISFSI is to be built or is built. (ANS-2.19-89)

Non-preferred variation (2) A defined area containing one or more facilities. (ANS-8.23-07)

site boundary. The extent of site control for occupational exposure and the start of off-site accident exposure. (ANS-53.1-2011)

Non-preferred variation (1) The site boundary is that boundary, not necessarily having restrictive barriers, surrounding the operations boundary wherein the reactor administrator may directly initiate emergency activities. The area within the site boundary may be frequented by people unacquainted with the reactor operations. (ANS-15.16-2015)

site response (amplification). The amplification (i.e., increase or decrease) of earthquake ground motion by rock and soil near the earth's surface in the vicinity of the site of interest. Topographic effects, the effect of the water table, and basin edge wave propagation effects are sometimes included under site response. (ANS-2.27-2008) (ANS-2.29-2008)

site seismology. Refers to pertinent geologic and seismic data used in establishing the Safe Shutdown Earthquake (SSE) and Operating Basis Earthquake (OBE) for the site. See 10 CFR 100, Appendix A, for definitions for SSE and OBE. (ANS-2.10)

skill of the craft. That level of skill expected of the personnel performing the associated function. (ASME/ANS RA-Sb-2013)

slow time. To decrease the rate of simulation for some or all computed values with respect to real time. (ANS-3.5-2009)

slurry wastes. Liquid radioactive wastes of high insoluble solids content (i.e., greater than 0.1 percent solids by weight) (ANS-55.1-92)(ANS-55.6-93) (ANS-55.6-99)

Non-preferred variation (1) Liquid radioactive waste of high insoluble-solids content (greater than 0.1% solids by weight). For example, bead resin is transferred with a high enough water-to-resin ratio and linear velocity to keep the resin suspended creating a slurry stream. (ANS-40.37-2009)

snapshot. The instantaneous storage of existing conditions at any selected point in time. The stored condition then becomes a temporary initialization point and may be called up repeatedly. (ANS-3.5-85)

Non-preferred variation (1) The storage of the existing simulated reference unit status at any point in time for later recall as an initial condition. (ANS-3.5-2009)

sodar: A wind profiling system that employs sound to probe the atmosphere (ANS-2.15-2013).

software. Computer programs and data. (ANS-7-4.3.2) (not in 93 draft)

software accuracy. The software attribute that provides a quantitative measure of the magnitude of error. (ANS-7-4.3.2)

software consistency. The software attribute that provides uniform design and implementation techniques and notation. (ANS-7-4.3.2)

software error tolerance. The software attribute that provides continuity of operation under postulated non-nominal conditions.(ANS-7-4.3.2)

software modularity. The software attribute that provides a structure of highly independent computer program units that are discrete and identifiable with respect to compiling, combining with other units, and loading. (ANS-7-4.3.2)

software quality assurance (SQA). Assurance that standards, processes, and procedures used for the development of computer software are appropriate for the project, can produce software products of suitable quality for their intended purposes, and are correctly implemented. A key attribute of SQA is the objectivity of the SQA function with respect to the project. (ANS-10.8-2015)

Non-preferred variation (1) All the planned and systematic activities implemented within a quality system that can be demonstrated to provide confidence that a software product or service will fulfill requirements for quality (ANS-3.11-2015).

software tools. (IEEE Std 610.12) A computer program used in the development testing, analysis or maintenance of a program or its documentation. Examples include comparator, cross reference generator, decompiler, driver, editor, flow charter, monitor, test case generator, timing analyzer.

NOTE: In this standard, software tools include compilers.

(ANS-7-4.3.2)

software validation. A process that evaluates the functional characteristics of the software, and certifies the achievement of acceptable comparisons with objective evidence. (ANS-3.2-93)

Non-preferred variation (1) The process of evaluating a system or component during or at the end of the development process to determine whether it satisfies specified requirements. Testing may be part of the evaluation process. (2) The process of

providing evidence that the system, software, or hardware and its associated products satisfy requirements allocated to them at the end of each life cycle activity, solve the right problem (e.g., correctly model physical laws), and satisfy the intended use and user needs. (3) The confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application are fulfilled. (ANS-10.8-2015)

software verification. The process that confirms that the performance of the software is unchanged from that demonstrated by validation. (ANS-3.2-93)

Non-preferred variation (1) The process of providing objective evidence that the system, software, or hardware and its associated products conform to requirements (e.g., for correctness, completeness, consistency, and accuracy) for all activities (acquisition, acceptance testing, operation, maintenance, and retirement) and satisfy standards, practices, and conventions during life cycle processes. (2) The confirmation, through the provision of objective evidence, that specified requirements are fulfilled. (ANS-10.8-2015)

soil temperature: The temperature that is measured at a given soil depth, typically at 2, 4, 8, and sometimes 20 and 40 in (ANS-3.11-2015).

soil water potential. A measure of the energy content of water in unsaturated materials, the spatial gradient of which causes soil water movement. The energy content is the sum of gravitational, pressure, osmotic, and other forces. (ANS-2.17-2010)

solar radiation: The total electromagnetic radiation emitted by the sun (ANS-3.11-2015).

Solidify. To immobilize by a method which converts the liquid, slurry or finely divided dry waste to a solid that is monolithic with a definite volume and shape and bounded by a stable surface of distinct outline on all sides (i.e., free-standing). (ANS-55.1-92)

solidification agent. Material which, when mixed in prescribed proportions with liquid or slurry waste, can form a free-standing product with no free liquid. (ANS-55.1-92)

solid radioactive waste. Wastes in a physically solid form containing radioactive materials that result from the operation of a nuclear facility. Solid wastes can be radioactive due to neutron activation or surface contamination, or both. (ANS-40.37-2009)

solo operation. Operation of the controls, including monitoring of instrumentation during steady station operations, with no other qualified person in the control room or other specified control areas, such as the refueling console. (ANS-3.4-87)

soluble neutron absorber: Any neutron poison easily dispersed in liquid, solution, or suspension, used specifically to reduce the reactivity of a system and for which reactivity credit is taken in the nuclear criticality safety evaluation of the system. (ANS-8.14-04)

solution. Liquid containing dissolved fissile material or a suspension of that fissile material in the liquid. This includes aqueous (water based) solutions but excludes those where the hydrogen is replaced by either deuterium or tritium. It also includes organic liquids, provided that their hydrogen content fall within the range specified in the note in section 6 (see page 4). (ANS-8.5-96)

sorbed. Retention of a liquid or gas substance taken into and retained by another substance. (ANS-53.1-2011)

sorption. All mechanisms, including ion exchange, that remove ions from the fluid phase and concentrate them on the solid phase of the medium. (ANS-2.17-89)

source of model uncertainty. A source is related to an issue in which there is no consensus approach or model and where the choice of approach or model is known to have an effect on the PRA model (e.g., introduction of a new basic event, changes to basic event probabilities, change in success criterion, introduction of a new initiating event). A source of model uncertainty is labeled “key” when it could impact the PRA results that are being used in a decision, and consequently, may influence the decision being made. Therefore, a key source of model uncertainty is identified in the context of an application. This impact would need to be significant enough that it changes the degree to which the risk acceptance criteria are met, and therefore, could potentially influence the decision. For example, for an application for a licensing base change using the acceptance criteria in RG 1.1.74, a source of model uncertainty or related assumption could be considered “key” if it results in uncertainty regarding whether the result lies in Region II or Region I, or if it results in uncertainty regarding whether the result becomes close to the region boundary or not. (ASME/ANS RA-Sb–2013)

source term. The timing, quantity, physical and chemical form of, and thermal energy associated with, a release of radioactive material from a plant during an accident. The definition of the source term includes sufficient information to calculate the off-site radiological consequences of an accident. (ANS-53.1-2011)

Non-preferred variation (1) The amount of radioactive material available for release from confinement if a leak were to occur at the confinement boundary. (ANS-5.10-98)

Non-preferred variation (2): the characteristics of a radionuclide release at a particular location, including the physical and chemical properties of released material, release magnitude, heat content (or energy) of the carrier fluid, location relative to local obstacles that would affect transport away from the release point and the temporal variations in these parameters (e.g., time of release duration, etc.). (ASME/ANS RA-S-1.2-2015)

source term, mechanistic. *It is preferred that (Source Term) and the associated definition be used in ANS standards*

source term, mechanistic. Calculated using validated models and supporting scientific data that simulate the physical and chemical processes that describe the radionuclide inventories and time-dependent radionuclide transport mechanisms that are necessary and sufficient to predict the source term. ANS-53.1-2011)

Non-preferred variation (1): a source term that is calculated using models and supporting scientific data that simulate the physical and chemical processes that describe the radionuclide inventories and the time-dependent radionuclide transport mechanisms that are necessary and sufficient to predict the source term. (ASME/ANS RA-S-1.4-2013)

spacer grid. Components which maintain the rods in a specific array in spent fuel assemblies and are axially located between the end fittings. The function of the spacer grids is to restrain the rod laterally from bowing and vibrating. (ANS-57.10-93)

spatial interval: A portion of a plume (e.g.; plume segment) with the same dispersion characteristics. (ASME/ANS RA-S-1.3-2016)

spatially explicit data. Attributes that can be geo-referenced to a specific location. (ANS-2.17-2010)

special event. An event that is part of the plant licensing basis but is not a DBE. Special events are identified in the plant licensing basis documentation and typically include

anticipated transients without scram (ATWS), fire, and station blackout (SBO). (ANS-58.14-2011)

