

GUIDE NO. AERB/SG/GLO



GOVERNMENT OF INDIA

GUIDE NO. AERB/SG/GLO

AERB SAFETY GLOSSARY

GLOSSARY OF TERMS
FOR
NUCLEAR AND RADIATION SAFETY



ATOMIC ENERGY REGULATORY BOARD

AERB SAFETY GLOSSARY AERB/SG/GLO

**GLOSSARY OF TERMS
FOR
NUCLEAR AND RADIATION SAFETY**

**Atomic Energy Regulatory Board
Mumbai-400 094
India
March, 2005**

Price:

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FOREWORD

Atomic Energy Regulatory Board (AERB) is entrusted with the responsibility of laying down safety standards, and framing rules and regulations covering regulatory and safety functions envisaged under the Atomic Energy Act, 1962. Hence, AERB has taken up a programme of preparation and publication of safety codes, standards, guides and associated manuals for both, nuclear and radiation installations, covering all aspects, such as siting, design, construction, operation, quality assurance, decommissioning and regulation. In all these regulatory documents, a large number of scientific and technical terms are used which are applicable to various fields. In order to avoid ambiguity in the definitions of these terms appearing in different documents, it was decided by AERB to bring out a normalised Glossary of terms applicable to nuclear and radiation safety. The Glossary is a comprehensive compilation of terms used in various AERB regulatory documents for nuclear and radiation facilities. In drafting this document, extensive use has been made of the information available in a number of national and international publications, including those of the International Atomic Energy Agency (IAEA).

In addition to the terms defined in this Glossary, it is expected that regulatory documents would use certain terms to convey a specific meaning in the context of a particular document. Such terms would be defined in the text of respective documents themselves.

This Glossary has been prepared by a Glossary Committee (GC) comprising AERB staff and experts drawn from Bhabha Atomic Research Centre (BARC) and Nuclear Power Corporation of India Limited (NPCIL) and has been reviewed by a Glossary Review Committee (GRC) composed of AERB staff and experts drawn from BARC and NPCIL. Many other experts have also reviewed the Glossary and based on their comments, GRC has revised and vetted the document before its issue. The list of persons who have participated in the committee meetings, along with their affiliations, is appended in the document. AERB wishes to thank all individuals and organisations who have reviewed the draft and helped in its finalisation.



(S. K. Sharma)
Chairman, AERB

PREFACE

As part of its programme of preparation of safety codes, standards, guides and manuals, AERB has published various regulatory documents which are relevant to nuclear and radiation facilities. It has been observed that in some places, the same term has been defined differently in these published documents, depending on the context in that particular document.

In order to remove the ambiguity in the definitions, AERB decided to “normalise” the definitions of the terms appearing in various AERB regulatory documents so as to give a normalised definition. For this purpose, Glossary Committee (GC) and Glossary Review Committee (GRC) were constituted. During the course of preparation of the various draft regulatory documents by the respective Advisory Committees/Working Groups, entrusted with the preparation of the documents, GC reviewed the definitions of various terms proposed in these documents for normalisation, which, in turn, were reviewed by the GRC for further necessary review and finalisation before being incorporated in the published documents.

For “normalisation” of the terms, various published international and national documents were referred. The terms which were used in obvious English sense having no special significance to the documents and the terms having relevance only in a special context (specific terms which are highly technical and applicable to a particular document) were deleted or were put as footnotes or in the text of the particular document where they were first used. As far as possible, reference from where the original definition was taken is mentioned in bracket at the end of definition along with ‘M’ (as applicable), indicating some modification in the original definition. As AERB prepares a number of regulatory documents pertaining to both nuclear and radiation facilities and since most of the terms vary considerably, it was felt that two separate sets of glossaries should be brought out. In this process, two sets of Glossaries were evolved, namely ‘Glossary for Nuclear Safety’ and ‘Glossary for Radiation Safety’. These two sets of glossaries are contained in this composite document.

During the initial stages of the Glossary preparation, various review comments were received on the first draft of the Glossary for consideration by GRC. These were incorporated as felt appropriate and the final set of two Glossaries has now been prepared. With this finalised set of Glossaries, it will become easier for anyone who is involved in the preparation of any regulatory document, to use the relevant definitions from these sets. However, it may also be noted that these sets will be periodically updated as new terms get added during the course of time.

**GLOSSARY FOR
NUCLEAR SAFETY
(GNS)**

GLOSSARY FOR NUCLEAR SAFETY (GNS)

Absorbed Dose

The fundamental dosimetric quantity D is defined as:

$$D = dE / dm$$

where, 'dE' is the mean energy imparted by ionising radiation to the matter in a volume element and 'dm' is the mass of matter in the volume element. The energy can be averaged over any defined volume, the average dose being equal to the total energy imparted in the volume divided by the mass in the volume. The SI unit of absorbed dose is joule/kg ($J.kg^{-1}$), termed the gray (Gy). [43M]

Acceptable Limits

Limits acceptable to the regulatory body for accident condition or potential exposure.[11M]

Acceptance Criteria

The standard or acceptable value against which the value of a functional or condition indicator is used to assess the ability of a system, structure or component to perform its design function or compliance with stipulated requirements. [91M]

Accident

An unplanned event resulting in (or having the potential to result in) personal injury or damage to equipment which may or may not cause release of unacceptable quantities of radioactive material or toxic/hazardous chemicals. [114]

Accident Conditions

Substantial deviations from operational states, which could lead to release of unacceptable quantities of radioactive materials. They are more severe than anticipated operational occurrences and include design basis accidents as well as beyond design basis accidents. [78M]

Accident Progression Event Tree (APET)/Containment Event Tree (CET)

Event tree generated for accident progression analysis in Level 2 PSA for various plant damage states. [130M]

Activation

The production of radionuclides by irradiation. [43]

Active Component

A component whose functioning depends on an external input, such as actuation, mechanical movement, or supply of power, and which, therefore, influences the system process in an active manner, e.g. pumps, valves, fans, relays and transistors. It is emphasized that this definition is necessarily general in nature as is the corresponding definition of passive component. Certain components, such as rupture discs, check valves, injectors and some solid state electronic devices, have characteristics which require special consideration before designation as an active or passive component. [48M]

Active Maintenance Time

That part of the maintenance time during which a maintenance action is performed on an entity, either automatically or manually, excluding logistic delays. [124]

Activity

The quantity 'A' for an amount of radionuclide in a given energy state at a given time is defined as:

$$A = dN/dt$$

Where 'dN' is the expectation value of the number of spontaneous nuclear transformations from the given energy state in a time interval 'dt'. The SI unit of activity is the reciprocal of second (s⁻¹), termed the Becquerel (Bq). [43]

Admixture

Material other than water, aggregate or cement, used as an ingredient of concrete and added to concrete before, during or subsequent to its mixing to modify its properties. [79M]

Ageing

General process in which characteristics of structures, systems or components gradually change with time or use [although the term 'ageing' is defined in a neutral sense - the changes involved in ageing may have no effect on protection or safety, or could even have a beneficial effect - it is commonly used with a connotation of changes that are (or could be) detrimental to protection or safety, i.e. as a synonym of 'ageing degradation']. [125M]

Ageing Management

The engineering, operations and maintenance actions taken to control ageing degradation and wearing out of systems, structures or components within acceptable limits. [75M]

Aggregate

Granular material, such as sand, gravel, crushed stone, and iron blast-furnace slag, used with a cementing medium to form a hydraulic-cement concrete or mortar. [79]

ALARA

An acronym for 'As Low As Reasonably Achievable'. A concept meaning that the design and use of sources, and the practices associated therewith, should be such as to ensure that exposures are kept as low as reasonably practicable, with economic and social factors taken into account. [40M]

Alpha-bearing Waste

Waste containing one or more alpha-emitting radionuclides in quantities and/or concentrations above clearance levels. [134]

Analysis

A process of mathematical or other logical reasoning or deduction that leads from stated premises to the conclusion/response/outcome/adequacy of a system or any other item of interest. [75]

Anchor

A structural member embedded in the concrete or attachment to other structures to which a liner, embedment, or surface mounted item is attached. [80]

Anchorage (Pre-stressing)

A device by which force is transferred to concrete. In post-tensioning, the device used is to anchor tendon to the concrete member, whereas in pre-tensioning, the device is used to anchor tendon during the hardening of concrete. [79]

Anchor Head

A nut, washer, plate, stud or bolt head or other steel components used to transmit anchor loads to the concrete by bearing. [80]

Annual Limit on Intake (ALI)

The intake by inhalation, ingestion or through the skin of a given radionuclide in a year by the reference man, which would result in a committed dose equal to the relevant dose limit. The ALI is expressed in units of activity. [43]

Anomaly

Deviations from normal which could be due to equipment failure, human error or procedural inadequacies but do not pose a risk which may exceed authorised operational limits and conditions. [131M]

Anticipated Operational Occurrences

An operational process deviating from normal operation, which is expected to occur during the operating lifetime of a facility but which, in view of appropriate design provisions, does not cause any significant damage to items important to safety, nor lead to accident conditions. [96]

Appeal

Request to the appellate authority for review against any decision of the regulatory body. [5M]

Applicant

Any person who applies to the competent authority for consent to undertake any of the actions for which the consent is required. [43M]

Approval

A type of regulatory consent issued by the regulatory body to a proposal. [114]

Appurtenance

An item of significant structural integrity or leak tightness and which is fabricated, inspected and stamped independently of the component, which can be attached to a component that has been previously stamped. [80M]

Aquifer

A water-bearing formation (bed or stratum) of permeable rock, sand and gravel capable of yielding significant quantities of water. [80]

Assessment

Systematic evaluation of the arrangements, processes, activities and related results for their adequacy and effectiveness in comparison with set criteria. [121]

Astigmatic Power

The maximum refractive power difference between two 'meridians' along the same sighting axis; expressed in 'diopters'. ('Meridian' is a line passing through the centre of a lens surface, from edge to edge.) [155M]

Atomic Energy Regulatory Board (AERB)

A national authority designated by the Government of India having the legal authority for issuing regulatory consent for various activities related to the nuclear and radiation facility and to perform safety and regulatory functions, including their enforcement for the protection of site personnel, the public and the environment against undue radiation hazards. [114]

Attachment

An element in contact with or connected to the inside or outside of a component. It may have either a pressure retaining or non-pressure retaining function. [81M]

Audit

A documented activity performed to determine by investigation, examination and evaluation of objective evidence, the adequacy of, and adherence to applicable codes, standards, specifications, established procedures, instructions, administrative or operational programmes and other applicable documents, and the effectiveness of their implementation. [5M]

Authorisation

A type of regulatory consent issued by the regulatory body for all sources, practices and uses involving radioactive materials and radiation generating equipment (see also "Consent"). [114]

Authorised Limits

(See "Prescribed Limits").

Availability

The fraction of time in which an entity is capable of performing its intended purpose.[78M]

Balanced Protection (Security)

A system of protection that provides for the minimum probability of detection of penetration of each of the barriers to be equal and the minimum time to penetrate each of these barriers also to be equal. [151M]

Base Flow

The normal flow in the river channel before any additional inflow starts contributing to the channel. [63M]

Base Temperature/Stress Free Temperature

Temperature at which it is assumed that the material is free of thermal stresses. [79]

Basic Event

An event in a logic model, which represents the state in which a component or a group of components is unavailable. Generally, basic events are component failures, operator errors, adverse environmental conditions, etc. However, they can also relate to operation, maintenance, etc. [122]

Becquerel

(See "Activity").

Beyond Design Basis Accidents (BDBA)

Accidents of very low probability of occurrence, more severe than the design basis accidents, those may cause unacceptable radiological consequences; they include severe accidents also. [96M]

Beyond Design Basis Events (BDBEs)

Events of very low probability of occurrence, which can lead to severe accidents and are not considered as design basis events. [103]

Bio-assay

The determination of the kind, quantity, location, and/or retention of radionuclides in the body by in vitro analysis of material excreted or removed from the body. [44M]

Bonded Tendon

Pre-stressing tendon that is bonded to concrete, either directly or through grouting.[79]

Bundle Power Envelope

The power variation profile of a maximum rated fuel bundle as its burnup progresses in the reactor core. [146]

Catastrophic Event

Any event, which could potentially cause the loss of primary system function(s) resulting in significant damage to the system or its environment and/or cause the loss of life or limb. [124]

Cause-Consequence Diagram (CCD)

A logic diagram showing the causes and consequences of an initiating event. [124]

Central Alarm System (CAS) (Security)

An installation which provides for the complete and continuous alarm monitoring and assessment of the facility and communications with guards, facility management and the response force. [150M]

Certification (of Personnel)

The formal process of certifying personnel by an authority for performing the various activities in nuclear and radiation facilities. [114M]

Channel (Coolant)

The primary heat-transport coolant tube and accessories through which the reactor coolant flows in a reactor. [97]

Channel (Instrumentation)

An arrangement of interconnected components within a system that initiates output(s). [97M]

Characteristic Strength of Material

The value of the strength of material below which not more than 5% of the test results are expected to fall. [139]

Checking (Design)

The detailed technical review of a document to ensure that it is accurate, and that all the technical design inputs, design basis and other design criteria have been correctly incorporated. [95M]

Cladding

An external sheath of material over nuclear fuel or other material that provides protection from a chemically reactive environment and containment of radioactive products produced during the irradiation of the composite. It may provide a structural support. [62M]

Clearance Levels

A set of values established by the regulatory body and expressed in terms of activity concentrations and/or total activity, at or below which sources of radiation may be released from regulatory control. [43M]

Coarse Aggregate

The aggregate particles retained on a 4.75 mm IS sieve. [82]

Cold Shutdown (Reactor)

Shutdown state in which the temperature of the primary heat transport system at inlet is less than the specific value (e.g. 55 °C for PHWRs). [157]

Collective Dose

An expression for the total radiation dose incurred by a population and defined as the product of the number of individuals exposed to a source and their average radiation dose. [43]

Collective Effective Dose

The total collective effective dose 'S' to the population is defined as :

$$S = \sum_i E_i N_i$$

where 'E_i' is the average effective dose in the population sub-group 'i' and 'N_i' is the number of individuals in the sub-group 'i'. [43]

Combustible Liquid

A liquid having a flash point at/or above 38° C. [52M]

Combustible Material

Any material used in a particular form in which it is used and under the conditions anticipated will ignite and burn, generally accompanied by flames, glow or emission of smoke or a combination thereof. [52M]

Commencement of Operation of Nuclear Power Plant

The specific activity/activities in the commissioning phase of a nuclear power plant towards first approach to criticality, starting from fuel loading. [47M]

Commissioning

The process during which structures, systems and components of a nuclear or radiation facility, on being constructed, are made functional and verified in accordance with design specifications and found to have met the performance criteria. [5M]

Committed Absorbed Dose, D (τ)

The quantity 'D (τ)' is defined as

$$D(\tau) = \int_{t_0}^{t_0 + \tau} \dot{D}(t) dt$$

where ' t_0 ' is the time of intake, ' $\dot{D}(t) dt$ ' is the absorbed dose rate at time 't' and ' τ ' is the time elapsed after an intake of radioactive substance. When ' τ ' is not specified, it will be taken to be 50 years for adults and age 70 years for intake by children. [43]

Committed Effective Dose, E (τ)

The time integral of the whole body effective dose rate following an intake of a radionuclide. The quantity 'E (τ)' is defined as

$$E(\tau) = \sum w_T H_T(\tau)$$

where ' $H_T(\tau)$ ' is the committed equivalent dose to tissue 'T' over the integration time ' τ '. When ' τ ' is not specified, it will be taken to be 50 years for adults and age 70 years for intake by children. [43M]

Committed Equivalent Dose, H (τ)

The time integral of the equivalent dose rate in an organ or tissue following an intake of a radionuclide. The quantity 'H (τ)' is defined as

$$H_T(\tau) = \int_{t_0}^{t_0 + \tau} \dot{H}_T(t) dt$$

where ' t_0 ' is the time of intake, ' $\dot{H}_T(t)$ ' is the equivalent dose rate at time 't' in an organ or tissue 'T' and ' τ ' is the time elapsed after an intake of radioactive substances. When

' τ ' is not specified it will be taken to be 50 years for adults and age 70 years for intake by children. [43M]

Common Cause Failure (CCF)

The failure of a number of devices or components to perform their functions, as a result of a single specific event or cause. [65M]

Common Mode Failure (CMF)

Failure of two or more structures, systems or components in the same manner or mode due to a single event or cause. It is a type of common cause failure. [125]

Competent Authority

Any official or authority appointed, approved or recognised by the Government of India for the purpose of the Rules promulgated under the Atomic Energy Act, 1962.[66M]

Component

The smallest part of a system necessary and sufficient to consider for system analysis.[124]

Computational Model

A calculational tool that implements a mathematical model. [125]

Computer-based System

A system consisting of one or more computers (comprising hardware and software) collectively forming a functional unit of an instrumentation and control system. [136]

Computer Hardware

Central processing unit, memory, standard peripherals, peripheral controllers, communication hardware and the power supplies for the above. [136]

Conceptual Model

A set of qualitative assumptions used to describe a system (or part thereof). [125]

Conditioning of Waste

The processes that transform waste into a form suitable for transport and/or storage and/or disposal. These may include converting the waste to another form, enclosing the waste in containers and providing additional packaging. [19]

Confidence Level (containment leakage rate)

The probability that the true leakage rate will not exceed the upper confidence limit. [94]

Confinement

Barrier, which surrounds the main parts of a nuclear facility, carrying radioactive materials and designed to prevent or to mitigate uncontrolled release of radioactivity into the environment during commissioning, operational states, design basis accidents or in decommissioning phase. [6M] (see “Containment” also)

Consent

A written permission issued to the “consentee” by the regulatory body to perform specified activities related to nuclear and radiation facilities. The types of consents are ‘licence’, ‘authorisation’, ‘registration’ and ‘approval’, and will apply according to the category of the facility, the particular activity and radiation source involved. [114]

Consentee

A person to whom consent is granted by the competent authority under the relevant Rules. [67]

Consequence Tree

A logic diagram showing the consequences of an initiating event. [124]

Construction

The process of manufacturing, testing and assembling the components of a nuclear or radiation facility, the erection of civil works and structures, the installation of components and equipment and the performance of associated tests. [47M]

Containment

(See “Primary Containment”/“Secondary Containment”/“Confinement”).

Containment Boundary

The outer limits of the containment system. [80]

Containment Envelope

Structures and penetrations, which provide pressure retaining barrier to prevent or limit the escape of any radioactive material that could be released from the fuel during accident conditions. [93]

Containment Isolation

The process of isolating or boxing up the containment so that there is no direct path from the system available for the radioactivity to reach the environment.[80M]

Containment Penetrations

Openings in the containment envelope for passage of personnel, materials, process piping and cables. [106]

Containment Structure

The concrete portion and embedded parts of the primary and secondary containment systems. [93M]

Contamination

The presence of radioactive substances in or on a material/the human body or other places in excess of quantities specified by the competent authority. [111]

Contractor

An individual or organisation rendering service (e.g. design, construction, inspection, review, maintenance and/or supplying items). [153]

Controlled Area

A delineated area to which access is controlled and in which specific protection measures and safety provisions are, or could be, required for

- (a) controlling normal exposures or preventing the spread of contamination during normal working conditions; and
- (b) preventing potential exposures or limiting their extent should they occur. [41]

Control System

A system performing actions needed for maintaining plant variables within prescribed limits. [48M]

Core Components

All items other than fuel, which reside in the core of a nuclear power plant and have a bearing on fuel integrity and/or utilisation (e.g. calandria, reactor vessel, coolant channels, in-core detectors and reactivity devices). [62M]

Core Damage

Reactor state brought about by the accident conditions with loss of core geometry or resulting in crossing of design basis limits or acceptance criteria limits for one or more parameters. (The parameters to be considered include: fuel clad strain, fuel clad temperature, primary and secondary systems pressures, fuel enthalpy, clad oxidation, % of fuel failure, H₂ generation from metal-water reaction, radiation dose, time required for operator to take emergency mitigatory action). [121]

Core Management

All activities associated with the use of fuel and core components in a nuclear power plant with the ultimate aim of ensuring integrity and efficient use of the same. [62M]

Corrective Maintenance

The maintenance carried out after fault recognition to put an entity into a state in which it can perform a required function. [124M]

Countermeasures

An action aimed at alleviating or mitigating the consequences of accidental release of radioactive material into the environment. [114]

Coupling (Pre-stressing)

The means by which the pre-stressing force is permanently transmitted from one portion of the pre-stressed steel to another, to form a complete tendon. [80]

Criteria

Principles or standards on which a decision or judgement can be based. They may be quantitative or qualitative. [42M]

Critical Component

Component, whose failure, in a given operating state of the system, results in the system failure. [125]

Critical Event

Any event, which could potentially cause the loss of the primary system function(s) resulting in significant damage to the said system or its environment (and negligible hazard to life or limb). [124]

Critical Group

A group of members of the public which is reasonably homogeneous with respect to its exposure for a given radiation source and given exposure pathway and is typical of individuals receiving the highest effective dose or equivalent dose (as applicable) by the given exposure pathway from the given source. When exposure occurs by more than one pathway, the term may also be used to mean the group which receives the highest total dose by all the pathways of exposure from a given source or practice. [41]

Critical Nuclides

Nuclide(s) that contributes to a major fraction of effective (equivalent) dose to the critical group of population. [22]

Critical Pathway

The dominant environmental pathway through which members of the critical group are exposed to radiation. [42]

Critical Target

A target that, if hit by a missile, could result in primary or secondary effects with safety significance. [137]

Criticality

The 'stage' or 'state' of a fissile material system where a self-sustained nuclear chain reaction is just maintained. [52M]

Criticality Analysis (PSA)

Analysis for evaluating the likelihood and severity of the failure. [124M]

Curvature Friction

Friction resulting from bends or curves in the specified pre-stressing tendon profile.[79]

Cut Set

A combination of basic events resulting in an undesirable event. [124]

Cyclone

A low-pressure belt generated in the upper atmosphere, which has circular isobaric pattern and associated wind speed greater than 60 km/h. [64]

Damaged Fuel

Fuel bundle, which has undergone damage to such an extent that it may get further deteriorated if handled by normal means. [99]

Decay Heat

The heat produced by the decay of radioactive nuclides. [52]

Decommissioning

The process by which a nuclear or radiation facility is finally taken out of operation in a manner that provides adequate protection to the health and safety of the workers, the public and the environment. [114]

Decontamination

The removal or reduction of contamination by physical or chemical means. [43]

Decontamination Factor

The ratio of initial level of contamination of radioactive material to residual level achieved through a decontamination process. [19]

Deductive Approach

The approach, where the line of reasoning goes down from the most general to the most specific. [124M]

Deep Water

Water of a depth greater than $L/2$, where L is the wavelength of the surface wave under consideration. [2]

Defects

Any deviation from the pre-defined acceptable limits, or any non-conformance with the stated requirements. [80]

Defence-in-Depth

Provision of multiple levels of protection for ensuring safety of workers, the public or the environment. [77]

Defence-in-Depth (Security)

A concept used to design physical protection systems that requires an adversary to overcome or circumvent multiple obstacles, either similar to or diverse, in order to achieve his objective. [150]

Deflagration

Vigorous burning with emission of large heat and intense light accompanied by subsonic flame propagation. [99]

Degradation Failure

A failure, which is both a gradual failure and a partial failure. In time, such a failure may develop into a complete failure. [124]

Degraded State

The state in which an entity exhibits reduced performance but insufficient degradation to declare the entity unavailable, according to the specified success criterion. (Examples of degraded states are relief valves opening prematurely outside the technical specification limits with less than 100 % flow but within a safety margin). [123M]

Deluge System

A fire control or extinguishing installation with open sprinkler heads where it is desired to deliver water through all the sprinklers simultaneously and to wet the entire area to be protected. [83]

Dependent Failures

Interdependent, simultaneous or concomitant failures of multiple entities. [124]

Derived Air Concentration (DAC)

That activity concentration of the radionuclide in air (Bq/m^3) which, if breathed by reference man for a working year of 2000 h under conditions of light physical activity (breathing rate of $1.2 \text{ m}^3/\text{h}$), would result in an inhalation of one ALI, or the concentration, which for 2000 h of air immersion, would lead to irradiation of any organ or tissue to the appropriate annual dose limit. [44M]

Derived Intervention Level (DIL)

The quantities that can be directly measured, such as exposure rate from ground-deposited activity and activity concentration in foodstuff and water, at which intervention in the form of countermeasures should be initiated. [45M]

Derived Limits

Values of quantities related to the primary or secondary limits by a defined model such that if the derived limits are not exceeded, it is most unlikely that the primary limits will be exceeded. [40]

Design

The process and results of developing the concept, detailed plans, supporting calculations and specifications for a nuclear or radiation facility. [114]

Design Analysis

All processes which use design inputs and which result in the generation of information necessary for preparation of design output, such as drawings, specifications and procedures. [145]

Design Basis Accidents (DBAs)

A set of postulated accidents which are analysed to arrive at conservative limits on pressure, temperature and other parameters which are then used to set specifications to be met by plant structures, systems and components, and fission product barriers.[2M]

Design Basis Events (DBEs)

The set of events, that serve as part of the basis for the establishment of design requirements for systems, structures and components within a facility. Design basis events (DBEs) include operational transients and certain accident conditions under postulated initiating events (PIEs) considered in the design of the facility (see also "Design Basis Accidents"). [103M]

Design Basis Fire

A hypothetical fire, which is assumed for the purpose of fire protection design or analysis. Fire is assumed to be one that would lead to the most severe damage in the area under consideration in the absence of fire protection systems. [83]

Design Basis External Events (DBEEs)

The parameter values associated with, and characterising, an external event (e.g. missile impact, chemical explosion in the vicinity, etc.) or combinations of external events selected for design of all or any part of a nuclear facility. [2M]

Design Basis Flood (DBF)

The flood selected for deriving a design basis for a nuclear facility. [2M]

Design Basis Ground Motion (DBGM)

The ground motion parameters of a given level of earthquake severity, which are used in the design of a facility. Examples of these parameters are peak ground acceleration (PGA), response spectrum, acceleration time history of the ground motion, etc. Examples of severity levels of earthquakes are safe shutdown earthquake (SSE) and operating basis earthquake (OBE) used in the design of nuclear power plants. [75M]

Design Basis Information (DBI)

The information based on which the design is made. [114]

Design Basis Missile

A missile for which the designer is required to take appropriate measures in the design.[137M]

Design Basis Natural Events (DBNEs)

Natural events (like storm, flood, etc.) selected for deriving design basis for a nuclear facility. [2M]

Design Basis Storm

The storm selected for deriving design basis for a nuclear facility. [63M]

Design Basis Threat (DBT)

The attributes and characteristics of potential insider and/or external adversaries, who might attempt unauthorised removal of nuclear material or sabotage, against which a physical protection system is designed and evaluated. [150]

Design Conditions

The service conditions used as the basis for ratings or design qualification of structures, systems, components or any other item. [148]

Design Inputs

The criteria, parameters, bases or other requirements upon which detailed final design is based. [75]

Design Leak Rate (for Containment Penetration Assembly)

The maximum permissible leak rate, at design pressure and temperature, through the assembly in the event of a design basis accident inside the reactor containment. [80]

Design Life

The period for which the item will perform satisfactorily meeting the criteria set forth in the design specification. [80M]

Design Limits

Limits on the design parameters within which the design of the structures, systems and components of a nuclear facility have been shown to be safe. [103]

Design Outputs

Documents, such as design reports, drawings and specifications that define technical requirements necessary for manufacture, installation and operation of structures, systems and components. [75]

Design Pressure (Containment)

The calculated peak containment internal pressure (P_a) as arrived at from the safety analysis of design basis accidents (e.g., MSLB, LOCA). While the pressure for leakage rate testing of the reactor containment will be based on LOCA, for proof testing the higher of the two pressures arrived at from MSLB or LOCA will be the governing pressure. [93M]

Deterministic Analysis

Analysis using, for key parameters, single numerical values (taken to have probability of 1), leading to a single value of the result. [125]

Deterministic Effects

A radiation effect for which generally a threshold level of dose exists, above which the severity of the effect is greater for a higher dose. [43]

Deterministic Method

A method for which most of the parameters and their values are mathematically definable and may be explained by physical relationships and are not dependent on random statistical events. [22M]

Detonation

An exothermic chemical reaction due to combustion of a substance, which propagates through reactive material at supersonic speed. [100]

Direct Cause

The latent weakness, which allows or causes the observed cause of an initiating event to happen, including the reasons for the latent weakness. [125]

Discharge (Radioactive)

Planned and controlled release of (gaseous or liquid) radioactive material into the environment. [42]

Discharge Limits

The limits prescribed by the regulatory body for effluent discharges into atmosphere/aquatic environment from nuclear/radiation facilities. [22M]

Disposal (Radioactive Waste)

The emplacement of waste in a repository without the intention of retrieval or the approved direct discharge of waste into the environment with subsequent dispersion.[42]

Disposition

An act to determine how a departure from a specified requirement is to be handled or settled. [46]

District Authority

A person notified by the appropriate government(s), with jurisdiction over the area outside the exclusion zone of the nuclear/radiation facility and who is having responsibility for coordinating the activities of various government agencies for protecting the public and the environment in case of an off-site emergency. [114]

Diversity

The presence of two or more different components or systems to perform an identified function, where the different components or systems have different attributes, so as to reduce the possibility of common cause failure. [120]

Documentation

Recorded or pictorial information describing, defining, specifying, reporting or certifying activities, requirements, procedures or results. [46]

Domain (Radiological Emergency)

Region bound by time-space considerations, categorised on the basis of radiological characteristics. [45M]

Dose

A measure of the radiation received or absorbed by a target. The quantities termed absorbed dose, organ dose, equivalent dose, effective dose, committed equivalent dose, or committed effective dose are used, depending on the context. The modifying terms are used when they are not necessary for defining the quantity of interest. [43]

Dose Constraint

A prospective and source-related restriction on the individual dose delivered by the source, which serves as a bound in the optimisation of protection and safety of the source. For occupational exposures, dose constraint is a source-related value of individual dose used to limit the range of options considered in the process of optimisation. For public exposure, the dose constraint is an upper bound on the annual dose that a member of the public should receive from the planned operation of any controlled source. The exposure to which the dose constraint applies is the annual dose to any critical group, summed over all exposure pathways, arising from the predicted operation of the controlled source. The dose constraint for each source is intended to ensure that the sum of doses to the critical group from all controlled sources remains within the dose limit. For medical exposure the dose constraint level should be interpreted as a guidance level, except when used in optimising the protection of persons, other than workers, who assist in the care, support or comfort of exposed patients. [43]

Dose Limit

The value of the effective dose or the equivalent dose to individuals from controlled practices that shall not be exceeded. [43]

Dosimeter

A device, instrument or system, which can be used to measure or evaluate any quantity related to the determination of either absorbed dose or equivalent dose. [40]

Dual Failure

A normal operating system failure with simultaneous unavailability of a safety system or any other system. [105M]

Earthquake

Vibration of earth caused by the passage of seismic waves radiating from the source of elastic energy. [68]

Effect Distance

(See “Hazard Distance”).