Non-preferred variation (1) An event that is part of the plant design basis, but is not a design basis event. (Note: Special events are identified in the plant licensing basis documentation (LBD) and typically include anticipated transients without scram, fire, station blackout, shutdown without control rods, and shutdown from outside the main control room). (ANS-58.6-92)(ANS-58.14-93)

special test exception (STE). A provision in the technical specifications which allows a temporary deviation from particular technical specifications for the performance of a necessary test which could not otherwise be performed. (ANS-58.4)

special treatment. Requirements imposed on the design, material, manufacture, construction, inspection, testing, operation, and/or maintenance of an SSC that assure that the SSC will perform (e.g., with adequate reliability and capability) its safety functions for a specific set of licensing-basis events (LBEs). Special treatments specify critical characteristic inspections, tests, their analyses, and acceptance criteria that assure safety functions required. Also see SECY 99-256, Definition, Appendix I: (1) go beyond industry-established requirements for equipment classified as commercial grade and (2) provide additional confidence that the equipment is capable of meeting its functional requirements under design-basis conditions. These additional special treatment requirements include additional design considerations, qualification, change control, documentation, reporting, maintenance, testing, surveillance, and quality assurance requirements. (ANS-53.1-2011)

special uses of direct and scattered categories. Because of the limitations of some computer programs (e.g., some point kernel approaches) it may not be possible to compute direct and scattered gamma-ray components as defined above. If the user of this standard requires a special use of the terms direct and scattered, this special use shall be clearly identified, and definitions appropriate to the specific calculation procedure should be provided by the analyst. (ANS-6.6.1-2015)

specific administrative control (SAC): For the purposes of this standard, an SAC is an administrative control that has a safety function that would be categorized as SC-2 or SC-3 if the function were provided by an SSC. (ANS-58.16-2014)

specific gravity. For purposes of this standard, specific gravity is considered numerically equal to density. (ANS-6.4.2-85)

spectral acceleration. The acceleration response of a linear oscillator with prescribed frequency and damping. (ANS-2.10-90)

Non-preferred variation (1) Pseudo-absolute response spectral acceleration, given as a function of period or frequency and damping ratio (typically 5%). It is equal to the peak relative displacement of a one degree of freedom linear oscillator of frequency f attached to the ground, times the quantity $(2\pi f)^2$. It is expressed in units of gravity (g) or $m/second^2$. (ANS-2.29-2008)

Non-preferred variation (2) Spectral acceleration, in general, given as a function of period or frequency and damping ratio (typically 5%), is equal to the peak relative displacement of a linear oscillator of frequency, f , attached to the ground, times the quantity $(2\pi f)^2$. It is expressed in gravitational acceleration (g) or centimeters per second squared (cm/s^2). (ASME/ANS RA-Sb-2013)

spectral analysis of surface waves (SASW). An in situ seismic method for determining shear wave velocity profiles. It uses the dispersive characteristics of surface waves to determine the variation of the shear wave velocity (i.e., shear modulus) of layered systems at depth. (ANS-2.27-2008)

spent fuel assembly. A single fabricated unit of fuel rods and support structures discharged from a light water power reactor, still in the same mechanical configuration in which it was irradiated, and meets the criteria for post-irradiation decay of this standard. It contains recoverable uranium, plutonium and fission products. (ANS-57.7-92) (ANS-57.9-92) (ANS-2.19-89)

Non-preferred variation (1) Variant form: (ANS-57.10-93)

split fraction. A unitless quantity that represents the conditional (on preceding events) probability of choosing one direction rather than the other through a branch point of an event tree. (ASME/ANS RA-Sb-2013)

spray subsystem. That portion of the containment spray system which is specifically designed to deliver water to the post-accident containment atmosphere. (ANS-56.5-87)

spray thermal effectiveness. The ratio of heat transferred from the containment atmosphere to the spray, to that heat transfer corresponding to thermal equilibrium:

$$E_t = \frac{h_{sf} - h_{si}}{h_{ca} - h_{si}}$$

where:

h_{sf} = spray enthalpy after being heated by the containment atmosphere.

h_{si} = enthalpy of the spray water at thermal equilibrium with the containment atmosphere (ANS-56.5)

spillage. Spillage to the primary containment sump following a LOCA is of two types:

(1) Liquid overflow (not entrained by discharging steam) out the break which occurs when the RCS is refilled above the break elevation; and,

(2) Direct spillage from the ECCS line if the break is postulated at the ECCS nozzle. (ANS-56.4-83)

spray thermal effectiveness. The ratio of heat transferred from the containment atmosphere to the spray, to that heat transfer corresponding to thermal equilibrium

$$e_t = \frac{h_{sf} - h_{si}}{h_{ca} - h_{si}} \text{ where:}$$

h_{sf} = spray enthalpy after being heated by the containment atmosphere.

h_{si} = spray water enthalpy nozzles.

h_{ca} = enthalpy of the spray water at thermal equilibrium with the containment atmosphere. (ANS-56.5-87)

spurious operation. The undesired operation of equipment resulting from a fire that could affect the capability to achieve and maintain safe shutdown (RG 1.189). (ASME/ANS RA-Sb-2013)

SSCs, safety-related. *It is preferred that (safety-related) and the associated definition be used in ANS standards*

SSCs, safety-related. systems, structures and components (SSCs) selected by the designer that have sufficient reliability and capability to fulfill their safety functions and thereby ensure that frequencies and consequences of design-basis events (DBEs) fall within the top-level safety criteria (TLSC) and that the consequences of the deterministically selected design-basis accidents (DBAs) meet regulatory dose limits in the deterministic safety analysis. (ANS-53.1-2011)

stability. The lack of sudden incapacitation. (ANS-3.4-94)

Non-preferred variation (1) Refers to a waste form that meets the requirements established for structural stability in order to meet 10 CFR 61 requirements. A stable waste form will generally maintain its physical dimensions and its form under the expected disposal conditions. NRC waste form technical position provides guidance on acceptable methods to demonstrate waste stability. (ANS-55.1-92)

Non-preferred variation (2) A measure of the degree of resistance of a layer of air to vertical motion. It is used to define the amount of turbulent mixing in the atmosphere, which directly influences atmospheric dispersion (ANS-2.15-2013).

stability array method: United States Environmental Protection Agency (EPA) technique for typing atmospheric turbulence into discrete stability classes. (ASME/ANS RA-S-1.3-2016)

stability class: A discrete classification of atmospheric stability, or the amount of turbulent mixing in the atmosphere and its effect on effluent dispersion (ANS-3.11-2015).

stacking of uncertainties. Addition of multiple uncertainties in one analysis: Depending on stacking assumption, the final analysis may be either extremely overly conservative, moderately conservative, or (potentially) nonconservative. (ANS-53.1-2011)

stagnation: An atmospheric condition that suppresses the dispersion of airborne material (ANS-2.15-2013).

standard conditions. Standard atmospheric conditions referred to by this standard will be these conditions: pressure 14.6959 psia (101.325 kPa), temperature 68°F (527.67° R 20°C, 273.15 K), dry air density 0.07517 lbm/ft³ (1.2041 kg/m³). (ANS-56.8-02)

standard cubic foot (SCF). An amount of gas occupying one cubic foot at a temperature of 60°F and a pressure of one atmosphere (absolute). (ANS-55.4-99)

Non-preferred variation (1) A volume of gas occupying one cubic foot at a temperature of 60° F and a pressure of one atmosphere (absolute).(ANS-55.1-92)(ANS-55.4-93);

Non-preferred variation (2) One cubic foot of gas at standard conditions of 14.6959 psia and 32°F. (ANS-56.1-D85)

standard cubic meter. One cubic meter of a gas at standard conditions of 101325 N/M² and 273.15°K. (ANS-56.1-D85)

standard of care. The minimum accepted level of emergency care to be provided as may be set forth by law, administrative orders, guidelines published by emergency care organizations and societies, local protocols and practice, and what has been accepted as precedence. Each state or locality has its own standard of care. (ANS-3.1.7-95)

standard deviation. The square root of the variance of a variable. For this application the variance is a measure of the variation of the observations within a measurement set. The standard deviation is often estimated using a set of measurements of the variable. The standard deviation has the same units as the measured quantity and, therefore, is particularly convenient when describing the variability of the measured quantity. This parameter may also be expressed as a relative standard deviation (i.e., as a percentage of the measured quantity). (ANS-41.5-2012)

standard project flood (SPF). The hydrograph representing runoff from the standard project storm (or snow melt, or both), as specified by the U.S. Army Corps of Engineers. (ANS-2.12-78)

standard project hurricane (SPH) or standard project windstorm (SPWS). A hypothetical hurricane or windstorm that is intended to represent the most severe combination of hurricane or windstorm parameters that is reasonably characteristic of a specified geographical region, excluding extremely rare combinations. (ANS-2.13-79)

standard reference data. Reference data that have been reviewed by a standards development organization and found to meet minimum requirements set forth by the standards development organization for specified purposes.. (ANS-6.1.2-2013)

standby. The condition in which the EDG is not operating but is capable of automatic start and subsequent uninterrupted operation. (ANS-59.52-98)

standby air compressor. A backup or emergency air compressor which serves safety related air operated devices. (ANS-59.3)