Effective Dose

The quantity 'E' defined as a summation of the tissue equivalent doses, each multiplied by the appropriate tissue weighting factor:

$$E = \sum w_T \cdot H_T$$

where 'H_T' is the equivalent dose in tissue 'T' and 'w_T' is the tissue weighting factor for tissue 'T'. [43]

Effective Pre-stress

The stress remaining in pre-stressing tendons after all losses have occurred (at the time of consideration), excluding the effects of dead load and superimposed load. [79M]

Effluent

Any waste discharged into the environment from a facility, either in the form of liquid or gas. [42M]

Electrical Protection System

A part of electrical system which protects an equipment or system. This encompasses all the electrical, electronic, mechanical, thermal, pneumatic devices and circuitry, including the sensors which generate the input signal for protection logic. [14M]

Electrical Separation

Means of preventing one electric circuit from influencing another through electrical phenomena. [48]

Embedment

The embedment is that portion of the component which is in contact with the concrete or grout used to transmit applied loads to the concrete structure through a direct bond or other anchor. The embedment may be fabricated lugs, bolts, plates, reinforcing bars, shear connectors, expansion anchors, inserts or any combination thereof. [75]

Embedded Parts (EPs)

Any structural member, plate, angle, channel, pipe sleeve or other section anchored to a concrete structure through a direct bond or other anchors. [75]

Emergency

A situation which endangers or is likely to endanger safety of the site personnel, the nuclear/radiation facility or the public and the environment. [60M]

Emergency Alert

Declared abnormal condition with the possibility of leading to plant/site/off-site emergency. [20M]

Emergency Electric Power System

The portion of the electrical power system, which is provided for the purpose of supplying electric power to safety related and safety systems during operational states, as well as during and following accident conditions. [14M]

Emergency Exercise

A test of an emergency plan with particular emphasis on coordination of the many inter-phasing components of the emergency response, procedures and emergency personnel/agencies. An exercise starts with a simulated/postulated event or series of events in the plant in which an unplanned release of radioactive material is postulated.[20M]

Emergency Plan

A set of procedures to be implemented in the event of an accident. [43]

Emergency Planning Zone (EPZ)

The zone defined around the plant upto 16 km radius providing a basic geographic framework for decision making on implementing measures as part of a graded response in the event of an off-site emergency. [45M]

Emergency Shelters

Rooms/buildings where personnel can be sheltered during emergencies. [20]

Engineered Safety Features (ESFs)

The system or features specifically engineered, installed and commissioned in a nuclear power plant to mitigate the consequences of accident condition and help to restore normalcy, e.g. containment atmosphere clean-up system, containment depressurisation system, etc.[77]

Entity

It refers to a structure, system or component and in specific case may include humans.[125M]

Environment

Everything outside the premises of a facility, including the air, terrain, surface and underground water, flora and fauna. [106]

Environmental Conditions

Parameters such as pressure, temperature, humidity, chemical spray, flooding, and radiological conditions associated with operational states and accident conditions. [74]

Equilibrium Core

The condition of the core of an operating reactor in which the rate of charging and discharging of the fuel in the core, averaged over a sufficiently long period of time, reaches and remains close to design value. [70]

Equivalent Dose ($H_{T,R}$)

The quantity ' $H_{T,R}$ ' is defined as

$$H_{T,R} = D_{TR} w_R$$

where ' D_{TR} ' is the absorbed dose delivered by radiation type 'R' averaged over a tissue or organ 'T' and ' w_R ' is the radiation weighing factor for radiation type 'R'. When the radiation field is composed of different radiation types with different values of ' w_R ' the equivalent dose is

$$H_T = \sum_R w_R D_{T,R}. \quad [43]$$

Error of Commission

An error that amounts to an unintended action, excluding inaction. It includes selection error, error of sequence, time error and qualitative error. [129]

Error of Omission

An error that amounts to omitting a part or entire task. [127]

Evacuation

The temporary removal of persons from locations where dose rates or projected doses arising in an emergency situation are unacceptably high, or where the avertable dose exceeds the relevant intervention level. [41]

Event

Occurrence of an unplanned activity or deviations from normalcy. It may be an occurrence or a sequence of related occurrences. Depending on the severity in deviations and consequences, the event may be classified as an anomaly, incident or accident in ascending order. [77]

Event Tree

Inductive logic model that orderly represents event sequence branches leading to end state arising from success or failure of mitigating actions required for each group of initiating events. [132]

Examination

An element of inspection consisting of investigation of materials, components, supplies or services to determine conformance with those specified requirements which can be determined by such investigation. [46]

Exclusion Zone

An area extending upto a specified distance around the plant, where no public habitation is permitted. This zone is physically isolated from outside areas by plant fencing and is under the control of the plant management. [45M]

Expansion Fastener

A component installed in hardened concrete for the transfer of loads into the concrete by direct bearing and/or friction. [80]

Explosion

An abrupt oxidation or decomposition reaction producing an increase in temperature, or in pressure, or in both simultaneously. [52]

Exposure

The act or condition of being subject to irradiation. Exposure can be either external (irradiation by sources outside the body) or internal (irradiation by sources inside the body). Exposure can be classified as either normal exposure or potential exposure; either occupational, medical or public exposure; and in intervention situations, either emergency exposure or chronic exposure. The term 'exposure' is also used in radiation dosimetry to express the amount of ions produced in air by ionising radiation. [43]

Exempt Waste

Waste, which is cleared from regulatory control in accordance with clearance levels. The designation should be in terms of activity concentration and/or total activity and may include a specification of the type, chemical/physical form, mass or volume of waste. [42M]

Exemption

The deliberate omission of a practice, or specified sources within a practice, from regulatory control or from some aspects of regulatory control, by the regulatory body on the grounds that the exposures which the practice or sources cause or have the potential to cause are sufficiently low as to be of no regulatory concern. [41]

Exposure Pathway

A route by which radiation or radionuclides can reach humans and cause exposure. [96]

Fail Safe Design

A concept in which, if a system or a component fails, then the plant/component/ system will pass into a safe state without the requirement to initiate any operator action. [101M]

Failure Mode

The effect by which a failure is observed. [124]

Failure Modes and Effects Analysis (FMEA)

A qualitative method of system analysis, which involves the study of the failure modes that can exist in every component of the system and the determination of the causes and effects of each failure mode. [124M]

Failure Modes, Effects and Criticality Analysis (FMECA)

A qualitative method of system analysis, which involves a failure modes and effects analysis together with a criticality analysis. [124]

Fault Tolerance

The attribute of an entity that enables it to perform a required function in the presence of certain given sub-entity faults. [124]

Fault Tree

Deductive model which starts with a most undesired event (system unavailability), known as 'top event', and proceeds downwards till all the credible combinations of basic events leading to the top event are depicted. [132]

Failure Mechanism

The physical, chemical or other process, which has led to a failure. [124]

Final Safety Analysis Report (FSAR)

Safety analysis report submitted to the regulatory body for obtaining consent for operation of a nuclear/radiation facility. [114]

Fine Aggregate (Sand)

The portion of aggregate passing a 4.75 mm IS sieve. [82]

Fire Barrier

A structural barrier, partially or completely limiting the spread and thus the consequences of a fire. [83]

Fire Cell

A sub-division of a larger fire compartment of concentrated fire load within a fire area (e.g. lubricating oil tank within turbine building) (see also "Fire Compartment"). [83]

Fire Compartment

An area or compartment of a building or a building itself bounded by a fire-resistive enclosure (walls, floor, ceiling or openings, if any) of a defined fire rating (see also "Fire Cell"). [83]

Fire Damper

A device, which is designed for automatic and/or manual operation to prevent propagation of fire through a duct in a given condition. [83M]

Fire Detection

Measures directed towards detecting and indicating the presence of fire. [83]

Fire Detector

Devices designed to automatically detect and indicate the presence of fire. [83]

Fire Gas Detector

A device that detects gases produced by fire. [83]

Fire Load

The calorific potential of combustible materials contained in a space, including the facings of the walls, partitions, floors and ceilings. [83]

Fire Prevention

Measures directed towards avoiding the inception of fire and spread of fire to other areas/zones. [83]

Fire Protection

Measures directed towards prevention, detection and suppression of fire. [83]

Fire Resistance/Rating (F)

The ability of an element of a structure to maintain against fire for a stated period of time the required stability, integrity and/or thermal insulation as specified in the standard fire resistance tests. [83]

Fire Retardant

The quality of a substance as a means of suppressing, reducing or delaying markedly the combustion of certain materials. [83]

Fire Stop

Physical barrier designed to restrict the spread of fire in cavities within or between the elements of installation. [83]

Fire Suppression

Measures directed towards control or extinguishment, or both, of fire through an automatic or fixed (manual) system, utilising an appropriate agent (such as water, carbon dioxide, foam or dry chemical powder). [83]

Flame Detector

A device which detects the infra-red, the ultra-violet or visible radiation produced by a fire. [83]

Flammable

Any medium which is capable of undergoing combustion in the gaseous phase, with emission of light during or after the application of igniting source. [94]

Flammable Liquid

A liquid having a flash point of 38°C or less and having a vapour pressure not exceeding 1.8 kg/cm² (g) at 38°C. [83M]

Flaw

An imperfection, discontinuity, irregularity or fault in the material of a component such as a crack, inclusion, porosity, lack of penetration, lack of fusion, etc. [80M]

Flued Head Fittings

A fitting with the provision of a flue at one end for the circulation of air. [80]

Fresh Core

The condition of the core after initial loading, which contains all fresh bundles with zero burnup. [70]

Frontline Systems

The systems that directly perform a safety function. [121]

Fuel Bundle

An assembly of fuel elements identified as a single unit (also called 'Fuel Assembly'). [70]

Fuel Element

A component of fuel assembly that consists primarily of the nuclear fuel and its encapsulating materials. [6M]

Fuel Failure (Failed Fuel)

A fuel bundle having failure of clad or end-plug in one or more fuel elements, leading to release of radioactive material. [98M]

Fuel Handling

All activities relating to receipt, inspection, storage and loading of unirradiated fuel into the core and unloading of irradiated fuel from the core, its transfer, inspection, storage and despatch from the nuclear power plant. [62M]

Full Power

The rated thermal power of the reactor, i.e. the gross fission power as established by the station heat balance, using approved methodology. [56]

Full Reservoir Level (FRL)

The maximum level of water in a reservoir above which water starts overflowing. [63M]

Functional Isolation

Prevention of influences from the mode of operation or failure of one circuit or system on another. [96]

Functions, Systems, Structure and Equipment Important to Safety (FSSE)

Functions to be carried out for a purpose or goal, the associated systems, structures and equipment or the collections of components and the components themselves employed to achieve the safety functions. [138M]

Grading (QA)

Category or rank given to entities having the same fundamental use but different requirements for quality. [95]

Gray (Gy)

The special name of the unit of absorbed dose. One 'gray' is equal to one joule per kilogramme

$$1 \text{ Gy} = 1 \text{ J kg}^{-1}. [41\text{M}]$$

Green Concrete

Concrete that may or may not have attained initial set, but has not yet gained appreciable strength. [80]

Guaranteed Shutdown State (GSS)

A specified shutdown state of the reactor with sufficiently large reactivity shutdown margin, established by the addition of liquid poison into moderator to provide positive assurance that an inadvertent increase in reactivity by withdrawal of all other reactivity devices cannot lead to criticality. [70M]

Guard (Security)

A person, who is entrusted with responsibility for patrolling, monitoring, assessing, escorting individuals or transport, controlling access and/or providing initial response. [150]

Guard Pipe

A pipe sleeve used to guard a penetration assembly. [80]

Handle

Manufacture, possess, store, use, transfer by sale or by export, import, transport or dispose of. [67M]

Hazard

Situation or source, which is potentially dangerous for human, society and/or the environment. [124M]

Hazard Distance

Distance upto which any adverse consequence of an accident would be felt. [116]

Health Surveillance

Medical supervision intended to ensure the initial and continuous fitness of workers for their intended task. [43]

Heat Detectors

A device, which detects and indicates a temperature or rate of temperature rise. [83]

High Level Waste (HLW)

A type of waste, which contains any of the following:

- The radioactive liquid containing most of the fission products and actinides present in spent fuel, which forms the residue from the first solvent extraction cycle in reprocessing, and some of the associated waste streams;
- Solidified high level waste from above and spent reactor fuel (if it is declared a waste);
- Any other waste with similar radiological characteristics. [96M]

Hot Shutdown

Shutdown state of the reactor with coolant temperature (inlet to reactor) and pressure close to normal operating conditions and with the coolant circulating pumps running. [77M]

Hot Standby State

State in which the reactor is critical (power level $\leq 2\%$ FP) with coolant temperature (inlet to reactor) and pressure close to normal operating conditions and with the coolant circulating pump running. [136]

House Load Operation

The operation of a unit, which is isolated from the grid and is providing power supply only to the station loads. [105M]

Human Behaviour

The performance, i.e. action or response of human operator to occurrence of event(s). [120M]

Human Reliability

The probability that an human operator will perform a required mission under given conditions in a given time interval. [123M]

Human Reliability Assessment/Analysis

Assessment concentrating on the human errors liable to be committed by the operator having a mission to fulfill on a system. [123M]

Hurricane

A tropical storm in which wind speeds exceed 120 km/h. [64M]

Incident

Events that are distinguished from accidents in terms of being less severe. The incident, although not directly or immediately affecting plant safety, has the potential of leading to accident conditions with further failure of safety system(s). [131M]

Incipient

The component is in a condition that, if left unremedied, could manifest propagation of degradation or flaw, ultimately leading to a failure or unavailable state. [121]

Independence

The ability of equipment, channel or system to perform its function irrespective of the normal or abnormal functioning of any other equipment, channel or system. Independence is achieved by functional isolation and physical separation. [48M]

Indication

The response or evidence from an examination that requires interpretation to determine relevance. [54M]

Inductive Approach

The approach in which the line of reasoning goes from the most specific to the following sequences resulting into condition or end state of concern. [124M]

Ingestion (of Radioactive Materials)

Intake of radioactive material by way of the gastro-intestinal system. [58]

Inhalation (of Radioactive Materials)

Intake of radioactive material by way of the respiratory system. [58]

Initial Pre-stressing Force

The force in a pre-stressing tendon on any specified location immediately following the stressing and anchoring of the tendon. [80]

Initiating Event / Initiator

An identified event that leads to anticipated operational occurrences or accident conditions and challenges safety functions. [96 M]

Inner Area (Security)

An area inside a protected area where Category I nuclear material is used and/or stored. [150]

In-service Inspection (ISI)

Inspection of structures, systems and components carried out at stipulated intervals during the service life of the plant. [54M]

Inspection

Quality control actions, which by means of examination, observation or measurement, determine the conformance of materials, parts, components, systems, structures as well as processes and procedures with predetermined quality requirements. [46]

Inspector (Regulatory)

A person authorised by the regulatory body to carry out regulatory inspection. [66M]

Institutional Control (Radioactive Waste)

The process of controlling the radioactive waste site by an authority or institution designated under the laws of the country. This control may be active (monitoring, surveillance, remedial work) or passive (land use control) and may be a factor in the design of a nuclear/radiation facility. [134]

Intake

The process of taking radionuclide into the body by inhalation or ingestion, or through the skin, and the amount of given radionuclide taken in during a given period. [41]

Integrated Leakage Rate Test (Containment)

The leakage test performed on the containment by pressurising the same to particular leakage rate test pressure, and determining the overall integrated leakage rate. [94]

Interim Storage

(See 'Storage').