standby component or system. A component or system that can perform the function of a similar operating component or system. (ANS-56.7)

standby system: a system that is not normally operating, but is intended to be ready to operate upon demand. (ASME/ANS RA-S-1.4-2013)

standby diesel generator. A diesel generator unit designed in accordance with IEEE-387-1972 [1] and installed to provide a standby power supply in accordance with Criteria for class IE Power Systems for Nuclear Power Generating Stations IEEE-308-1974 (ANS-59.51)

standby power supply. The power supply that is selected to furnish electric energy when the preferred power supply is not available. (From IEEE Std. 30801974) (ANS-4.1)

start of pre-operational testing. That time when construction of the first safety related system is complete for performance/ integrated system testing (Note: not component testing).(ANS-3.1-87)

starting threshold. The minimum wind speed above which the measuring instrument is performing within its minimum specification. (ANS-3.11-2015)

startup: a POS during which the reactor power level is increased from low power to full power following a plant outage. (ANS/ASME-58.22-2015)

startup mode: a plant mode defined by Technical Specifications (Mode 2) during which the

power level is less than 5% with the reactor critical for PWRs or the position (e.g., startup) of the Mode Selector Switch for BWRs. (ANS/ASME-58.22-2015)

startup testing. Commences following the receipt of the unit NRC operating license which allows fuel loading, initial criticality, low power testing and the power ascension test program. (ANS-3.1)

startup testing Test activities that are to be performed during and following fuel loading. These activities include precritical tests, initial criticality, low power tests, and power-ascension tests that confirm the design bases and demonstrate, to the extent practical, that the plant will operate in concordance with design and is capable of responding as designed to anticipated transients and postulated accidents.(ANS-3.1-2014)

state-of-knowledge correlation. The correlation that arises between sample values when performing uncertainty analysis for cutsets consisting of basic events using a sampling approach (such as the Monte Carlo method); when taken into account, this results, for each sample, in the same value being used for all basic event probabilities to which the same data applies). (ASME/ANS RA-Sb–2013)

station blackout. A loss of all electrical power supplies except nuclear safety-related station batteries. (ANS-54.1-89)

Non-preferred variation (1) Complete loss of alternating current (AC) electric power to the essential and nonessential switchgear buses in a nuclear power plant.). (ASME/ANS RA-Sb–2013)

station blackout occurrence. *It is preferred that (station blackout) and the associated definition be used in ANS standards.*

station blackout occurrence. Complete loss of AC power to the essential and non-essential station switchgear busses for some period of time. The sources of AC power which are not available include the unit generator, offsite power and the onsite emergency AC power sources (i.e., diesel generators) normally capable of feeding the essential station switchgear busses). This occurrence does not include the independent loss of various special purpose diesel generators, such as those associated with diesel driven fire protection equipment or BWR HPCS systems, unless their failure is caused by the station blackout occurrence. (ANS-58.12-85)

station (nuclear). A facility wherein electric energy is produced from nuclear energy by means of a suitable apparatus. The station may consist of one or more units located on a contiguous site, which may or may not share common auxiliaries. (ANS-51.1-W1998)(ANS-52.1-W1998) (ANS-59.1-W1996)

statistical model. A model in which a modeling parameter or behavior is treated as a random variable with specified statistical characteristics). (ASME/ANS RA-Sb–2013)

storage array (array). A regular arrangement of storage cells. (ANS-8.7-75)

storage capacity. The minimum required quantity of lube oil for engine operation.(ANS-59.52-93)

storage cell (cell). A volume having defined boundaries within which a storage unit is positioned. (ANS-8.7-75)

storage coefficient. The volume of water an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in head. (ANS-2.9-89)(ANS-2.17-89)

storage concepts. The following definitions are based on the major characteristics of each concept, namely the predominant heat transfer path, shielding, portability, location with respect to grade, degree of independence of individual storage cells, and the storage structure:

(1) cask (silo). Above-ground, portable, or nonportable structures containing one or more individual storage cavities. Each cavity could contain one or more fuel units. Shielding is provided primarily by structural material such as steel cast iron, or concrete. Heat removal is by conduction through the structural shielding material to the atmosphere.

(2) drywell (caisson). Stationary, below ground, lined, individual storage cavities containing one or more fuel units. Shielding is provided by the surrounding earth and a shield plug. Heat removal is by conduction through the earth to the atmosphere.

(3) Vault (canyon). Above-or below-ground, reinforced concrete structures containing an array of storage cavities. Each cavity could contain one or more fuel units. Shielding is provided by the structure surrounding the stored fuel units. Heat rejection to the atmosphere is either direct or via a secondary cooling system. (ANS-57.9-92)

storage unit (unit). A mass of fissile material considered as an entity. The material may be of any shape, and a unit may consist of separate pieces. (ANS-8.7-75)

storm surge. A rise above normal water level on the lake, open sea or coast, due to the action of wind and atmospheric pressure. (ANS-2.12) (ANS-2.19-89)

straight-line steady-state model: Gaussian model in which the release amount, wind speed, wind direction and turbulence parameters are assumed to not vary with time. (ASME/ANS RA-S-1.3-2016)

stratigraphy. The branch of geology that deals with the definition and description of major and minor natural divisions of soil and rock, and the interpretation of their significance in geologic history; specifically, the form arrangement, geographic distribution, chronologic succession, classification, and correlation and mutual relationships. (ANS-2.11-78) (ANS-2.19-89)

stray rod. A rod in any one of the following conditions during the rod consolidation process:

- (a) partly inserted into a canister; or,
- (b) in a position not normal for the process. (ANS-57.10-93)

streaming. The penetration of radiation through gaps, voids, or ducts existing in the shield structure. (ANS-6.4-85)

stuck rod. Any rod which cannot be removed from the spent fuel assembly during the normal operation of rod removal. (ANS-57.19-93)

structural integrity test (SIT). A pneumatic test that demonstrates the capability of a primary containment to withstand a specified internal design pressure load. (ANS-56.8-02)

Variant form: (ANS-56.2-84)

structural seismic model Mathematical representation of all Seismic Category I structures and interconnected non-seismic category structures used to predict the dynamic response. (ANS-2.10)

structure, system, or component (SSC). *It is preferred that the separate definitions of (structure, system and component) and the associated definition be used in ANS standards. SSC should be defined in the acronym list.*

structure, system, or component (SSC). A *structure* is an element, or a collection of elements, to provide support or enclosure, such as a building, free-standing tanks, basins, dikes, or stacks. A *system* is a collection of components assembled to perform a function, such as piping, cable trays, conduits, or Heating Ventilation and Air Conditioning (HVAC). A *component* is an item of mechanical or electrical equipment, such as a pump, valve, or relay, or an element of a larger array, such as a length of pipe, elbow, or reducer. (ANS-2.27-2008)(ANS-2.29-2008) (ANS-2.30-2015)

structured observation. Observation activity included as part of training program requirements. (ANS-3.1-2014)

structures. Civil constructions (e.g., buildings), portions of civil constructions (e.g., doors, hatches, or walls), supports for items, or structural components such as fuel racks and building sump debris screens. (These might have system-level or component-level plant-unique identification codes). (ANS-58.14-2011)

Non-preferred variation (1) Civil constructions (e.g., buildings), portions of civil constructions (e.g., doors, hatches, or walls), or supports for items. (These might have system-level or component-level plant-unique identification codes.) (ANS-58.16-2014)

sub-compartment. A fully or partially enclosed sub-division of primary or secondary reactor containment or other building structures. A sub-compartment may consist of one or more node volumes. (ANS-56.10-87)

sub-critical flow. (See critical flow.) (ANS-56.4-83) (ANS-56.10)(ANS-56.10-87)

sub-critical limit (limit). The limiting value assigned to a controlled parameter that results in a sub-critical system under specified conditions. The controlled parameter limit allows for uncertainties in the calculations and experimental data used in its derivation but not for contingencies (e.g., double batching or failure of analytical techniques to yield accurate values). (ANS-8.1-14)

Non-preferred variation (1) Variants: (ANS-8.12-87) (ANS-8.15-81)

subject matter expert. An individual who possesses the appropriate education, license, experience, or unique qualifications to perform assessments and make recommendations in a particular subject area.(ANS-3.5-2009)

subsurface. All rock, soil, and fill material below the ground surface. (ANS-2.17-2010)

subsurface water. Water contained in pores and voids within geologic media below the ground surface. (ANS-2.17-2010)

success criteria. Criteria for establishing the safe and stable plant parameters and minimum levels of performance per component during a specific mission time to ensure that a reactor-specific safety function is satisfied. (ANS-53.1-2011)

Non-preferred variation (1) Criteria for establishing the minimum number or combinations of systems or components required to operate, or minimum levels of performance per component during a specific period of time, to ensure that the safety functions are satisfied). (ASME/ANS RA-Sb-2013)

success path. A set of systems and associated components that can be used to bring the plant to a stable hot or cold condition and maintain this condition for at least 72 hr. (ASME/ANS RA-Sb-2013)

sudden incapacitation: Abrupt onset of loss of control of physical or mental function ~or functions! that results in a loss or impairment of consciousness, control, or performance (ANS-3.4-2013)

sump. A structure in the containment provided to collect water after an accident, for the recirculation mode. The sump may also be a pressure suppression pool (BWR). (ANS-56.5-87)

sump or sump tank. A collection point to which all lubricating oil drains and from which the lubricating oil pumps take suction. (ANS-59.52-98)