Intermediate Level Waste (ILW)

Radioactive waste, in which the concentration or quantity of radionuclides is above that of low level waste but below that of high level waste (HLW), with the thermal power below that of HLW. It requires shielding during handling and transportation. Thermal power of ILW is below 2 kW/m³. This is also termed as 'Medium Level Waste'. [134M]

Intervention

Any action intended to reduce or avert exposure or its likelihood to sources which are not a part of controlled practice or which are out of control as a consequence of an accident. [43]

Intervention Level

A level of avertable dose at which a specific protective or remedial action is taken in an emergency or chronic exposure situation. [43]

Intrusion Detection

Detection of an intruder by a guard or by a system comprising of a sensor(s), transmission medium and control panel to annunciate an alarm. [150]

Investigation Level

The value of a quantity such as effective dose, intake, or contamination per unit area or volume, at or above which an investigation should be conducted. [96]

Irradiators

A facility that houses a particle accelerator, X-ray machine or large radioactive sources for imparting high radiation dose to materials. [96M]

Islanding Mode of Operation

Operation with one or more generating units within a restricted area (i.e. with voltage and frequency within acceptable limits) by separating from the main grid, in order to prevent catastrophic failure of the grid during deteriorating grid conditions. [105M]

Isohyets

A line drawn on a map through places having equal amount of rainfall. [63M]

Isolation Device

The device in a circuit which isolates one section of the circuit from the other(s) to prevent malfunctions in one section of a circuit causing unacceptable influences in the other circuit(s). [74]

Isolation Zone (Security)

An area, which isolates the protected area from the prohibited area by means of double fencing and has provisions for intrusion detection. [152M]

Item

A general term covering structures, systems, components, parts or materials. [46]

Items Important to Safety (IIS)

The items which comprise:

- those structures, systems, equipment and components whose malfunction or failure could lead to undue radiological consequences at plant site or off-site;
- those structures, systems, equipment and components which prevent anticipated operational occurrences from leading to accident conditions;
- those features which are provided to mitigate the consequences of malfunction or failure of structures, systems, equipment or components.[47M]

Kerma

The quantity 'K' defined as

$$K = dE_{tr}/dm$$

where 'dE_{tr}' is the sum of the initial kinetic energies of all charged ionising particles liberated by uncharged ionising particles in a material of mass 'dm'. The SI unit of kerma is joule per kilogramme (J.kg⁻¹) termed gray (Gy). [43]

Leak

It may constitute an opening, however minute, that allows the unintended passage of a fluid/air/gas. [101M]

Leakage

The quantity of fluid/air/gas escaping from a leak. [101]

Leak Tightness

The ability of a component to maintain leakage rate within a prescribed value. [80]

Level 1 PSA (Nuclear Reactor)

It evaluates core damage frequency by developing and quantifying accident sequences (event trees) with postulated initiating events together with system unavailability values derived from fault tree analyses with inputs from failure data on components, common causes and human actions. [124 M]

Level 2 PSA (Nuclear Reactor)

It takes inputs from Level 1 PSA results and quantifies the magnitude and frequency of radioactive release to the environment following core damage progression and containment failure. [124 M]

Level 3 PSA (Nuclear Reactor)

Taking inputs from Level 2 analysis, it evaluates frequency and magnitude of radiological consequences to the public, environment and the society considering meteorological conditions, topography, demographic data, radiological release and dispersion models.[124M]

Licence

A type of regulatory consent, granted by the regulatory body for all sources, practices and uses for nuclear facilities involving the nuclear fuel cycle and also certain categories of radiation facilities. It also means authority given by the regulatory body to a person to operate the above said facilities (see “Licenced Person” and “Licenced Position”).[114]

Licenced Person

A person who has been licenced to hold certain licensed position of a nuclear power plant after due compliance with authorised procedure of certification by the regulatory body. [114]

Licenced Position

A position, which can be held only by person certified by the regulatory body or a body, designated by it. [114]

Limit

The value of a parameter or attribute (which is variable) used in certain specific activities or circumstances that must not be exceeded. [43M]

Limiting Conditions for Operation (LCO)

Conditions that are imposed on operation which are intended to ensure safety during startup, normal operation and shutdown. They also help to avoid reaching the limiting safety system settings and ensure readiness for performing necessary functions in the event of an accident. LCO include limits of operating parameters, requirements of minimum operable equipment of various systems, minimum specified staffing as well as prescribed actions to be taken by operating staff. [136]

Limiting Safety System Settings (LSSS)

Settings on instrumentation, which initiate the automatic protection action at a level such that the safety limits are not exceeded. [136]

Liner

Any metallic or non-metallic material applied to the surface of a base material for the purpose of protection against corrosion, abrasion or for leak tightness for the intended service conditions. [80]

Line Type Detector

A device in which detection is continuous along a path. [52]

Liquefaction (of Soil)

Sudden loss of shear strength and rigidity of saturated and cohesionless soils due to vibratory ground motion. [2M]

Living PSA

A PSA which is updated to reflect the current design and operational features, and is documented in such a way that each aspect of the PSA model can be directly related to existing plant information, plant documentation or the analysts' assumptions in the absence of such information. [124M]

Local Leakage Rate Test (Containment)

The leakage test performed on the various containment penetrations, such as access airlocks, penetration seals with expansion bellows, cable seals and containment isolation valves. [101]

Local Missile Effects

Missile effects on a target (a structure, system or component), which are largely independent of the overall dynamic characteristics of the target. [137]

Logistic Delay

The accumulated time during which a desired action cannot be performed due to the necessity to acquire required resources, excluding administrative delay. Logistic delays can be due to maintenance activity, travelling to unattended installations, pending arrival of spare parts, specialists, test equipment, information and suitable environmental conditions. [124M]

Long-lived Wastes

Radioactive wastes containing long-lived radionuclides having sufficient radiotoxicity and/or concentrations requiring long time isolation from the biosphere. The term long-lived radionuclides refers to half lives usually greater than 30 years. [1]

Loss of Coolant Accident (LOCA)

An accident resulting from the loss of coolant to the fuel in a reactor due to a break in pressure retaining boundary of the primary coolant system. [45M]

Low and Intermediate Level Waste (LILW)

Radioactive wastes in which the concentration or quantity of radionuclides is above

clearance levels established by the regulatory body, but with radionuclide content and thermal power below those of high level waste. Low and intermediate level waste is often separated into short lived and long lived wastes. [135]

Low Level Waste (LLW)

Radioactive waste in which the concentration or quantity of radionuclides is above clearance levels established by the regulatory body but with the radionuclide content below those of intermediate and high level wastes. It does not require shielding during handling and transportation. [42]

Luminous Transmittance

The ratio of the transmitted luminous flux to that of the incident luminous flux. [155]

Maintenance

Organised activities covering all preventive and remedial measures, both administrative and technical, to ensure that all structures, systems and components are capable of performing as intended for safe operation of the plant. [96M]

Main Steam Line Break (MSLB)

A break in steam pipeline which leads to discharge of high enthalpy steam. [106]

Main Structural Members

The structural members, which are primarily responsible to withstand, carry and distribute the applied load. [75]

Man Machine Interface (MMI)

The abstract boundary between people and the hardware or software they interact with. [128]

Mathematical Model

A set of mathematical equations designed to represent a conceptual model. [96]

Maximum Draw Down Level (MDDL)

The lowest level upto which water can be drawn from a dam. [63M]

Mean Down Time (MDT)

The expectation value of the down time. [124M]

Mean Time Between Failures (MTBF)

The expected operating time between two failures. [124]

Mean Time to Failure (MTTF)

The expected operating time to first failure. The MTTF is also called MTTF (mean time to first failure). [124]

Mean Time to Repair (MTTR)

The expectation of the time for restoration (or repair). [124M]

Mean Recurrence Interval (MRI)

The mean interval during which the design external event is expected to occur. [63M]

Mean Sea Level (MSL)

The average height of the surface of the sea for all stages of the tide determined from hourly height readings over a long period. [92]

Medical Exposure

Exposure incurred by patients as part of their own medical or dental diagnosis or treatment; by persons, other than those occupationally exposed, knowingly while voluntarily helping in the support and comfort of patients and; by volunteers in a programme of biomedical research involving their exposure. [43]

Member of the Public

Any individual in the population except for one who is subject to occupational or medical exposure. For the purpose of verifying compliance with the annual dose limit for public exposure, the member of the public is the representative individual in the relevant critical group. [43M]

Membrane Stress

The component of normal stress, which is uniformly distributed and equal to the average of stress across the thickness of the section under consideration. [81]

Metal-Water Reaction

Reaction of water/steam with fuel cladding as a function of time and temperature during accident conditions. [99M]

Minimal Cut Set

Combination of a minimum number of events such that, if one of the events in a minimal cut set does not occur, then the undesirable event will not happen. [124M]

Missile

A mass that has kinetic energy and has left its design location. [137]

Mission Time

Duration/period for which the operation of the system must be ensured. [103M]

Mitigation

Process of minimising the severity of a consequence following an incident/accident.[99]

Model

An analytical representation or quantification of a real system and the ways in which phenomena occur within that system, used to predict or assess the behaviour of the real system under specified (often hypothetical) conditions. [96]

Monitoring

The continuous or periodic measurement of parameters for reasons related to the determination, assessment in respect of structure, system or component in a facility or control of radiation. [6M]

Natural Exposure

Exposure due to natural sources. [96]

Near Surface Disposal

Disposal of waste with/without engineered barriers, or below the ground surface with adequate final protection covering to bring the surface dose rate within prescribed limits. [96M]

Nodalisation

Simulation of the system by dividing it into a finite number of volumes or grids, for solving applicable set of conservation equations. [121]

Non-restorable Detector

A device, whose sensing element is designed to be destroyed by the process of detecting a fire. [52]

Normal Exposure

An exposure which is expected to be received under normal operating conditions of an installation or a source, including possible minor mishaps that can be kept under control.[43]

Normal Operation

Operation of a plant or equipment within specified operational limits and conditions. In case of a nuclear power plant, this includes, start-up, power operation, shutting down, shutdown state, maintenance, testing and refuelling. [4M]

Normal Power Supply

Power supply derived from the grid via transmission lines or the plant generator or a combination of these for supply of electrical power to equipment in nuclear power plant. [14M]

Nuclear Facility

All nuclear fuel cycle and associated installations encompassing the activities from the front end to the back end of nuclear fuel cycle processes and also the associated industrial facilities such as heavy water plants, beryllium extraction plants, zirconium plants, etc. [114]

Nuclear Fuel Cycle

All operations associated with the production of nuclear energy, including mining, milling, processing and enrichment of uranium or processing of thorium, manufacture of nuclear fuel, operation of nuclear reactors, reprocessing of irradiated nuclear fuel, decommissioning, and any activity for radioactive waste management and research or development activity related to any of the foregoing. [114]

Nuclear Power Plant (NPP)

A nuclear reactor or a group of reactors together with all the associated structures, systems, equipment and components necessary for safe generation of electricity. [114]

Nuclear Safety

The achievement of proper operating conditions, prevention of accidents or mitigation of accident consequences, resulting in protection of site personnel, the public and the environment from undue radiation hazards. [96]

Nuclear Security

All preventive measures taken to minimize the residual risk of unauthorised transfer of nuclear material and/or sabotage, which could lead to release of radioactivity and/or adverse impact on the safety of the plant, plant personnel, public and environment. [157]

Objective Evidence (Quality Assurance)

Qualitative or quantitative information, record or statement of fact pertaining to quality of an item or service which is based on observation, measurement or test and which can be verified. [46M]

Observed Cause

The failure, action, omission or condition, which directly leads to an initiating event. [96]

Occupational Exposure

All exposures of personnel incurred in the course of their work. [43M]

Occupational Worker

Any person, working full time or part time in a nuclear or radiation facility, who may be employed directly by the “consentee” or through a contractor. [114]

Occupier

One who has been given the ultimate control over the affairs of the installations. [117]

Off-site

Area in public domain beyond the site boundary. [20M]

Off-site Emergency

Accident condition/emergency situation involving excessive release of radioactive materials/hazardous chemicals from the plant to the public domain calling for intervention.[77]

Off-site Emergency Director (OED)

A specifically designated officer (for instance, the Collector/District Magistrate) with adequate legal authority to control and coordinate all off-site emergency measures in the public domain. [77]

Off-site Power Source

The electric power supply source located outside the nuclear plant and controlled by an agency other than nuclear power station operators. [105]

On-site Power Source

The electric power supply source located within the nuclear power plant and controlled by the nuclear power station operators. [105]

Operating Basis Earthquake (OBE)

An earthquake which, considering the regional and local geology and seismology and specific characteristics of local sub-surface material, could reasonably be expected to affect the plant site during the operating life of the plant. The features of a nuclear power plant necessary for continued safe operation are designed to remain functional, during and after the vibratory ground motion caused by the earthquake. [11M]

Operating Organisation

The organisation so designated by responsible organisation and authorised by the regulatory body to operate the facility. [47M]

Operating Personnel

Members of the site personnel who are involved in operation of the nuclear/radiation facility. [38M]

Operating State

The state when an entity performs a required function. [123]

Operation

All activities following and prior to commissioning performed to achieve, in a safe manner, the purpose for which a nuclear/radiation facility is constructed, including maintenance. [47M]

Operational Limits and Conditions (OLCs)

Limits on plant parameters and a set of rules on the functional capability and the performance level of equipment and personnel, approved by the regulatory body, for safe operation of the nuclear/radiation facility (see also “Technical Specifications for Operation”). [55M]

Operational Records

Documents such as instrument charts, certificates, log books, computer printouts and magnetic tapes, made to keep objective history of the operation of nuclear/radiation facility. [55M]

Operational States

The states defined under “normal operation” and “anticipated operational occurrences”. [47]

Optimisation of Protection (Radiological)

The process of determining what level of protection and safety makes exposures and the probability and magnitude of potential exposures, “as low as reasonably achievable, (ALARA), economic and social factors being taken into account” as required by the ICRP system of radiological protection. [78]

Partial Failure

A failure which results in the inability of an entity to perform some, but not all, required functions. [122]

Passive Component

A component which has no moving part and only experiences a change in process parameters such as pressure, temperature, or fluid flow in performing its functions. In addition, certain components, which function with very high reliability, based on irreversible action or change, may be assigned to this category (examples of passive components are heat exchangers, pipes, vessels, electrical cables, and structures. Certain components, such as rupture discs, check valves, injectors and some solid-state electronic devices have characteristics, which require special consideration before designation as an active or passive component). [48M]

Patrol (Security)

A function carried out by guards to inspect elements of physical protection at regular or irregular intervals. [150]

Peak Stress

The increment of stress which is additive to the primary plus secondary stresses by reason of local discontinuities or local thermal stress including the effects, if any, of stress concentrations. Its basic characteristic is that it does not cause any noticeable distortion and is objectionable only as a possible source of a fatigue crack or brittle

fracture. A stress which is not highly localised falls in this category if it is of a type which cannot cause noticeable distortion. Examples of peak stresses are, stresses at a local structural discontinuity, certain thermal stresses which may cause fatigue but not distortion, surface stresses produced by thermal shock, etc. [80M]

Performance

The effectiveness with which an intended function is carried out. [76M]

Personnel Emergency

Emergency resulting in serious injury and/or excessive contamination of personnel involving radioactive/toxic chemicals. [69]

Physical Barrier (Security)

A fence or wall or a similar impediment, which provides penetration delay and complements access control. [150]

Physical Protection

Measures for the protection of nuclear/radiation facility designed to prevent unauthorised access or removal of radioactive material, or sabotage. [96M]

Physical Separation

A means of ensuring independence of equipment through separation by geometry (distance, orientation, etc.), appropriate barriers or a combination of both. [48M]

Plant Damage States

Accident sequences obtained from Level 1 PSA analysis that have similar effects on containment response and where fission product source terms are grouped into one state, called plant damage state, for further analysis. [131M]

Plant Emergency

Declared emergency conditions in which the radiological/other consequences, confined to the plant or a section of the plant, requiring immediate operator action. [20M]

Plant Management

Members of the site personnel who have been delegated responsibility and authority by the operating organisation for directing the operation of the plant. [47M]

Plant States

operational states		accident conditions		
normal operation	anticipated operational occurrences	a	design basis accidents	beyond design basis accidents
				b severe accidents
				accident management

- a = Accident conditions which are not explicitly considered as design basis accidents, but are enveloped by them.
- b = Beyond design basis accidents without significant core degradation.
- Accident conditions include all non-operational states, rather than just design basis accidents and those enveloped by them (marked as 'a');
 - The category, marked 'b', of beyond design basis accidents which are not classified as severe accidents because there is no significant core degradation; and
 - The term accident management is applied only to beyond design basis accidents, rather than all non-operational states. [120M]

Point Stress

The maximum apparent stress calculated by adding the membrane stress and the maximum bending stress calculated by elemental beam formulae. When advanced analytical methods (e.g. finite element analysis) are used for containment design, the point stress is defined as the maximum stress across the section under consideration. [80]

Poison (Neutron Poison)

A substance used to reduce reactivity in a reactor core, by virtue of its high neutron absorption cross-section. [96]

Postulated Initiating Events (PIEs)

Identified events during design that lead to anticipated operational occurrences or accident conditions, and their consequential failure effects. [96M]

Post-tensioning

A method of pre-stressing in which the tendons are tensioned after the concrete hardens.[79M]

Potential

A possibility worthy of further consideration for safety. [36]

Potential Exposure

Exposure that is not expected to be delivered with certainty but that may result from an accident at a source or owing to an event or sequence of events of a probabilistic nature, including equipment failures and operating errors. [43]

Power Operation

Operation at a power level exceeding the conditional trip values as stipulated by the regulatory body for plant operation. [157]

Practice

Any human activity that introduces additional sources of exposure or exposure pathways or extends exposure to additional people or modifies the network of exposure pathways from existing sources, so as to increase the exposure or the likelihood of exposure of people, or the number of people exposed. [43]

Predictive Maintenance

It is a form of preventive maintenance performed continuously or at intervals governed by observed condition to monitor, diagnose or trend a structure, system or component's condition indicators; results indicate current and future functional ability or the nature of and schedule for planned maintenance. It is also known as condition based maintenance. [96]

Preferred Power Supply

The parts of the normal power supply systems that provide power supply to emergency electric power system. [107M]

Preliminary Hazard Analysis

Analysis for identifying and assessing the (economic, human, etc.) hazards inherent in using a system and which is carried out before using other more precise methods of analysis. [121]

Preliminary Safety Analysis Report (PSAR)

Safety analysis report submitted to regulatory body for obtaining consent for construction. [114]

Pre-operational Stage

The stage of study and investigation after the start of construction and before the start of operation in order to complete and refine the assessment of site/plant data characteristics. [5M]

Prescribed Limits

Limits established or accepted by the regulatory body. [47M]

Prescribed Substance

Any substance including any mineral which the Central Government may, by notification, prescribe, as being a substance which, in its opinion may be used for the production or use of atomic energy or research into matters connected therewith and includes uranium, plutonium, thorium, beryllium, deuterium or any of the respective derivatives or compounds or any other materials containing any of the aforesaid substances. [112]

Pre-Service Inspection (PSI)

The inspection performed prior to or during commissioning of the plant to provide data on initial conditions supplementing manufacturing and construction data as a basis for comparison with subsequent examinations during service. [84]

Pre-treatment (Radioactive Waste)

Any operation/conditioning of waste prior to final treatment before disposal. [42]

Preventive Maintenance

Maintenance carried out at predetermined intervals or according to prescribed criteria and to reduce the probability of failure or the degradation of the functioning of an entity. [124]

Primary Containment

The principal structure of a reactor unit that acts as a pressure retaining barrier, after the fuel cladding and reactor coolant pressure boundary, for controlling the release of radioactive material into the environment. It includes containment structure, its access openings, penetrations and other associated components used to effect isolation of the containment atmosphere. [93M]

Primary Force

An internal force/moment, which is required to equilibrate applied loads. In some regions of the shell, and for some loadings, there is a redundancy of internal force systems. In such cases, the equilibrium of the primary force with the loads are to be justified in the design report. [81M]

Primary Stress

Any normal stress or shear stress developed by an imposed loading which is necessary to satisfy the laws of equilibrium of external and internal forces and moments. The basic characteristic of a primary stress is that it is not self-limiting. [81M]

Prismatic Power

The apparent angular displacement of an object by an optical system. It is expressed in 'prism dioptres'. [155]

Probabilistic Risk Assessment (PRA)/Probabilistic Safety Assessment (PSA)

A comprehensive structured approach to identifying failure scenarios constituting a conceptual and mathematical tool for deriving numerical estimates of risk. The term PRA and PSA are interchangeably used. [96M]

Probable Maximum Flood (PMF)

The postulated flood (characterised by peak flow, volume and hydrograph shape) that is considered to be most severe but reasonably possible, corresponding to the probable maximum precipitation. [64M]

Probable Maximum Precipitation (PMP)

The estimated depth of precipitation for a given duration, drainage area and time of year of which there is virtually no risk of exceeding. The probable maximum precipitation for a given duration and drainage area approaches and approximates to that maximum which is thought to be physically possible within the limits of contemporary hydro-meteorological knowledge and techniques. [64]

Probable Maximum Water Level

A hypothetical water level (exclusive of wave run-up from normal wind-generated waves) that might result from a most severe combination of hydrological, meteorological, geoseismic and other geophysical factors that is considered reasonably possible in the region involved, with each of these factors considered as affecting the locality in a maximum manner. [64M]

Process Systems

Nuclear and conventional systems required for operation as per the design intent. [77]

Projected Dose

The dose to be expected if no protective or remedial action is taken. [43]

Prophylactics

Specific stable chemical compounds which have a reducing or blocking effect on the uptake of certain radionuclides. [114]

Prophylaxis

The intake of specific stable chemical compounds which have a reducing or blocking effect on the uptake of certain radionuclides, e.g. the use of stable KI (Potassium Iodide) or KIO_3 (Potassium Iodate) to reduce the uptake of radioiodines (particularly I-131) in thyroid gland. [45M]

Protected Area

An area under surveillance, containing Category I or II nuclear material, and/or vital/inner areas surrounded by a physical barrier. [1M]

Protection System

A part of the safety critical system which encompasses all those electrical, mechanical devices and circuitry, from and (including the sensors) upto the input terminals of the safety actuation system and the safety support features, involved in generating the signals associated with the safety tasks. [74M]

Protective Barrier or Shielding (Radiation)

A barrier of appropriate thickness used to reduce radiation levels to specified values. [154]

Public Exposure

Exposure incurred by members of the public from radiation sources, excluding any occupational or medical exposure and the normal local natural background radiation, but, including exposure from authorised sources and practices and from intervention situations. [43]

Purging

Displacement of an existing medium in a system by continuous injection of the same or another media, e.g. process of injection of air/CO₂ (carbon dioxide) to eject hydrogen generated in the reactor building containment to reduce hydrogen concentration. [99]

Qualified Person

An individual who, by virtue of certification by appropriate authorities and through experience, is duly recognised as having expertise in a relevant field of specialisation like quality assurance, radiation protection, plant operation, fire safety or any relevant engineering or safety speciality. [94]

Quality

The totality of features and characteristics of an item or service that have the ability to satisfy stated or implied needs. [46M]

Quality Assurance (QA)

Planned and systematic actions necessary to provide the confidence that an item or service will satisfy given requirements for quality. [96M]

Quality Control (QC)

Quality assurance actions, which provide means to control and measure the characteristics of an item, process or facility in accordance with the established requirements. [46]

Raceway

Any channel that is designed and used expressly for supporting or enclosing wires, cable or bus-bars. Raceways consist primarily of cable trays and bus-ducts. [105]

Radiation Facility

Any installation/equipment or a practice involving use of radiation-generating units or use of radioisotopes in the field of research, industry, medicine and agriculture. [114]

Radiation Generating Equipment

Device capable of generating radiation, such as X-rays, neutrons, electrons or other charged particles. [114]

Radiation Protection Survey / Radiological Survey

An evaluation of radiation safety, using appropriate radiation measuring instruments.[113]

Radiation Surveillance

Measures that may be specified by the competent authority to provide adequate protection either generally or in any individual case. [50M]

Radiation Weighting Factor

Multipliers of absorbed dose used for radiation protection purposes to account for the relative effectiveness of different types of radiation in inducing health effects. [43]

Radiation Safety

(See “Nuclear Safety”).

Radiation Worker

Any person who is occupationally exposed to radiation and who in the opinion of the regulatory body should be subjected to radiation surveillance. [44]

Radioactive Material/ Radioactive Substance

Any substance or material, which spontaneously emits radiation in excess of the levels prescribed by notification by the Central Government. [111]

Radioactive Waste

Material, whatever its physical form, left over from practices or interventions for which no further use is foreseen: (a) that contains or is contaminated with radioactive substances and has an activity or activity concentration higher than the level for clearance from regulatory requirements, and (b) exposure to which is not excluded from regulatory control. [41]

Radioactive Waste Management Facility

Facility specifically designed to handle, treat, condition, temporarily store or permanently dispose of radioactive waste. [43]

Radiograph

A permanent record of a transmission image, produced by a beam of radiation after passing through the subject/specimen. [113]

Random Process

Set of time-dependent random variables whose values are governed by a given set of multidimensional distributions, which correspond to all the combinations of the random variables. [124]

Random Variable

Variable which can take any one of a given set of values, each with an associated distribution. [124]

Reactivity

A measure of the deviation from the criticality (defined as 'ρ') of a nuclear chain reacting medium. Reactivity 'ρ', is related with effective multiplication factor 'k_{eff}' by the relation

$$\rho = (k_{\text{eff}} - 1) / k_{\text{eff}}$$

Reactivity is expressed in terms of mk (10⁻³ k). Other units used are dollar, cent, inhour and pcm. [96M]

Reactor Building

The concrete containment structure that contains and supports the reactor and other related systems, such as the heat transport system, the moderator system etc. [54]

Reactor Regulating System (RRS)

System that provides for automatic control of neutron flux and reactivity in the core and the thermal output of the reactor for an approved power range (between 10⁻⁷ - 110% FP). [70M]

Reactor Startup State

A subcritical state of reactor in which reactor protection system is poised, reactor regulating system is in specified state and positive reactivity addition is permitted to achieve reactor criticality. [157]

Reactor Trip

Actuation of a shutdown system to bring the reactor to shutdown state. [76]

Reactor Trip (Absolute)

That comes into action at all reactor power levels. [157]

Reactor Trip (Conditional)

That comes into action when reactor power is at or above the specified value approved by the regulatory body. [157]

Records

Documents, which furnish objective evidence of the quality of items and activities affecting quality. They include logging of events and other measurements. [46M]

Recording Level

A level of dose, exposure or intake specified by the regulatory body at or above which values of dose, exposure or intake received by workers are to be entered in their individual exposure records. [43]

Redundancy

Provision of alternative structures, systems, components of identical attributes, so that any one can perform the required function, regardless of the state of operation or failure of the other. [96M]

Reference Area

For the purpose of siting considerations in the case of nuclear power plants, an area with defined population characteristics, population density (e.g. state average) and total population in the area to enable comparisons with any other area. [22]

Reference Level

Action level, intervention level, investigation level or recording level established for any of the quantities determined in the practice of radiation protection. [43M]

Reference Man

An idealised adult Caucasian human defined by the ICRP for the purpose of radiation protection assessment. [43]

Reference Population

For the purpose of siting consideration in the case of nuclear power plants, it is the population characteristic used for comparison with any candidate site characteristic.[22M]

Refractive Power

The reciprocal of the back focal length of an optical system, expressed in 'diopters'. ('Back focal length' is the distance from the last lens surface of the optical system to its image plane). [155]

Region

A geological area, surrounding and including the site, sufficiently large to contain all the features related to a phenomenon or to the effects of a particular event. [2]

Registration

The regulatory consent shall be the registration for sources and practices that include

- (i) medical diagnostic X-ray equipment including computed tomography (CT) and therapy simulator;
- (ii) analytical X-ray equipment used for research;
- (iii) nucleonic gauges;
- (iv) radioactive sources in tracer studies;
- (v) bio-medical application and research using radioactive materials; and
- (vi) any other source and practice notified by the competent authority.[67]

Regulatory Authority

(See “Competent Authority”).