Non-preferred variation (1) The sump refers to the lube oil collection point in a wet sump type engine. The sump tank refers to the lube oil collection point in a dry sump type engine. Either provides a collection point to which all lube oil drains and from where the lube oil pumps take suction. (ANS-59.52-93)

supervision. Direction of personnel activities or monitoring of plant functions by an individual responsible and accountable for the activities he/she directs or monitors. (ANS-3.2-93)

supporting systems. Systems and equipment not a part of, but required by the safety-related control air system for the performance of its safety functions shall have Safety Class 3 components. (ANS-59.3)

Non-preferred variation (1) A system that provides a support function (e.g., electric power, control power, or cooling) for one or more other systems. (ASME/ANS RA-Sb-2013)

supplemental personnel: Persons who conduct work or provide services on- or off-site who are not full-time station personnel. These include any of the following: contractors and vendors who perform work on-site; contractors and vendors who perform work off-site, such as engineering modifications or analyses, component fabrication, equipment refurbishment, and equipment testing; personnel from another location within the owner organization or from an industry alliance who perform work on-site, such as shared resources during outages; owner organization personnel who may only work part time at the station, such as switchyard personnel, refueling personnel, and roving valve or turbine teams; owner organization personnel from another location who perform work off-site, such as corporate engineering support. (ANS-3.1-2014)

supplemented grade (S). Classification applied to an item that does not perform a safety-related function, but to which a significant licensing requirement or commitment applies. (ANS-58.14-93)

Variant form: (ANS-59.2-D92)

suppression pool. In a water pressure suppression (WPS) primary containment, a pool of water into which steam resulting from a LOCA is directed and condensed to reduce the pressure in the primary containment. (ANS-5.4-83)

Surface contamination. Radioactive material on the surface of solid objects. (ANS-5.10-98)

surface Design Dose Equivalent rate. The design dose equivalent rate at a location directly on the surface of the component or shield. For components covered with insulation

or other materials, the "surface dose equivalent rate" is at a location directly on the covering surrounding the component. This definition is for design purposes and may differ from measured contact dose equivalent rates. (ANS-5.6.1-D90)

surface design dose rate. A design dose rate at a location directly on the surface of the component or shield. For components covered with insulation or other materials, the "surface dose rate" is at a location directly on the covering surrounding the component. This definition is for design purposes and can differ from measured contact dose rates. (ANS-5.6.1-D90)

surface vehicle explosion. Accidental explosion of land or water vehicles, including ship, barge, truck and railroad car. (ANS-2.12-78)(ANS-2.19-89)

surface vehicle impact. Accidental impact of a surface vehicle with or near a safety-related plant structure, system, or component (SSC) caused by an out-of-control vehicle due to operator error, vehicle failure, or due to natural hazards such as a flood. (ANS-2.12-78)

Surface contamination. Radioactive material on the surface of solid objects. (ANS-5.10-98)

surface vehicle impact. Accidental impact of a surface vehicle with or near an ISFSI. (2.19-89)

surveillance. The act of monitoring or observing to verify whether an item or activity conforms to specified requirements. (ANS-3.2-93)

Variant form: (ANS-4.1)

surveillance testing. Periodic testing to verify that structures, systems and components (SSCs) continue to function or are in a state of readiness to perform their functions. (ANS-3.2-93)

survival speed: The maximum wind speed at which the sensor can operate properly (ANS-3.11-2015).

suspension mechanism. The type and level of force/energy input defined and utilized for analysis of a given postulated accident for the process or operation performed. (ANS-5.10-98)

symptomatic data. Refers to data on variables which are well enough correlated with population size so that a change in value of the variable can reasonably be taken to mean a change in size for the population generating the value. (ANS-2.6-81)

system. A group of physically interconnected components that together perform a specified design function. (Systems are normally designated by a system-level plant unique identification code). (ANS-58.14-93)(ANS-3.11-00) (ANS-58.14-2011) (ANS-58.16-2014)

Non-preferred variation (1) In the context of this standard, the system consists of (a) all facilities from which a release to the groundwater might occur, (b) all facility policies or procedures that might impact or cause a release, (c) the man-machine interface of a facility that might cause or contribute to a release, (d) all engineered barriers and leak detection systems, (e) the local and regional hydrogeology, and (f) all monitoring well networks and procedures for gathering and analyzing soil and groundwater samples. (ANS-2.17-2010)

system accuracy: The extent to which results of a calculation or the readings of an instrument approach the true values of the calculated or measured quantities. System

accuracy encompasses all components of the system (i.e., sensor, data processing equipment, computer, calibrations, data displays, etc.). System accuracy is compared with applicable requirements to evaluate the adequacy of the monitoring program. (ANS-3.11-2015)

system and equipment wastes. Liquid from radioactive components, equipment, or systems, and from component cooling systems. (ANS-55.6-1993(R2007))

system calibration: The process of validating the output of an observing system against known reference observations or standards. (ANS-3.11-2015)

system failure. System-level failure involving at least one (but probably more) system functional failures. (ANS-53.1-2011)

Non-preferred variation (1) Loss of the ability of a system to perform a modeled function. (ASME/ANS RA-Sb-2013)

system important to safety. A system whose function is required to meet the general criteria of 4.1; for example, this includes those systems required to shut down the reactor (and maintain shutdown), cool the core, limit damage to the core, cool another safety system, or after an accident cool the containment, control combustible concentrations in the containment, or that contains, controls or reduces radioactivity released in an accident. Only those portions of a system are included that are designed to accomplish one of the above functions or whose failure could prevent accomplishing one of the above functions. (ANS-58.3)

(In the future it is suggested that the term important to safety be defined and used in ANS standards rather than this term.)

system, support. An auxiliary or supporting system providing services or power. (ANS-53.1-2011)

system testing (IEEE Std 610.12). Testing conducted on a complete, integrated system to evaluate the system's compliance with its specified requirements. (ANS-7-4.3.2)

systems approach. An analytical and interdisciplinary method used to evaluate the fire hazards and select fire prevention and protection systems in a manner acceptable to management and independent reviewers.

Additional definitions or discussions of terms commonly used in the fire protection industry may be found in the National Fire Protection Association (NFPA) "Fire Protection Handbook," Fourteenth edition. (ANS-59.4-79W83)

systems, structures, and components (SSCs). *It is preferred that the separate definitions of (structure, system and component) and the associated definition be used in ANS standards*

systems, structures, and components (SSCs). Generic term for those components, structures, and integrated systems that comprise the designed plant. (ANS-53.1-2011)

systems, structures, and components (SSCs), non-safety-related (NSR) (NSR SSCs). SSCs whose reliabilities and capabilities are not required or credited for the frequency and consequences of any licensing basis event (LBE) to fall within the top-level safety criteria (TLSC). (ANS-53.1-2011)

systems, structures, and components (SSCs), non-safety-related with special treatment (NSRWST) (NSRWST (SSCs)). SSCs selected by the designer to provide defense-in-depth (DID) for safety functions. (ANS-53.1-2011).

SSC, active: an SSC whose function depends on mechanical movement or an external input such as actuation signal, or supply of motive power. Example active SSCs include pumps, gas blowers, control rods, and relief valves. (ASME/ANS RA-S-1.4-2013)

SSC, passive: an SSC whose function does not depend on mechanical movement or an external input such as actuation signal, or supply of motive power. Example passive SSCs include the reactor pressure vessel, reactor coolant pressure boundary, operation of rupture discs and mechanical safety valves, dropping of control rods by gravity, when the SSC functions are accomplished without the need for any active SSCs. (ASME/ANS RA-S-1.4-2013)

systematic approach to training. An accepted process used to develop and maintain performance-based, accredited training programs that meet identified job requirements for the reference unit. The process includes the elements of analysis, design, development, implementation, evaluation, and feedback. (ANS-3.5-2009)

T.

take credit. Rely upon SSCs in safety analysis design-basis accidents (DBAs) (limiting conservative analysis), Chapter 15 of the NRC Safety Analysis Report (SAR) (NUREG-0800 [4]). The analysis to demonstrate safety criteria relies on, takes into account, uses, and bases analysis on the “credited” SSC performance. (The SSCs relied on are then subject to special treatment commensurate with their safety significance. Balance-of-plant SSCs are not credited in Chapter 15 for positive responses. Balance-of-plant SSCs are included or “credited” in other analyses of realistic plant performance, such as Chapter 19, design chapters, etc., of NUREG-0800.) (ANS-53.1-2011)

tanks. All tanks used to support diesel generator operation; where used without modifiers, it includes day, integral, and supply tanks.

(1) day tank. A fuel oil tank or tanks which provide fuel directly to its associated diesel generator or integral tank.

(2) integral tank. A fuel oil tank furnished by the diesel generator manufacturer and mounted on the diesel engine.

(3) supply tank. A separate fuel oil tank for storage of fuel, which supplies a day tank or integral tank. (ANS-59.51-89)

target. May refer to a fire damage target and/or to an ignition target. A fire damage target is any item whose function can be adversely affected by the modeled fire. Typically, a fire damage target is a cable or equipment item that belongs to the fire PRA cable or equipment list and that is included in event trees and fault trees for fire risk estimation. An ignition target would be any flammable or combustible material to which fire might spread (NUREG/CR-6850–EPRI TR-1011989 [1-5]). (ASME/ANS RA-Sa–2009)

target performance goal. Target mean annual frequency of an SSC exceeding its specified Limit State. Target performance goals of 1×10^{-4} /year, 4×10^{-5} /year, and 1×10^{-5} /year are

used in ASCE/SEI 43-05 [2] for SSCs defined at SDC-3 or higher. (ANS-2.27-2008) (ANS-2.29-2008) (ANS-2.30-2015)

target set. A group of damage targets that will be assumed to suffer fire-induced damage based on the same damage criteria and damage threshold in any given fire scenario. (ASME/ANS RA-Sb-2013)

NOTE: The collection of target sets associated with a fire scenario often represents a subset of the damage targets present in the fire compartment but may also encompass all risk-relevant damage targets in a single physical analysis unit or a collection of damage targets in multiple physical analysis units. This definition implies that all members of any single target set will be assumed to fail when the first member of the target set fails (i.e., "... damage based on the same damage criteria and damage threshold"). Progressive or time-dependent states of fire damage may be represented through the definition of multiple target sets for a single fire scenario (e.g., cables in raceways directly above a fire source versus cables in raceways remote from the fire source). The level of detail associated with target set definition will generally parallel the level of detail employed in fire scenario selection and analysis (e.g., screening level analysis versus detailed analysis). (ASME/ANS RA-Sb-2013)

task. A well defined unit of work having an identifiable beginning and end. (ANS-3.1-2014)

task analysis. The systematic process to identify conditions, standards, elements, and required skills or knowledge to perform a task. (ANS-3.1-87)

task qualification. Measures used to evaluate and designate qualifications to perform an assigned task. Measures include training, evaluations, and meeting established experience, knowledge, and skill requirements. (ANS-3.1-2014)

task qualified Documented approval from line management to independently perform a task. (ANS-3.1-2014)

technical specifications (TS). As defined in 10 CFR 50.36, "Technical Specifications." (ANS-1.10)

technical staff: Personnel with specific skills and experience who can assist in the implementation of the requirements defined in this standard. Such personnel may include, but are not limited to, criticality safety, health and safety, and facility process support personnel. (ANS-8.23-07)

technology neutral. Applicable to any type of reactor and independent of any single reactor technology. (ANS-53.1-2011)

temporary medical condition: When an operator does not meet the specific minimum requirements in this standard but is expected to meet those requirements ~without exception! again in the future, the operator's condition disability is considered temporary and does not need to be reported to the NRC. The facility licensee is expected to administratively restrict the operator's activities, as appropriate, during the term of the condition disability. It is up to the licensee's examining physician to evaluate each operator's situation and assess whether the operator will be capable of meeting the requirements within 90 days. (ANS-4.3-2013)

temporary. A system, subsystem, or component whose design, construction, or intent is not of a permanent nature with respect to facility license design. (ANS-40.39-2009)

Temporary Emergency Exposure Limit (TEEL): For the purposes of this standard, TEELs are temporary limits intended for use until AEGLs or ERPGs are adopted for chemicals. See DOE-HDBK-1046-2008, "DOE Handbook—Temporary Emergency Exposure Limits for Chemicals: Methods and Practice" [5]. Because AEGLs and ERPGs exist only for a limited number of chemicals, DOE also commissions the development of TEELs so that DOE facilities may conduct Emergency Planning Hazard Assessments and consequence assessments during response for chemicals lacking AEGLs or ERPGs. TEELs are roughly equivalent to AEGLs and ERPGs. (ANS-58.16-2014)

terminal end. That section of piping originating at a structure or component (e.g., a vessel or component nozzle or structural piping anchor) that acts as an essentially rigid constraint to the piping thermal expansion. Typically, an anchor assumed for the piping code stress analysis would be a terminal end. The branch connection to the main run is one of the terminal ends of a branch run, except for the special case where the branch pipe is classified as part of a main run (see paragraph (b) of definition for branch run). (ANS-58.2)

termination time: time following a severe accident at which the radionuclide release calculation is terminated (truncated) for Level 2 analysis purposes. (ASME/ANS RA-S-1.2-2015)

Tertiary. The geologic period from 1,800,000 years before present to 63,000,000 years before present. (ANS-2.27-2008)

test connection or test vent. Connection to valves or connecting piping which is provided so that isolation valves can be tested for leakage tightness. (ANS-56.2-84)

test, aquifer. The effect of pumping a well as measured in the pumped well and in one or more observation wells, for the purpose of determining aquifer properties. (ANS-2.9-89)(ANS-2.17-89)

test, packer. A method of isolating a section of a borehole by inserting one or more expandable glands (packers) in order to measure hydraulic conductivity or water quality in the section. (ANS-2.17-89)

test, well. The withdrawal of water from or addition of water to a well in measured rates or amounts, in order to measure the response with time of the water level. (ANS-2.9-89)

testing. An element of verification for the determination of the capability of an item to meet specified requirements by subjecting the item to a set of physical, chemical, environmental, or operating conditions. (ANS-3.2-93)

thermal internal boundary layer: An internal boundary layer in the atmosphere caused by horizontal movement across a discontinuity in surface temperature. (ASME/ANS RA-S-1.3-2016)

thyroid blocking agent. A material introduced into the body that minimizes uptake of radioiodine into the thyroid by saturating the thyroid with stable iodine. (ANS-3.8.1-93)(ANS-3.8.2-93) (ANS-3.8.3-93)(ANS-3.8.6-94) (ANS-3.8.2-95)

Variant form: (ANS-3.8.5-D92)

time available. The time period from the presentation of a cue for human action or equipment response to the time of adverse consequences if no action is taken. (ASME/ANS RA-Sb-2013)

time-averaged CDF: a risk metric for the expected number of core damage events per calendar year summed over all LPSD evolution types modeled. No one specific evolution is

to be considered an “average” LPSD evolution. Rather, an average LPSD evolution of each LPSD evolution type is one whose POS durations and equipment outage durations in each POS are consistent with the data from plant operation averaged over many years from all LPSD evolutions of that same type. LPSD evolution types are described in Part 2 and non-mandatory Appendix 2.A. (ANS/ASME-58.22-2015)

time-dependent CDF: the computation of CDF (expected number of core damage events per unit of time) at one particular time and for a single plant configuration in one POS. The plant configuration is characterized by the specific plant system alignments and maintenance conditions at that point in time rather than by time-averaged maintenance alignments. The average of the time dependent CDF over a year is the time-averaged CDF for that year. When averaged over a long period of time, the result is equivalent to the time-averaged CDF; i.e., one of the risk metrics of a baseline PRA. (ANS/ASME-58.22-2015)

time-history accelerograph. An instrument capable of measuring and permanently recording acceleration versus time. (ANS-2.10-90)(ANS-2.2-02)

time interval. (ANS-58.8) The elapsed time between two sequential, time points Specific time intervals include:

(1) indication --

($TI_{INDICATION} = t_{IND} - t_{ST}$). The time interval between the start of the DBE and the first indication of the DBE. For some DBEs, this time interval might be zero.

(2) dead (TI_{DEAD}) The time interval allowed in the analyses in which the operator is not required to take action during the course of a DBE. A TI_{DEAD} always precedes T_{MAI} and follows T_{ECA} for the first operator action and follows T_{SFC} for subsequent operator actions in the analyzed sequences. (ANS-58.8-92)

(3) diagnosis --

($TI_{DIAGNOSIS} = t_{ECA} - t_{IND}$). The time interval between the first indication of the DBE and the earliest time for which credit can be taken for initiation of safety-related operator actions. During this interval, it is assumed that the operator verifies automatic responses, observes plant parameters, and plans subsequent actions.

(4) operator response --

($TI_{OPERATOR} = t_{SAC} - t_{MAI}$). The time interval during which the operator completes a safety-related action.

(5) process response --

($TI_{PROCESS} = t_{SFC} - t_{SAC}$). The time interval between the completion of a safety-related operator action and the receipt of the indication that the corresponding safety-related function is completed through the response of the mitigating equipment and the response of the process. For some DBEs this time interval may be zero.

(6) safety --

($TI_{SAFETY} = (t_{LIM} - t_{SFC})$). The time interval between the completing of the last safety-related function and reaching the design requirement limit.