Regulatory Body

(See “Atomic Energy Regulatory Board”).

Regulatory Clearance

A type of regulatory consent, which is issued for a nuclear facility during the intermediate stages of consenting process. [114]

Regulatory Consent

(See “Consent”).

Regulatory Constraints

Restrictions on radiation protection parameters as specified by the regulatory body. [44M]

Regulatory Inspection

An examination through review of documents, observation, measurement or test undertaken by or on behalf of the regulatory body during any stage of the regulatory consenting process, to ensure conformance of materials, components, systems and structures as well as operational and maintenance activities, processes, procedures, practices and personnel competence with predetermined requirements. [114M]

Reliability

The probability that a structure, system, component or facility will perform its intended (specified) function satisfactorily for a specified period under specified conditions. [114M]

Relocation (Off-site Emergency)

The removal of members of the public from their homes, for an extended period or time, as a protective action in a chronic exposure situation. [78]

Repository

A facility where radioactive waste is emplaced for disposal. Future retrieval of waste from the repository is not intended. [42M]

Repository, geological

A facility for radioactive waste disposal located underground (usually more than several hundred meters below the surface) in a stable geological formation to provide long term isolation of radionuclides from the biosphere. Usually such a repository would be used for long-lived and/or high level waste. [42M]

Repository, near surface

A facility for radioactive waste disposal located at or within a few tens of meters from the Earth's surface. Such repository is suitable for the disposal of short-lived low and intermediate level waste. [42M]

Research Reactor

A critical/sub-critical assembly of nuclear fuel elements used for the purpose of research, teaching and production of radioisotopes. [114]

Residual Heat

The sum of the time-dependent heat loads originating from radioactive decay and shutdown fission and heat stored in reactor-related structures and heat transport media in a nuclear reactor facility. [48M]

Resolution

The least entity discernible on the display mechanism. [99]

Response Forces / Quick Response Team

Persons, on-site or off-site, who are armed and appropriately equipped and trained to counter an attempted unauthorised removal of nuclear material or an act of sabotage. [150]

Response Time

The time required for a system component instrumentation to achieve a specified output state from the time it receives a signal. [97M]

Responsible Organisation

An organisation having overall responsibility for siting, design, construction, commissioning, operation and decommissioning of a facility. [47M]

Restorable Detector

A device, whose sensing element is not ordinarily destroyed by the process of detecting a fire. Restoration may be manual or automatic. [52]

Review

Documented, comprehensive and systematic evaluation of the fulfillment of requirements, identification of issues, if any. [95]

Risk

A multi-attribute quantity expressing hazard, danger or chance of harmful or injurious consequences associated with an actual or potential event under consideration. It relates to quantities such as the probability that the specific event may occur and the magnitude and character of the consequences. [43M]

Risk Based Approach

Approach in which the decision making is solely based on the numerical result of the risk assessment judging against the probabilistic safety criteria set or established. [121]

Risk Informed Approach

An approach to decision making that represents a philosophy whereby risk insights

derived from risk assessment, by comparison of the results with the probabilistic safety goals, are considered together with other information obtained from deterministic safety analysis, engineering judgment and experience. [121]

Risk Monitor

A plant specific real-time tool used to determine the instantaneous risk based on the actual states of the systems and components. At any given time, the risk monitor reflects the current plant configuration in terms of status of various systems and/or components, e.g. whether a component is out of service for maintenance or tests. The model used by the risk monitor is based on and is consistent with living PSA for the facility. [121M]

Root Cause

The fundamental cause of an event, which, if corrected, will prevent its recurrence, i.e. the failure to detect and correct the relevant latent weakness(es) (undetected degradation of an element of a safety layer) and the reasons for the failure. [96M]

Run-up

The rush of water up a structure or beach on the breaking of a wave. The height of run-up is the vertical height above still water level that the rush of water reaches. [64]

Run-off

Overland flow of water during precipitation. [64]

Sabotage (Security)

Any deliberate act directed against a nuclear/radiation facility or nuclear material in use, storage or transport which could directly or indirectly endanger the health and safety of personnel, the public and the environment by exposure to radiation or release of radioactive substances. [150]

Safe Shutdown Earthquake (SSE)

The earthquake which is based upon an evaluation of the maximum earthquake potential considering the regional and local geology, seismology and specific characteristics of the local sub-surface material. It is that earthquake which produces the maximum vibratory ground motion for which certain structures, systems and components are designed to remain functional. These structures, systems, and components are those which are necessary to assure

- the integrity of the reactor coolant pressure boundary; or
- the capability to shutdown the reactor and maintain it in a safe shutdown condition; or
- the capability to prevent the accident or to mitigate the consequences of accidents which could result in potential off-site exposures higher than the limits specified by the regulatory body; or
- the capacity to remove residual heat. [75M]

Safety

(See “Nuclear Safety”).

Safety Action

An action initiated by a protection system and completed by the safety actuation system with the help of safety support system, to accomplish a safety task. [96M]

Safety Actuation System

A part of the safety critical system, which encompasses all the equipment required to accomplish the required safety action when initiated by the protection system. [96M]

Safety Analysis

Evaluation of the potential hazards (risks) associated with the implementation of a proposed activity. [96M]

Safety Analysis Report (SAR)

A document, provided by the applicant/consentee to the regulatory body, containing information concerning the nuclear or radiation facility, its design, accident analysis and provisions to minimise the risk to the public, the site personnel and the environment.[114]

Safety Assessment

A review of the aspects of design and operation of a source which are relevant to the protection of persons or the safety of the source, including the analysis of the provisions for safety and protection established in the design and operation of the source and the analysis of risks associated both with normal conditions and accident situations. [43]

Safety Channel

An arrangement of interconnected components within a system that initiates a single output. [74M]

Safety Classification

Classification of structures, systems and components based on their nuclear safety functions. [76]

Safety Code

A document stating the basic requirements, which must be fulfilled for particular practices or applications. This is issued under the authority of the regulatory body and mandatory to be followed by the respective utilities. [114]

Safety Critical System

(See “Safety System”).

Safety Culture

The assembly of characteristics and attitudes in organisations and individuals which establishes that as an overriding priority, the protection and safety issues receive the attention warranted by their significance. [43]

Safety Function

A specific purpose that must be accomplished for safety. [96]

Safety Guide

A document containing detailed guidelines and various procedures/ methodologies to implement the specific parts of a safety code, that are acceptable to the regulatory body, for regulatory review. This is issued under the authority of regulatory body and is of non-mandatory nature. [114]

Safety Limits

Limits upon process variables within which the operation of the facility has been shown to be safe. [2M]

Safety Manual

A document detailing the various safety aspects/instructions and requirements relating to a particular practice or application, that are to be followed by a utility. [44M]

Safety Report

A document provided by the applicant or licensee to the regulatory body, containing information concerning the facility, its design, accident analysis and provisions to minimise the risk to the site personnel, the public and/or the environment. [2M]

Safety Related Systems

Systems important to safety which are not included in “safety systems”, and which are required for the normal functioning of the safety systems. [15M]

Safety Standard

A document similar to a safety code, elaborating upon the various technical requirements that must be met for a particular practice or application, so as to meet the requirements of the code. [7M]

Safety Support System

Part of safety systems which encompasses all equipment that provide services, such as cooling, lubrication and energy supply (pneumatic or electric) required by the protection system and safety actuation systems. [96M]

Safety System

System important to safety and provided to assure that under anticipated operational occurrences and accident conditions, the safe shutdown of the reactor followed by heat removal from the core and containment of any radioactivity, is satisfactorily achieved. (Examples of such systems are shutdown systems, emergency core cooling system and containment isolation system). It is also called the “safety critical system”. [77M]

Safety System Settings

The levels at which protective devices are automatically actuated in the event of anticipated operational occurrences or accident conditions, so as to prevent safety limits being exceeded. [96M]

Scheduled Maintenance

The preventive maintenance carried out in accordance with an established time schedule.[124]

Sealed Source

Radioactive source material that is either permanently sealed in a capsule or is closely bounded and in solid form. The capsule or material of a sealed source shall be strong enough to maintain leak tightness under conditions of wear and tear for which the source was designed and also under foreseeable mishaps. [43M]

Sealing Plug (Coolant Channel)

Device used to close the ends of a coolant channel in a leak-tight manner. [98]

Secondary Containment

The structure surrounding the primary containment that acts as a further barrier to limit the release of radioactive materials and also protects the primary containment from external effects. It includes secondary containment structure and its access openings, penetrations and those systems or portions thereof, which are connected to the containment structure. [93M]

Secondary Force

A local internal force/moment which results from applied loads and may be either:

- (a) a local internal force/moment which results from applied loads, but which is not required to equilibrate such loads; or
- (b) a local internal force/moment which results from non-load, volume change effects, such as shrinkage strain and thermal strain. [81]

Secondary Stress

A normal stress or shear stress developed by the constraints of adjacent material or by self-constraint of the structure. The basic characteristic of a secondary stress is that it is self-limiting. [139M]

Secondary Waste

A form and quantity of waste that results as a by-product of the process when applying a waste treatment technology to the initial waste [134M]

Security Survey

A detailed examination, made by the competent authority, of proposed physical protection measures in order to evaluate them for approval. [150M]

Segregation (Radioactive Waste)

An activity where waste or materials (radioactive and exempt) are separated or are kept separate according to radiological, chemical and/or physical properties to facilitate waste handling and/or processing. It may be possible to segregate radioactive material from exempt material and thus reduce the waste volume. [42]

Seiche

An oscillation of an enclosed water body in response to a disturbing force (seismic or atmospheric) having the same frequency as the natural frequency of the water body.[33M]

Seismic Hazard

Any physical phenomenon (e.g. ground vibration, ground failure) associated with an earthquake that may produce adverse effects. [132]

Services

The performance by a supplier of activities such as design, fabrication, installation, inspection, non-destructive examination, repair and/or maintenance. [46M]

Sensitivity (Detector)

Relative degree of response of a detector to the parameter to be detected. [52M]

Sensitivity Analysis

A quantitative examination of how the behaviour of a system varies with change, usually in the values of governing parameters. [96]

Setback

Controlled gradual reduction in reactor power effected by the reactor regulating system in response to an identified abnormality in one or more plant process variables, until the conditions causing the setback are cleared or the preset limit for power rundown is reached. [70M]

Severe Accident

Nuclear facility conditions beyond those of the design basis accidents causing significant core degradation. [48M]

Shallow Water

Water at a depth less than $L/25$, where 'L' is the wavelength of the surface wave under consideration. [33]

Shear Connectors

General term used for steel members attached to the liner and embedded in the concrete to provide general compatibility of strains between liner and concrete. [80]

Short-lived Waste

Radioactive waste in quantities and/or concentrations, which will decay to activity levels considered acceptably low from the radiological point of view within the time period during which administrative controls are expected to last. Radionuclides in short-lived wastes will generally have half-lives shorter than 30 years. [42M]

Shrinkage (Concrete)

Time-temperature-humidity dependent volume reduction of concrete as a result of hydration, moisture migration and drying process. [79]

Shutdown Margin

The minimum specified sub-criticality of a reactor under shutdown condition at any time during the operation from the most reactive state of the core or under postulated failure of a specified number of shutdown devices of the highest reactivity worth(s) for the given shutdown system. [70M]

Shutdown State

State of a reactor when it is maintained subcritical with specified negative sub-criticality margin. [77]

Significant Event

Any event, which degrades system performance function(s) without appreciable damage to either the system or life or limb. [124]

Significant Events (Nuclear Facility)

Unusual occurrences exceeding the limits and conditions stipulated by the regulatory body. [157]

Single Failure

A random failure, which results in the loss of capability of a component to perform its intended safety function. Consequential failures resulting from a single random occurrence are considered to be part of the single failure. [121]

Site

The area containing the facility defined by a boundary and under effective control of the facility management. [2]

Site Emergency

Accidental condition/emergency situation in the plant involving radioactivity transgressing the plant boundary but confined to the site, or involving release of hazardous chemicals or explosion, whose effects are confined to the site, with off-site consequences being negligible. [69M]

Site Emergency Director

A specifically designated officer with adequate authority to control and coordinate all site emergency actions. [140]

Site Evaluation Report (SER)

A document indicating the impact of a nuclear/radiation facility on the environment and the impact of the environment on the same so as to establish the suitability of the site for safe operation of the facility. [115]

Site Personnel

All persons working at the site, either permanently or temporarily. [47]

Site Selection Stage

The stage at which identification of one or more preferred candidate sites for a facility are carried out to determine/demonstrate their suitability from various aspects, and in particular, from the safety point of view. [5M]

Siting

The process of selecting a suitable site for a facility including appropriate assessment and definition of the related design bases. [2M]

Small Leak

Any leak due to break size smaller than small break LOCA, that can be handled within the capability of the system pressurising devices. [147M]

Smoke Detector

A device which detects the visible or invisible particles of combustion. [52]

Software (Computer)

The set of instructions that make computer hardware perform certain tasks. Programs, operating systems, device drivers and macros are all different kinds of software. [103]

Software Quality

The composite characteristics of software that determine the degree to which the software in use will meet the expectations of the user. [136]

Solidification (Radioactive Waste)

Immobilisation of gaseous, liquid-like materials by conversion into solid waste form, usually with the intent of producing a physically stable material that is easier to handle and less dispersible. Calcination, drying, cementation, bituminisation and vitrification are some of the typical ways of solidifying liquid radioactive waste (See also “Conditioning of Waste”). [134]

Source

Anything that causes radiation exposure, either by emitting ionising radiation or releasing radioactive substances or materials. [41M]

Specification

A written statement of requirements to be satisfied by a product, a service, a material or process, indicating the procedure by means of which it may be determined whether the specified requirements are satisfied. [46]

Spent Fuel

Irradiated fuel not intended for further use in reactors in its present form. [96 M]

Spot-type Detector

A device, whose detecting element is concentrated at a particular location. [52]

Station Blackout (SBO)

The complete loss of both off-site and on-site AC power supplies. [109M]

Stepback

An automatic fast reduction in reactor power initiated by the reactor regulating system in response to an identified abnormality in one or more plant process variables to a preset lower power level. [70M]

Sterilised Zone

The annulus of specified radius around the plant, beyond the exclusion zone, where only natural growth is permitted and developmental activities which lead to growth of population are restricted by administrative control. [45M]