(ANS-58.8-92)

tolerance chart. A chart developed to evaluate the response of an instrument or process to a predetermined tolerance level as determined by an appropriate QC source. The

predetermined tolerance level, typically expressed as a percentage, is set with the overall quality performance (bias and precision) parameters for an analytical technique in mind. For practical reasons the response of most instruments is held in control to a tolerance as specified by the MQOs and is related to the instrument calibration. (ANS-41.5-2012)

top event. Undesired state of a system in the fault tree model (e.g., the failure of the system to accomplish its function) that is the starting point (at the top) of the fault tree. (ASME/ANS RA-Sb-2013)

top-level design criteria (TLDC). TLSC design implementing criteria; design criteria based on meeting the TLSC, unique to a specific type of plant technology. (ANS-53.1-2011)

top-level regulatory criteria (TLRC). Criteria expressed in the national nuclear regulator's regulations that are used to define the TLSC. (ANS-53.1-2011)

top-level safety criteria (TLSC). Limits on the frequency and consequences of licensing-basis events (LBEs) derived from TLRC. (ANS-53.1-2011)

tornado. A violently rotating column of air whose circulation reaches the ground, pendant from the base of a convective cloud, and often observable as a condensation funnel attached to the cloud base, or as a rotating dust cloud rising from the ground. (ANS-2.3-83)

Variant form: (ANS-2.12-78)

tornado-generated missile. Tornado-generated missiles are objects that either become airborne, or tumble along the ground, or both, as the result of the wind pressure forces of a tornado and the aerodynamic characteristics of the objects. (ANS-2.3-88)

total effective dose equivalent (TEDE). The sum of the deep dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures). (ANS-53.1-2011)

Non-preferred variation (1) Summation of the dose equivalent from external exposure and the committed effective dose from internal exposure. (ANS-8.10-15)

total propagated uncertainty (TPU). see "combined standard uncertainty." (ANS-41.5-2012)

trace element. An element found in small quantities (i.e., usually less than 1%) within a material. (ANS-6.4.2-85)

trace radioactivity. Radioactivity due to trace amounts of naturally occurring radioisotopes contained within a material. (ANS-6.4.2-85)

traceability. The documented ability to trace the history, application, or location of an entity. In a calibration sense, traceability relates measuring equipment to national and international standards, primary standards, basic physical constants and properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the process back to the requirements for quality for the project. (ANS-3.11-2015)

Non-preferred variation (1) Demonstrated linkage by means of an unbroken chain of comparisons of a measurement to nationally or internationally recognized standards or certifying body within specified uncertainty limits. (ANS-41.5-2012)

train. Any set of required equipment dependent on a single emergency onsite power source. (ANS-5.11-88)

training. Instructional program designed to develop or improve on-the-job performance. (ANS-3.1-2012)

Non-preferred variation (1) : instruction that imparts knowledge and skills necessary for safe and efficient on-the-job performance. (ANS-8.20-91)

training needs assessment. An appraisal by a subject matter expert of a simulator deviation, deficiency, or modification, and its relative importance to the operator during performance of required tasks.(ANS-3.5-2009)

transfer machine. The equipment required to move the fuel units between the fuel handling area and the storage area. It may include a shielded confinement enclosure, transport vehicle, and handling equipment. (ANS-57.9-92)

transient combustible. Combustible materials that are not fixed in place or an integral part of an operating system or component (RG 1.189 [1-2]). (Note that the term "component" as used in this definition is considered interchangeable with the terms "equipment" or "piece of equipment" as those terms are used in this Standard.). (ASME/ANS RA-Sb-2013)

transient population. Includes persons who routinely spend substantial portions of their time in the area, but do not sleep there. Does not include persons merely passing through the area.²

Footnote: (2) Sometimes the term "transient population" is defined to include persons passing through the area. However, U.S Nuclear Regulatory Commission Regulatory Guide 4.7 excludes such persons in its usage of the term and that definition prevails for this Standard.

(ANS-2.6-81)

translation. Motion in a horizontal plane. (ANS-57.1-92)(ANS-57.3-93)

transport. That component of dispersion that addresses the trajectory of the released material. (ANS-3.8.6-94)(ANS-3.8.6-95)

Non-preferred variation (1)The movement of gaseous and or particulate matter through the atmosphere (ANS-2,15-2013).

transportation package. A container used to transport spent fuel to or from an ISFSI. It may, in particular, consist of one or more receptacles, spacing structures, radiation shielding, and devices for cooling or for absorbing mechanical shocks. The vehicle, tie-down system, and auxiliary equipment may be integral parts of the container. 10 CFR 71, "Packaging and Transportation of Radioactive Material," provides regulatory requirements for packaging and transporting of spent fuel beyond the confines of the ISFSI site. (ANS-57.9-92)

treatment. Any method, technique or process, including neutralization, designed to change the physical, chemical or biological character or composition of any hazardous material, or to recover energy or material resources from the waste, or to render the waste non-hazardous or less hazardous; safer to transport, store, or dispose of; or amenable for recovery, amenable for storage or reduced in volume. (ANS-55.1-92)

trend. The general tendency of the current value (i.e., increasing, constant, or decreasing). (ANS-4.5)

trending. The extrapolation of data from periodic non-destructive measurement of a control Raschig ring's physical and chemical properties, and from certain properties of the vessel, to predict changes with time in the properties measured. (ANS-8.24-07)

triaxial. Able to measure a variable in three mutually orthogonal components (directions), one of which is vertical; applies to description of the function of an instrument or group of instruments. (ANS-2.2-02)

true north: The direction from any point on the earth's surface toward the geographic North Pole (ANS-3.11-2015).

truncation limit. The numerical cutoff value of probability or frequency below whose results are not retained in the quantitative PRA model or used in subsequent calculations (such limits can apply to accident sequences/ cutsets, system level cutsets, and sequence/cutset database retention). . (ASME/ANS RA-Sb-2013)

tsunami. A series of long period waves generated by the displacement of water by a submarine or coastal earthquake, volcanic eruption, or landslide. (ANS-2.19-89)

Variant form: (ANS-2.12-78)

turbine building wastes. Liquids from steam, feed water and condensate system, and from sampling, maintenance and testing operations in the turbine building. (ANS)

turbulence: Atmospheric motions in which local velocities and pressures fluctuate irregularly, in a random manner, to form swirling eddies that can cause rapid mixing (ANS-2.15-2013).

type A test. A test to measure the containment system overall integrated leakage rate under conditions representing DBA containment pressure and systems alignments. (ANS-56.8-02)

Type A test performance criterion. Criterion used for establishing Type A test intervals. The sum of the measured Type A test upper confidence limit (UCL) and the as-left MNPLR from all Type B and Type C pathways isolated during the Type A test. The sum is required to be less than L_a for a Type A test to pass the performance criterion. (ANS-56.8-02)

Type B test. A pneumatic test intended to detect or measure leakage across pressure-retaining or leakage-limiting boundaries other than valves, such as:(1) containment penetrations whose design incorporates resilient seals, gaskets, sealant compounds, expansion bellows, or flexible seal assemblies; (2) seals, including door operating mechanism penetrations which are part of the primary containment; (3) doors and hatches with resilient seals or gaskets except for seal-welded doors. (ANS-56.8-02)

type C tests. A pneumatic test to measure leakage rates from containment isolation valves, which are potential gaseous leakage pathways from containment during a design-basis LOCA. (ANS-56.8-02)

U.

ultimate disposal. Placement of radioactive waste in a disposal facility with no intention of removing the waste, e.g., disposal at a shallow land burial facility licensed in accordance with 10 CFR 61. (ANS-40.37-2009)

ultimate heat sink. The nuclear safety-related means of heat dissipation from the unit to the environment, including the necessary retaining structures (e.g., a dammed lake or a cooling tower) and any connecting canals or conduits. (ANS-51.1/52.1-98)

Non-preferred variation (1) Variant form: (ANS-54.1-89)(ANS-59.1)(ANS-2.12-78)

Non-preferred variation (2) The complex of water sources, including necessary retaining structures (e.g., a pond or river with its dam), and the canals or conduits connecting the sources with, but not including, the cooling water system intake structures for a nuclear power unit. The sink constitutes the source of service water supply necessary to safely operate, shut down, or cool down a plant following a design-basis accident.(ANS-2.21-2012)

unavailability. The probability that a system or component is not capable of supporting its function including, but not limited to, the time it is disabled for test or maintenance. . (ASME/ANS RA-Sb–2013)

unbiased. A measurement of a variable is called unbiased if the expected value of the measurement is equal to the stated value of the property being measured. (ANS-41.5-2012)

uncertainty. A representation of the confidence in the state of knowledge about parameter values and models.

Non-preferred variation (1) See “variability,” “epistemic uncertainty,” and “aleatory variability.” (ANS-2.27-2008) (ANS-2.29-2008) (ANS-2.30-2015)

Non-preferred variation (2) A representation of the confidence in the state of knowledge about the parameter values and models used in constructing the PRA. (ASME/ANS RA-Sb–2013)

Non-preferred variation (3) (As used in seismic-fragility analysis): the variability in the median seismic capacity arising from imperfect knowledge about the models and model parameters used to calculate the median capacity. (ASME/ANS RA-Sb–2013)

uncertainty analysis. The process of identifying and characterizing the sources of uncertainty in the analysis, and evaluating their impact on the PRA results and developing a quantitative measure to the extent practical. (ASME/ANS RA-Sb–2013)

uncertainty distribution. Probability distribution used to describe the uncertainty in the estimation of a parameter that is used to calculate the frequency, consequences, or risk associated with an event sequence. (ANS-53.1-2011)

unclassified. Designation applied to an item that has not been classified. (ANS-58.14-93)

uncontrolled access. Access to areas which are not under direct control for purposes of radiation protection. (ANS-5.6.1-D90)

Variant form: (ANS-6.7.1-85)

uniform hazard response spectrum (UHRS). A response spectrum derived such that the annual probability of exceeding the spectral quantity (i.e., spectra acceleration, spectral displacement, etc.) is the same for all oscillator frequencies.

Non-preferred variation (1) A response spectrum derived such that the annual probability of exceeding the spectral quantity (i.e., spectra acceleration, spectral displacement, etc.) is the same for all oscillator frequencies. A UHRS is determined in accordance with ANS-2.29-2008) [3]. (ANS-2.27-2008) (ANS-2.29-2008)

Non-preferred variation (2) A plot of a ground response parameter (for example, spectral acceleration or spectral velocity) that has an equal likelihood of exceedance at different frequencies. (ASME/ANS RA-Sb–2013)

unit. One nuclear power reactor, all items required for electrical power generation, and all items require to provide reasonable assurance that the nuclear power reactor can be operated without undue risk to the health and safety of the public. Items that are shared between units are part of each unit. (ANS-59.1-94)

Non-preferred variation (1) Variant form: (ANS-59.1)(ANS-56.4)(ANS-58.9-R87)(ANS-51.1/52.1-93)

units of measurement. The special unit of measurement of exposure to x-rays or gamma rays is the roentgen (R). The common unit of exposure rate is milliroentgen per hour (mR/hr). For purposes of this standard, the terms milli-roentgen and millirem are used interchangeably.(ANS-6.8.1-81)

unlimited air. The storage atmosphere that does not limit the availability of oxygen as a design feature of the ISFSI. (ANS-57.9-92)

unmitigated analysis: For the purposes of this standard, analysis of DBEs for event progression and consequences without taking any credit for preventive or mitigative features or controls. “Unmitigated” is meant to consider material quantity, form, location, dispersibility, and interaction with available energy sources but not to consider safety features (e.g., ventilation systems, fire suppression system, etc.) that will prevent or mitigate a release. (ANS-58.16-2014)

unreliability. The probability that a system or component will not perform its specified function under given conditions upon demand or for a prescribed time. (ASME/ANS RA-Sb–2013)

unrestricted area. An area, access to which is neither limited nor controlled by the licensee. (ANS-2.17-2010)

unsaturated zone. A subsurface region where pores are filled partially with water and partially with air; most commonly, the zone between the ground surface and the top of the capillary zone. (ANS-2.17-2010)

upender. Handling equipment rotating about a fixed horizontal axis used to move fuel assemblies from a vertical to other than a vertical position and vice versa. (ANS-57.1-92)

upper bounding. (See lower bounding). (ANS-56.4-83)(ANS-56.10-87)

upper confidence limit (UCL). A calculated value constructed from test data that places a statistical upper bound on the true leakage rate (%/24h). (Note: UCL is calculated at 95% confidence level in this standard. (ANS-56.8-02)

upper probability limit for damage. The threshold probability value for design consideration. If the probability of an event is equal to or less than the Upper Probability Limit for Damage, its consequences need not be evaluated. (ANS-58.3)

upper subcritical limit: A limit on the calculated k-effective value established to ensure that conditions calculated to be subcritical will actually be subcritical. (ANS-8.24-07)

upscale bias. A method of supplementing the exposure rate indication of an area monitor channel, either by means of a radioactive source placed on or near the detector, or by means of an input signal to the detector or electronic readout module. (ANS-6.8.1-81)

Use-as-is. A disposition permitted for a nonconforming item when it can be established that the item is satisfactory for its intended use. (ANS-3.2-93)

user. A person who applies a program to perform a specific task. (ANS-10.5-79)

Non-preferred variation (1) Authorized user of software (ANS-10.8-2015)

user organization. Organization responsible for authorized use of the software. (ANS-10.8-2015)

V.

vadose zone. A subsurface region where the water gauge pressure is negative; most commonly, the zone between the ground surface and the water table. (ANS-2.17-2010)

validated computational methods. A calculation method that has been tested, by comparison with experimental data or previously validated calculations, to establish the reliability of results obtained when the method is applied to conditions of interest. (ANS-57.7-92)

Variant form: (ANS-8.7-98)

validation. The test and evaluation of the integrated computer system to ensure compliance with the functions, performance and interface requirements. (ANS-7-4.3.2-W2000)

Non-preferred variation (1) A technically based analyte- and sample-specific evaluation process that extends beyond method or written analytical specification (e.g., SOW, contract, project plans) compliance, provides a level of confidence that an analyte is present or absent, and examines the uncertainty of the reported concentration of the analyte relative to the intended use of the data. Data validation is a systematic process, performed externally from the data generator, that applies a defined set of performance-based criteria to a body of data that may result in qualification of the data. Data validation occurs prior to drawing a conclusion from the body of data. (ANS-41.5-2012)

Non-preferred variation (1) The process of quantifying (e.g., establishing the appropriate bias and bias uncertainty) the suitability of a computer code system for use in nuclear criticality safety analyses. (ANS-8.24-07)

Variants (ANS-8-14-04) (ANS-8-21-95)

validator. An individual that performs the validation process and meets the qualifications for validator defined in Sec. 7 of ANA 41.5-2012. (ANS-41.5-2012).

valve closure time. Time it takes for a power operated valve to be in the fully closed position after the actuation power has reached the operator assembly. This does not include instrument delay time. (ANS-56.2-84)

variability. See “epistemic uncertainty” and “aleatory variability.” (ANS-2.27-2008)(ANS-2.29-2008)(ANS-2.30-2015)

variable. A quantity or condition that is subject to change or a quantity that can assume any of a given set of values. (ANS-8.3.1-87)

variable-trajectory model: An atmospheric dispersion model where plumes follow complex flow fields usually in three or four dimensions (ANS-2.15-2013).

variable types. Type A Those variables to be monitored that provide the information required to permit the control room operator to take the pre-planned manual actions to accomplish and maintain safe plant shutdown for design basis accident events.

NOTE: Type A may include, but is not limited to, variables required to initiate planned manual actions associated with radioactive material releases from: (1) spent fuel, (2) equipment located outside the primary reactor containment and needed during the accident for recirculation of reactor coolant, and (3) waste gas storage vessels.

Type B Those variables to be monitored that provide to the control room operator information to assess the process of accomplishing or maintaining critical safety functions, i.e., reactivity control, core cooling, reactor coolant system integrity, primary reactor containment integrity and radioactive effluent control.

Type C Those variables to be monitored that provide to the control room operator information to monitor (1) the extent to which parameters, which have the potential for causing a breach of the primary reactor containment, have exceeded the design basis values, or (2) that the in-core fuel clad, the reactor coolant system pressure boundary or the primary reactor containment may have been breached. (ANS-4.5)

verifiable count. The term means that the counting process shall be documented well enough so that independent audits of all parts of the process can be performed. (ANS-2.6-81D)

verification. The act of reviewing, inspecting, testing, checking, auditing, or otherwise determining and documenting whether items, processes, services, or documents conform to specified requirements. (ANS-3.2-93)

Non-preferred variation (1) The process of confirming that the computer code system correctly performs intended numerical calculations. (ANS-8.24-07)

Non-preferred variation (1) The establishment of confirmation of the truth or accuracy of a fact by investigation, comparison with a standard, or reference to the facts. (ANS-8.14-04) (ANS-8.21-95)

verification test. A test intended to confirm the capability of the Type A test method and equipment to measure L_a . This test is performed by inducing a known leakage rate from containment, measuring the resulting combined leakage rate, and comparing this measurement against the expected result. (ANS-56.8-02)

verification and validation (V&V)(IEEE Std 610.12). The process of determining whether the requirements for a system or component are complete and correct, the products of each development phase fulfill the requirements or conditions imposed by the previous phase, and the final system or component complies with specified requirements.

NOTE: In this standard, the phrase V&V, and its usage is considered as equivalent to the term verification, and its usage from ASME NQA-1-1989, Quality Assurance Program Requirements for Nuclear Facilities. (ANS-7-4.3.2-W00)

Non-preferred variation (1)

verification and validation (V&V). Activities related to the V&V of a product or activity (ANS-10.8-2015)

verifier. An individual that performs the compliance verification process and meets the qualifications for verifier defined in Sec. 7 of ANS-41.5-2012. (ANS-41.5-2012)

verify. To determine that a particular action has been performed in accordance with the rules and requirements of this standard, either by witnessing the action or by reviewing records. (ANS-2.29-2008) (ASME/ANS RA-Sb-2013) (Note: The term 'verify' is a candidate for deletion in ASME/ANS RA-S-20XX, issuance in 2017.)

vertical temperature difference: Also known as delta-T, a simple representation of the mean lapse rate within a layer of the atmosphere, obtained by calculating the difference between observed temperatures at the bottom and top of the layer (ANS-3.11-2015).

vertical wind direction: The wind elevation angle relative to the horizon. Values are reported in degrees elevation and are positive when wind is from below (updraft) and negative when from above (downdraft) (ANS-3.11-2015).

vertical wind speed: The ratio of the distance covered by the movement of air to the time taken to cover it perpendicular to the horizon. Values are positive when wind is from below (i.e., updraft) and negative when from above (i.e., downdraft) (ANS-3.11-2015).

vessel. A container designed to hold solution. This includes any volume within which criticality control is provided by Raschig rings. (ANS-8.5-96)

visually simulated hardware. Hardware that is present on the simulator control panels for realistic appearance and visual orientation but has no interface with the dynamic simulation models. (ANS-3.5-2009)

vital area. An area that contains vital (e.g., nuclear safety related) equipment.

(Note: Definition of Vital equipment should be included when this term is used.)