Still Water Level

The elevation that the surface of the water would assume if all the waves were absent.[2]

Stochastic Analysis

Often taken to be synonymous with probabilistic analysis. Strictly speaking, stochastic conveys directly the idea of randomness, whereas probabilistic is directly related to probabilities and hence, only indirectly concerned with randomness. Therefore, a natural event or process might more correctly be described as stochastic, whereas probabilistic would be more appropriate for describing a mathematical analysis of stochastic events or processes and their consequences (such an analysis, would strictly be stochastic if the analytical method itself included an element of randomness, e.g. Monte Carlo analysis). [96M]

Stochastic Effects (Radiation)

Radiation effects generally occurring without a threshold level of dose whose probability is proportional to the dose and whose severity is independent of the dose. [43]

Storage (Radioactive Waste)

The placement of radioactive waste in an appropriate facility with the intention of retrieving it at some future time. Hence, waste storage is by definition an interim measure and the term interim storage should not be used. [78]

Storm

Violent disturbance of the atmosphere marked by wind and usually by rain, snow, hail, sleet or thunder and lightning. [33M]

Storm Surge

A rise above normal water level on the open coast due to the action of wind stress on the water surface together with the atmospheric pressure reduction caused by a cyclone.[64M]

Stress Relaxation

A phenomenon in which loss of stress occurs when a constant strain is maintained at a constant temperature. [79]

Structure

The assembly of elements which supports/houses the plants, equipment and systems.[96M]

Structural integrity

The ability of a structure to withstand prescribed loads. [80]

Supervised Area

Any area not designated as a controlled area but for which occupational exposure conditions are kept under review even though specific protective measures and safety provisions are not normally needed. [43]

Support Systems

Systems those are required for proper functioning of the frontline systems. [132M]

Suppression Pool

A pool of water located at the lowermost elevation of the reactor building, into which steam resulting from LOCA/MSLB is directly led and condensed to reduce the pressure in the primary containment. [106]

Surface Water (Concrete)

Water held by an aggregate on the surface except that held by absorption within the aggregate particles themselves. [80M]

Surveillance

All planned activities, viz. monitoring, verifying, checking including in-service inspection, functional testing, calibration and performance testing carried out to ensure compliance with specifications established in a facility. [44M]

System Logic Model

A model that identifies the combinations of component states that lead to undesired system states. [124]

Technical Specifications for Operation

A document approved by the regulatory body, covering the operational limits and conditions, surveillance and administrative control requirements for safe operation of the nuclear or radiation facility. It is also called as 'operational limits and conditions'. [46M]

Tendon

Steel element such as wire, cable, bar, rod or a bundle of such elements used to impart pre-stress to concrete. [79]

Test

An experiment carried out in order to measure, quantify or classify a characteristic or a property of an entity. [124]

Test Bundle

A fuel bundle identical to regular fuel bundle used for fuelling machine/fuel transfer system testing to meet the design intent. [157]

Testing (QA)

The determination or verification of the capability of an item to meet specified requirements by subjecting the item to a set of physical, chemical, environmental or operational conditions. [56]

Thermal Resistance

An inverse measure of the capability to transmit heat and may be defined as the ratio of temperature difference across a material to the heat flowing through it. [155]

Tidal Rise

The maximum height of tide above the mean sea level. [92M]

Tissue Weighting Factors

Multipliers of the equivalent dose to an organ or tissue used for radiation protection purposes to account for the different sensitivities of different organs and tissues to the induction of stochastic effects of radiation. [43]

Topography

The configuration of a terrain giving general description of physical features like hills, valleys, slopes, water bodies and other man-made structures. [92M]

Toxic Material

Material that causes ill health or fatality of human being at or above a specified concentration. [117M]

Transport (Nuclear Material)

International or domestic carriage of nuclear material by any means of transportation beginning with the departure from a facility of the consignor and ending with the arrival at a facility of the consignee. [150M]

Transport Control Centre (Nuclear Material)

An installation which provides for the continuous monitoring of transport vehicle location and security status and for communication with the transport vehicle, its guards, the response forces and the consignor/consignee. [150M]

Tropical Storm

An intense tropical cyclone in which winds tend to spiral inward towards a core of low pressure, with maximum surface wind velocities that are less than 120 km/h for several minutes or longer at some points. [92]

Tsunami

A wave train produced by impulsive disturbances in a body of water caused by displacements associated with submarine earthquakes, volcanic eruptions, submarine slumps or shoreline slides. [2M]

Ultimate Heat Sink

The atmosphere or a body of water or the ground water to which a part or all of the residual heat is transferred during normal operation, anticipated operational occurrences or accident conditions. [2]

Unavailability

The inability of an entity to be in a state to perform a required function under given conditions at a given point of time. It is measured as the probability (relative frequency) that the entity is in an unavailable state at a point of time. [124M]

Unbonded Tendons

Tendons in which the pre-stressing steel is permanently free to move relative to the surrounding concrete to which their pre-stressing forces are applied. [79M]

Uncertainty Analysis

An analysis to estimate the uncertainties and error bounds of the quantities involved in, and the results from, the solution of a problem. [124]

Uninterrupted Power Supply (UPS)

A system that converts input AC electric power to voltage and frequency of controlled and filtered AC power that provides uninterrupted power supply for a defined duration, even with deterioration/loss of input AC power. [109M]

Unrestricted Use

Any release or use of materials, equipment, buildings or site without any restriction imposed by the regulatory body. [19M]

Unusual Occurrence

Any occurrence which has the potential to impair or impairs the plant safety, radiological safety, industrial safety and/or environmental safety. [114M]

Uplift

The upward water pressure on the base of a structure or pavement. [92]

Upper Confidence Limit (UCL)

A calculated value constructed from sample data with the intention of placing a statistical upper bound on the parameter of interest. [102]

Validation

The process of determining whether a product or service is adequate to perform its intended function satisfactorily. [96]

Validation (Computer Code)

The evaluation of software at the end of the software development process to ensure compliance with the user requirements. Validation is therefore 'end-to-end verification'. [129M]

Verification

The act of reviewing, inspecting, testing, checking, auditing, or otherwise determining and documenting whether items, processes, services or documents conform to specified requirements. [46]

Verification (Computer Code)

The process of determining that the controlling physical and logical equations have been correctly translated into computer code. [129M]

Vital Area

An area inside a protected area containing equipment, systems or devices, or nuclear material, the sabotage of which could directly or indirectly lead to unacceptable radiological consequences. [150]

Walkdown (Plant)

A step or process during which data is gathered, assumptions on component capabilities are checked and analysis is performed. (e.g. walkdown for PSA with respect to component capacity assessment). [121]

Waste Form

The waste in its physical and chemical form after treatment and/or conditioning prior to packaging. [96]

Waste Immobilisation

The conversion of radioactive waste into solid form (by solidification, or by embedding, or encapsulating in a matrix material) to reduce the potential for migration or dispersion of radionuclides during transport, storage and disposal. [134]

Waste Management

All administrative and operational activities involved in the handling, pre-treatment, treatment, conditioning, transportation, storage and disposal of radioactive waste. [96M]

Waste Package

The product of conditioning that includes the waste form and any containers and internal barriers (e.g. absorbing materials and liner), as prepared in accordance with requirements for handling, transportation, storage and/or disposal. [78]

Waste Treatment

Operations intended to benefit safety and/or economy by changing the characteristics of the wastes by employing methods such as

- (a) volume reduction;
- (b) removal of radionuclides;
- (c) change of composition.

After treatment, the waste may or may not be immobilised to achieve an appropriate waste form. [96]

Wave Runup

The rush of water up a structure or beach on the breaking of a wave. It is also called uprush. The amount of runup is the vertical height above still water level that the rush of water reaches. [64]

Wobble Friction

In pre-stressed concrete, friction caused by the unintended deviation of pre-stressing tendon from its specific profile. [79]

Worker

Any person who works, whether full-time, part-time or temporarily, for an employer and who has recognised rights and duties in relation to occupational radiation protection. (A self-employed person is regarded as having the duties of both an employer and worker). [43]

**GLOSSARY FOR
RADIATION SAFETY
(GRS)**

GLOSSARY FOR RADIATION SAFETY (GRS)

A₁ (Transport of Radioactive Materials)

Maximum activity of special form radioactive material permitted in a Type A package. [85]

A₂ (Transport of Radioactive Materials)

Maximum activity of radioactive material, other than special form radioactive material permitted in a Type A package. [85]

Accelerator

A device in which, charged particles are accelerated. Conventional X-ray tube is not considered as an accelerator. [86]

Accessible Surface

Any surface of the source housing that can readily be reached by any part of the human body without the use of tools or without the removal of any part of the housing. [112]

Activity

The quantity 'A' for an amount of radionuclide in a given energy state at a given time, defined as :

$$A = dN/dt$$

where, 'dN' is the expectation value of the number of spontaneous nuclear transformations from the given energy state in a time interval 'dt'. The SI unit of activity is the reciprocal of second (s⁻¹), termed the Becquerel (Bq). [43]

Adequate Protection

Protection against radiation so provided that the prescribed operational limits on levels of radiation or contamination are not exceeded. [111]

Afterloading Applicator

A device applied to the patient into which radioactive sources are introduced either manually or by a remotely operated system. [112]

Ambient Dose Equivalent

The quantity 'H*(d)' at a point in a radiation field, defined as the dose equivalent that

would be produced by the corresponding aligned and expanded field in the ICRU sphere at a depth on the radius opposing the direction of the aligned field. A depth $d = 1$ cm is recommended for strongly penetrating radiation. [43]

Ambient Equivalent Dose Rate (IGRED)

Dose rate measured as an average over sensitive volume of the detector.

- Measurements of the ambient equivalent dose rate shall be made at 1 m from the surface, additionally at the surface and at 5 cm from the surface of the source housing. The ambient equivalent dose limits are given in safety standard, AERB/SS-1
- Measure the ambient equivalent dose rate at surface of the source housing, using a X-ray film or other appropriate device with cross sectional area not greater than 10 cm^2 . Measure the ambient equivalent dose rate at 5 cm from the surface using a detector with cross sectional area not greater than 10 cm^2 and no linear dimensions greater than 5 cm. Measure the ambient equivalent dose rate at 1 m from the surface using a detector with cross sectional area not greater than 100 cm^2 and no linear dimensions greater than 20 cm. [156M]

Applicant

Any person who applies to the competent authority for consent to undertake any of the actions for which the consent is required. [43M]

Approval

A type of consent issued by the regulatory body to a proposal. [114]

Atomic Energy Regulatory Board (AERB)

A national authority designated by the Government of India having the legal authority for issuing regulatory consent for various activities related to the nuclear and radiation facility and to perform safety and regulatory functions, including their enforcement for the protection of site personnel, the public and the environment against undue radiation hazards. [114]

Attenuation

The reduction in intensity of radiation passing through matter due to processes like absorption and scattering. [113M]

Authorisation

A type of regulatory consent issued by the regulatory body for all sources, practices and uses involving radioactive materials and radiation generating equipment (see also "Consent"). [114]

Automatic Securing Mechanism

Device designed to automatically restrict the source assembly to the secured position. [156]

Balanced Protection (Security)

A system of protection that provides for the minimum probability of detection of penetration of each of the barriers to be equal and the minimum time to penetrate each of these barriers also to be equal. [151M]

Beam Hardening

The process of filtration of an X-ray beam by preferential absorption of lower energy photons, thereby increasing the average energy of the beam. [113]

Beam Limiting Device

Shielded device located at the working position designed to reduce the radiation dose rate in directions other than the directions intended for use. [156]

Becquerel

(See "Activity").

Betatron

An electron accelerator in which electrons are accelerated in an increasing magnetic field maintaining a stable orbit of electrons. [142]

Brachytherapy

Branch of radiation therapy which relates to the uses of sealed sources for : (a) implants and intra-cavitary insertions, and (b) external mould/surface applications, in which the source to skin distance is not more than 5 cm. Some of the present day brachytherapy sources, e.g. ^{32}P coated stents and ^{192}Ir wires may not comply with all the regulatory requirements for sealed sources. [112M]

Capacity (Source Housing)

The maximum activity in becquerels specified for a given radionuclide that shall not exceed in a source housing or a source changer. [156]

Cargo Aircraft

Any aircraft, other than a passenger aircraft, which is carrying goods or property. [90]

Carrier

An individual, organisation or government, undertaking the transport of radioactive material by any mode of transport. The term includes both carriers for hire (known as contract carriers) and carriers on own account (known as private carriers). [90M]

Central Alarm System (CAS) (Security)

An installation which provides for the complete and continuous alarm monitoring and assessment of the facility and communications with guards, facility management and the response force. [150M]

Collimator or Field Limiting Diaphragm

A device used for limiting the size and shape of the primary radiation beam. [110]

Collimator Zone

The portion of the source/tube-housing of radiotherapy/radio-diagnostic equipment, which includes the mechanism for defining the useful beam. [110M]

Commissioning

The process during which structures, systems and components of a nuclear and radiation facility, on being constructed, are made functional and verified to be in accordance with design specifications and to have met the performance criteria. [114M]

Committed Absorbed Dose, $D(\tau)$

The quantity ' $D(\tau)$ ' is defined as

$$D(\tau) = \int_{t_0}^{t_0 + \tau} \dot{D}(t) dt$$

where ' t_0 ' is the time of intake, ' $\dot{D}(t)dt$ ' is the absorbed dose rate at time ' t ' and ' τ ' is the time elapsed after an intake of radioactive substance. When ' τ ' is not specified, it will be taken to be 50 years for adults and age 70 years for intake by children. [43]

Committed Effective Dose, $E(\tau)$

The time integral of the whole body effective dose rate following an intake of a radionuclide. The quantity ' $E(\tau)$ ' is defined as :

$$E(\tau) = \sum w_T H_T(\tau)$$

Where ' $H_T(\tau)$ ' is the committed equivalent dose to tissue 'T' over the integration time ' τ '. When ' τ ' is not specified, it will be taken to be 50 years for adults and age 70 years for intake by children. [43M]

Committed Equivalent Dose, $H(\tau)$

The time integral of the equivalent dose rate in an organ or tissue following an intake of a radionuclide. The quantity ' $H(\tau)$ ' is defined as :

$$H_T(\tau) = \int_{t_0}^{t_0 + \tau} \dot{H}_T(t) dt$$

where ' t_0 ' is the time of intake, ' $\dot{H}_T(t)$ ' is the equivalent dose rate at time 't' in an organ or tissue 'T' and ' τ ' is the time elapsed after an intake of radioactive substances. When ' τ ' is not specified it will be taken to be 50 years for adults and age 70 years for intake by children. [43M]

Common Cause Failure (CCF)

The failure of a number of devices or components to perform their functions, as a result of a single specific event or cause. [65M]

Competent Authority

Any official or authority appointed, approved or recognised by the Government of India for the purpose of the Rules promulgated under the Atomic Energy Act, 1962. [66M]