Non-preferred variation (1) An area that contain nuclear safety-related equipment. (ANS-59.52-98)

Variant form: (ANS-5.6.1-D90)

Non-preferred variation (2) An area that contains vital (e.g., nuclear safety related) equipment, which is any plant equipment, system, or device required to protect core integrity and whose failure could directly or indirectly endanger public health and safety by exposure to radiation. (ANS-59.51-89) (ANS-59.52-93)

Non-preferred variation (3) Any area that contains vital equipment. The Central Alarm Station, although not containing vital equipment, shall be considered a vital area. (ANS-3.3-88)

vital equipment. Any plant equipment, system or device, required to protect reactor core or spent fuel integrity the failure or destruction of which could directly or indirectly endanger public health and safety by exposure to radiation. (Note: Security equipment is not vital equipment.) (ANS-3.3-88)

volume source: The initial configuration of a plume or puff of material within a dispersion model that represents a three-dimensional volume (ANS-2.15-2013).

volumetric source zone. A volume of the earth's crust within which future seismicity is assumed to have distributions of source properties and locations of energy release that do not vary in time and space. (ANS-2.27-2008) (ANS-2.29-2008)

vortex. A vortex is any closed circulation flow. (ANS-2.3-83) (ANS-2.3-2011)

W.

walkdown. Inspection of local areas in a nuclear power plant where systems and components are physically located to ensure accuracy of procedures and drawings, equipment location, operating status, and environmental effects or system interaction effects on the equipment, which could occur during accident conditions. (ASME/ANS RA-Sb-2013)

wash-off. Liquid containing the mobile surface contamination removed from the specimen by immersing it in demineralized water for 30 s. (ANS-16.1-03)

watchman. An individual, not necessarily uniformed or armed with a firearm, who may perform other duties in the course of providing protection a plant. (ANS-3.3-88)

water pressure suppression (WPS) primary containment. A WPS primary containment consists of a drywell, sup-pression pool, and wetwell. In the event of a reactor coolant pressure boundary break in the drywell, reactor coolant energy is transferred from the drywell to the suppression pool by the vent system connecting the drywell and wetwell. The reactor coolant energy and decay heat are removed from the sup-pression pool by Residual Heat Removal (RHR) heat exchanges. (ANS-56.4-83)

water table. The water surface in an unconfined aquifer corresponding to where the water gauge pressure is zero, also called the phreatic surface. (ANS-2.17-2010)

waves. Surface motion in an ocean or large body of water caused by winds, barometric pressure anomalies (e.g., squall lines, etc.) and seismic disturbances. For floating nuclear plants, waves can induce plant motion which must be considered in plant design. Waves increase the effective water depth to be considered in the design of a plant sited on or near a large body of water. The dynamic effects of waves are consider-ed in the definitions of floods in American National Standard "Standards for Determining Design Basis Flooding at Power Reactor Sites," N170-1976 (ANS-2.8) (ANS-2.12-78)

wet-bulb temperature. The temperature of a wet-bulb thermometer when the heat leaving the wet bulb from evaporative cooling is equal to the heat transferred to the wet bulb by convective heat transfer from the surrounding air.(ANS-2.21-2012)

Non-preferred variation (1) The temperature an air parcel would have if cooled adiabatically to saturation at constant pressure by evaporation of water into it, with all latent heat being supplied by the parcel.(ANS-3.11-2015)

wet waste. Waste media containing appreciable amounts (greater than 1 vol %) of free liquid, for example, spent bead or powdered resin, filter sludge, and cartridge filters. (ANS-40.37-2009)

wetwell. In a water pressure suppression (WPS) primary containment, the structure which forms the boundary of the suppression pool and the vapor space contiguous to it. (ANS-56.4-83)

wind direction. The direction from which the wind os blowing. Wind direction data should be reported in degrees azimuth measured clockwise from true north and range from 0° to 360° (e.g., north is 0° or 360°, east is 90°, etc.). See also "sigma theta. (ANS-3.11-00)

wind-generated missile. Wind-generated missiles are objects that either become airborne, or tumble along the ground, or both, as the result of the wind pressure forces and the aerodynamic characteristics of the objects. (ANS-2.3-2011)

X.

Y.

yield, specific. The ratio of the volume of water which the rock or soil, after being saturated, will yield by gravity to the volume of the rock or soil.

(ANS-2.9-89)(ANS-2.17-89)

Z.

zero period acceleration. The acceleration level in a response spectrum at frequencies where the response curve is asymptotic to a line perpendicular to the acceleration axis. This usually corresponds to accelerations at frequencies greater than 33 cycles per second for the horizontal direction, and 50 cycles per second for the vertical direction and is identical to the maximum acceleration in time history (accelerogram). (ANS-2.2-02)

zone. A classification of plant areas that have similar dose rate limitations based on accessibility requirements and design precautions. A zone starts at the access door or gate. Unless separately zoned, labyrinth entrances to an area are considered part of that area and are assigned the same zone designation. (ANS-5.6.1-D90)

zone design dose rate. Maximum expected surface design dose rate in the areas of the zone that can be physically reached by an individual without the use of portable ladders, scaffolding, or other special equipment. (ANS-5.6.1-D90)

APPENDIX A

LIST OF STANDARDS PUBLISHED SINCE 2013 INCLUDED IN THIS UPDATE

LIST OF STANDARDS PUBLISHED SINCE 2013 INCLUDED IN THIS UPDATE

Standards	CC
ANSI/ANS-2.15-2013, "Criteria for Modeling and Calculating Atmospheric Dispersion of Routine Radiological Releases from Nuclear Facilities" (new standard)	ES
ANSI/ANS-2.30-2015, "Criteria for Assessing Tectonic Surface Fault Rupture and Deformation at Nuclear Facilities" (new standard)	ES
ANSI/ANS-3.11-2015, "Determining Meteorological Data for Nuclear Facilities" (revision of ANSI/ANS-3.11-2005 (R2010))	ES
ANS/ASME-58.22-2014, "Requirements for Low Power and Shutdown Probabilistic Risk Assessment" (new trial use standard)	JCNRM
ASME/ANS RA-S-1.2-2014, "Severe Accident Progression and Radiological Release (Level 2) PRA Standard for Nuclear Power Plant Applications for Light Water Reactors (LWRs)" (new trial use standard)	JCNRM
ASME/ANS RA-S-1.4-2013, "Probabilistic Risk Assessment Standard for Advanced Non-LWR Nuclear Power Plants" (new trial use standard)	JCNRM
ASME/ANS RA-Sb-2013, "Standard for Level 1/ Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications"	JCNRM
ANS/ASME RA-S-1.3 (58.25), "Standard for Radiological Accident Offsite Consequence Analysis (Level 3 PRA) to Support Nuclear Installation Applications" (In Ballot resolution) (Trial Use Pilot Applications)	JCNRM
ANSI/ANS-3.1-2014, "Selection, Qualification, and Training of Personnel for Nuclear Power Plants" (superseded ANSI/ANS-3.1-1993 (R1999))	LLWR
ANSI/ANS-3.2-2012, "Managerial, Administrative and Quality Assurance Controls for the Operational Phase of Nuclear Power Plants (revision of ANSI/ANS-3.2-2006)	LLWR
ANSI/ANS-3.4-2013, "Medical Certification and Monitoring of Personnel Requiring Operator Licenses for Nuclear Power Plants" (superseded ANSI/ANS-3.4-1996)	LLWR
ANSI/ANS-8.10-2015, "Criteria for Nuclear Criticality Safety Controls in Operations with Shielding and Confinement" (revision of ANSI/ANS-8.10-1983 (R2012))	NCS
ANSI/ANS-8.1-2014, "Nuclear Criticality Safety in Operations with Fissionable Material Outside Reactors" (revision of ANSI/ANS-8.1-1998 (R2007))	NCS
ANSI/ANS-8.15-2014, Nuclear Criticality Control of Special Actinide Elements (revision of ANSI/ANS-8.15-1981 (R2005))	NCS
ANSI/ANS-8.19-2014, "Administrative Practices for Nuclear Criticality Safety" (revision of ANSI/ANS-8.19-2005)	NCS
ANSI/ANS-8.27-2015, "Burnup Credit for Light Water Reactor Fuel" (revision of	NCS

Standards	CC
ANSI/ANS-8.27-2008)— IN PRODUCTION	
ANSI/ANS-58.16-2014, “Safety Categorization and Design Criteria for Nonreactor Nuclear Facilities” (new standard)	NRNF
ANSI/ANS-15.16-2015, “Emergency Planning for Research Reactors” (revision of ANSI/ANS-15.16-2008)	RAR
ANSI/ANS-15.21-2012, “Format and Content for Safety Analysis Reports for Research Reactors” (revision of ANSI/ANS-15.21-1996)	RAR
ANSI/ANS-10.7-2013, “Non-Real-Time, High-Integrity Software for the Nuclear Industry—Developer Requirements” (new standard)	SRA
ANSI/ANS-10.8-2015, “Non-Real Time, High-Integrity Software for the Nuclear Industry—User Requirements” (new standard) – IN PRODUCTION	SRA
ANSI/ANS-5.1-2014, “Decay Heat Power in Light Water Reactors” (revision of ANSI/ANS-5.1-2005)	SRA
ANSI/ANS-6.1.2-2013, “Neutron and Gamma-Ray Cross Sections for Nuclear Radiation Protection Calculations for Nuclear Power Plants” (revision of ANSI/ANS-6.1.2-1999 (R2009))	SRA
ANSI/ANS-6.6.1-2015, “Calculation and Measurement of Direct and Scattered Radiation from LWR Nuclear Power Plants” (revision of ANSI/ANS-6.6.1-1987 (R2007)) – IN PRODUCTION	SRA