Compliance Assurance (Transport)

A systematic programme of measures applied by the competent authority and which is aimed at ensuring that the provisions of the relevant code on "Safe Transport of Radioactive Materials" are met in practice. [90M]

Computed Tomography (CT)

Reconstructive tomography in which image recording and processing are effected by a computing system. [50]

Confinement System (Transport of Radioactive Materials)

The assembly of fissile material and packaging components specified by the designer and accepted by the competent authority to preserve criticality. [90M]

Consent

A written permission issued to the “consentee” by the regulatory body to perform specified activities related to nuclear and radiation facilities. The types of consents are ‘licence’, ‘authorisation’, ‘registration’ and ‘approval’, and will apply according to the category of the facility, the particular activity and radiation source involved. [114]

Consentee

A person to whom consent is granted by the competent authority under the relevant Rules. [67]

Consignee

Any individual, organisation or government which receives a consignment. [90]

Consignment

Any package or packages, or load of radioactive material, presented by a consignor for transport. [90]

Consignor

Any individual, organisation or government, which presents a consignment for transport, and is named as consignor in the transport documents. [90]

Containment System (Transport of Radioactive Materials)

The assembly of components of the packaging specified by the designer as intended to retain the radioactive material during transport. [90]

Contamination (Transport of Radioactive Materials)

The presence of radioactive substance on a surface in quantities in excess of 0.4 Bq/cm² for beta and gamma emitters and low toxicity alpha emitters, or 0.04 Bq/cm² for all other alpha emitters. [90]

Contamination

The presence of radioactive substances in or on a material or in the human body or other place in excess of quantities specified by the competent authority. [67]

Contractor

An individual or organisation rendering service (e.g. design, construction, inspection, review, maintenance and/or supplying items). [153]

Control (IGRED)

A mechanism attached to an exposure device, which, upon actuation, causes the source to be exposed or retracted. Controls may be operated manually or by other means. [156]

Control Cable (IGRED)

Cable or other mechanical means used to project and retract the source assembly out from and into the exposure device by means of remote control. [156]

Control Cable Sheath (IGRED)

Rigid or flexible tube for guiding the control cable from the remote control to the exposure device and for providing physical protection to the control cable. [156]

Controlled Area

A delineated area to which access is controlled and in which specific protection measures and safety provisions are, or could be, required for

- controlling normal exposures or preventing the spread of contamination during normal working conditions; and
- preventing potential exposures or limiting their extent should they occur.[41]

Conveyance

Transport by (a) road or rail: any vehicle, (b) water: any vessel, or any hold, compartment, or defined deck area of a vessel, and (c) air: any aircraft. [89]

Criticality Safety Index (CSI) (Transport of Radioactive Materials)

A number assigned to a package, overpack or freight container containing fissile material to provide control over the accumulation of such packages, overpacks or freight containers containing fissile material. [90M]

Cyclotron

A device in which charged particles (other than electrons) travel in a succession of semicircular orbits of increasing radii under the influence of a constant magnetic field and are accelerated by traversing a number of times in an electric field produced by a high frequency generator. [142M]

Decommissioning

The process by which a nuclear or radiation facility is finally taken out of operation, in a manner that provides adequate protection to the health and safety of the workers, the public and the environment. [114]

Decontamination

The removal or reduction of contamination by physical or chemical means. [43]

Defence in Depth (Security)

A concept used to design physical protection systems that requires an adversary to overcome or circumvent multiple obstacles, either similar to or diverse, in order to achieve his objective. [150]

Defined Deck Area

The area of the weather-deck of a vessel, or of a vehicle-deck of a roll-on/roll-off ship or a ferry, which is allocated for the stowage of radioactive material. [90]

Design (Transport of Radioactive Materials)

The description of special form of radioactive material, low dispersible radioactive material, package or packaging which enables such an item to be fully identified. The description may include specifications, engineering drawings, reports demonstrating compliance with regulatory requirements and other relevant documents as specified by the competent authority. [90M]

Design Basis Threat (DBT)

The attributes and characteristics of potential insider and/or external adversaries, who might attempt unauthorised removal of nuclear material or sabotage, against which a physical protection system is designed and evaluated. [150]

Directional Dose Equivalent Rate (7 mg/cm²)

The radiation level of X-rays, gamma rays, charged particles and/or neutrons in mSv/h measured with a detector having a total window and absorber thickness of 7 mg/cm² of tissue equivalent material. [143]

Directional Dose Equivalent Rate (300 mg/cm²)

The radiation level of X-rays, gamma rays, charged particles and/or neutrons in mSv/h measured with a detector having a total window and absorber thickness of 300 mg/cm² of tissue equivalent material. [143]

Disposal

The emplacement of waste in a repository without the intention of retrieval or the approved direct discharge of waste into the environment with subsequent dispersion. [42]

Dosage (Nuclear Medicine)

The activity of a radio-pharmaceutical administered for diagnosis or therapeutic purposes. [141M]

Dose

A measure of the radiation absorbed by a target. The quantities termed absorbed dose, organ dose, equivalent dose, effective dose, committed equivalent dose, or committed effective dose are used, depending on the context. The modifying terms are used when they are not necessary for defining the quantity of interest. [43M]

Dosimeter

A device, instrument or system, which can be used to measure or evaluate any quantity that can be related to the determination of either absorbed dose or equivalent dose. [40]

Dosimetry

Measurements and/or calculations performed in connection with the determination of radiation dose and/or dose distributions in the irradiated volume. [50M]

Dummy Sealed Source

Facsimile of a radioactive sealed source whose encapsulation has the same construction and is made with exactly the same materials as the sealed source that it represents but contains, in place of the radioactive material, a substance resembling it as closely as practical in physical and chemical properties. [144]

Effective Dose

The quantity 'E' is defined as a summation of the tissue equivalent doses, each multiplied by the appropriate tissue weighting factor:

$$E = \sum_T w_T \cdot H_T$$

where 'H_T' is the equivalent dose in tissue 'T' and 'w_T' is the tissue weighting factor for tissue 'T'. [43]

Emergency

A situation which endangers or is likely to endanger safety of the site personnel, the nuclear/radiation facility or the public and the environment. [60M]

Employer

Any person with recognised responsibility, commitment and duties towards a worker in his or her employment by virtue of a mutually agreed relationship. (A self-employed person is regarded as being both a worker and employer). [43]

Encapsulation

Protective envelope used to prevent leakage of radioactive material. [42M]

Enclosed Installation

In the case of industrial radiography any installation in which radiography operations are carried out in an enclosure which has walls providing adequate radiation protection to persons working outside the enclosure, and which prevents unauthorised entry of persons into the enclosure during radiography operations. Such installations may include open top installations also. [87]

Equivalent Dose ($H_{T,R}$)

The quantity ' $H_{T,R}$ ' is defined as :

$$H_{T,R} = D_{T,R} w_R$$

where ' $D_{T,R}$ ' is the absorbed dose delivered by radiation type 'R' averaged over a tissue or organ 'T' and ' w_R ' is the radiation weighing factor for radiation type 'R'. When the radiation field is composed of different radiation types with different values of ' w_R ', the equivalent dose is

$$H_T = \sum_R w_R D_{T,R}. \quad [43]$$

Ethical Review Committee

A committee of independent, qualified persons to advise on the conditions of exposure and the dose constraints to be observed for individuals exposed for biomedical research when there is no direct benefit to the exposed individual. [41M]

Event

Occurrence of an unplanned activity or deviations from normalcy. It may be an occurrence or a sequence of related occurrences. Depending on the severity in deviations and consequences, the event may be classified as an anomaly, incident or accident in ascending order. [77]

Excepted Package (Transport of Radioactive Materials)

Packaging containing quantities of radioactive material not exceeding the applicable limits prescribed by the competent authority or an empty packaging incorporating depleted uranium that is designed to meet only the general requirements for all packagings and packages (applicable limits mean activity limits for excepted packages given in AERB/SC/TR-1). [90]

Exclusive Use (Transport of Radioactive Materials)

The sole use by a single consignor, of a conveyance or of a large freight container in respect of which all (initial, intermediate, and final) loading and unloading are carried out in accordance with the directions of the consignor or consignee. [90]

Exposure

The act or condition of being subject to irradiation. Exposure can be either external (irradiation by sources outside the body) or internal (irradiation by sources inside the body). Exposure can be classified as either normal exposure or potential exposure; either occupational, medical or public exposure; and in intervention situations, either emergency exposure or chronic exposure. The term 'exposure' is also used in radiation dosimetry to express the amount of ions produced in air by ionising radiation. [43]

Exposure Head (IGRED)

Device, which locates the sealed source included in the source assembly, in the selected working position, and prevents the source assembly from projecting out of the guide tube. [156]

Filter (Radiation)

A radiation-attenuating material incorporated in the path of the radiation beam to absorb preferentially the less penetrating components of the useful beam. It may consist of a permanent filter which is an integral part of the X-ray tube housing and which cannot be removed by the user and/or an added filter incorporated to increase the total filter thickness. [113M]

Fissile Material

Uranium-233, uranium-235, plutonium or any material containing these substances or any other material that may be declared as such by notification of the Central Government.[111]

Fixed Contamination (Transport)

Contamination, other than non-fixed contamination (see also “Non-fixed Contamination”). [90]

Fluoroscopy

The technique of imaging by using a fluorescent screen. [113]

Fluoroscopic Screen

A plastic base upon which a layer of fluorescent material is evenly spread and which emits visible radiation on being exposed to X-rays. [113]

Freight Container

An article of transport equipment designed to facilitate the transport of goods, either packaged or unpackaged, by one or more modes of transport without intermediate reloading. It shall be of a permanent enclosed character, rigid and strong enough for repeated use and must be fitted with devices facilitating its handling, particularly in transfer between conveyances and from one mode of transport to another. A small freight container is that which has either any overall outer dimension less than 1.5 m, or an internal volume of not more than 3.0 m³. Any other freight container is considered to be a large freight container [90]

Gauging Device (Gauge)

A mechanism designed and manufactured for the purpose of determining and/or controlling thickness, density, moisture, level, interface location, and/or qualitative or quantitative chemical composition. It shall include radiation source, radiation shields, useful beam control mechanism and other components which form an integral part of the device to meet the requirements or specifications of standard specifications for “Construction and Design of Nucleonic Gauges (AERB/SS-2)”. [143]

Grid (Diagnostic X-rays)

A device composed of alternate strips of lead and radiolucent material encased suitably placed between the patient and the X-ray film to absorb scattered radiation. ‘Potter Bucky grid’ or ‘Bucky’ means a device containing a grid and a mechanism to impart motion to the grid during radiography exposure. [113]

Guard (Security)

A person, who is entrusted with responsibility for patrolling, monitoring, assessing, escorting individuals or transport, controlling access and/or providing initial response. [150]

Guide Tube or Projection Sheath (IGRED)

Flexible or rigid tube for guiding the source assembly from the exposure device to the working position and having necessary connections for attachment to the source housing and to the exposure head, or including the exposure head itself. [156]

Handle

Manufacture, possess, store, use, transfer by sale or otherwise export, import, transport or dispose of. [67M]

Implant (Source)

The procedure by which sealed sources are applied to the body tissues or organs either manually or by an after-loading system. [112]

Industrial Gamma Radiography Exposure Device (IGRED)

An assembly of components necessary to make radiographic exposures and which includes the source housing, mechanism for securing the source assembly, exposure mechanism, that includes source drive associated system, positioning devices and guide tubes. [156]

Industrial Packagea) **Type 1 (Type IP-1)**

A package, tank, or freight container intended for the transport of low specific activity (LSA) material or surface contaminated object (SCO) that is designed to meet the general requirements for all packagings and packages, and the additional requirements specified for transport by air.

b) **Type 2 (Type IP-2)**

A packaging, tank, or freight container fulfilling the requirements for a Type IP-1 and, in addition, (i) fulfilling those requirements specified in the AERB code for Safe Transport of Radioactive Materials, (ii) capable of withstanding the static and dynamic stresses resulting from normal handling and routine conditions of transport, and (iii) conforming to the requirements prescribed in the International Organisation for Standardisation Document (ISO 1496/1-1978) “Series 1 Freight Containers”, such that, if it were subjected to the prescribed tests it would be capable of preventing loss of shielding which would result in more than a 20% increase in the radiation level at any external surface.

c) **Type 3 (Type IP-3)**

A packaging, tank or freight container fulfilling the requirements of Type IP-2, and in addition, the requirements specified in the code for “Safe Transport of Radioactive Materials”. [90]

Industrial Radiography

Non-destructive testing of materials employing ionising radiation. [149M]

Inner Area (Security)

An area inside a protected area where Category I nuclear material is used and/or stored. [150]

Intermediate Bulk Container (IBC) (Transport of Radioactive Materials)

A portable packaging that

- has a capacity of not more than 3 m³,
- is designed for mechanical handling,
- is resistant to the stresses produced in handling and transport, as determined by performance tests, and
- is designed to conform to the standards in the chapter on “Recommendations on Intermediate Bulk Containers (IBCs) of the United Nations Recommendations on the Transport of Dangerous Goods”. [90]

Internal Exposure

Exposure due to a source within the body. [90]

Intrusion Detection

Detection of an intruder by a guard or by a system comprising of a sensor(s), transmission medium and control panel to annunciate an alarm. [150]

Ionisation

Formation of ions by the division of molecules or by the addition or removal of electrons from atoms or molecules. [142]

Irradiation

Exposure to ionising radiation. [142]

Irradiators

A facility that houses a particle accelerator, X-ray machine, or large radioactive sources for imparting high radiation doses to materials. [91M]

Isocentre

A virtual point in free space where the axes of rotation of the collimator, the gantry and the treatment couch of a teletherapy equipment meet. [110]

Isolation Zone (Security)

An area, which isolates the protected area from the prohibited area by means of double fencing and has provisions for intrusion detection. [152M]

Kerma

The quantity 'K', defined as

$$K = dE_{tr} / dm$$

where 'dE_{tr}' is the sum of the initial kinetic energies of all charged ionising particles liberated by uncharged ionising particles in a material of mass 'dm'. The SI unit of kerma is the joule per kilogramme (J.kg⁻¹) termed gray (Gy). [43]

Lead Equivalence

The thickness of lead, which under specified conditions of irradiation, affords the same attenuation as the material under consideration. [113]

Leakage Radiation

Any radiation coming out of the source/tube housing, except the useful beam or primary beam. [113M]

Licence

A type of regulatory consent, granted by the regulatory body for all sources, practices and uses for nuclear facilities involving the nuclear fuel cycle and also certain categories of radiation facilities. It also means authority given by the regulatory body to a person to operate the above said facilities.[114]

Light Beam Collimator or Light Beam Diaphragm

The mechanism to collimate the radiation field and indicate the same by optical means.[113M]

Limit

The value of a parameter or attribute (which is variable) used in specific activities or circumstances that must not be exceeded. [43M]

Linear Accelerator

An accelerator in which, charged particles are accelerated along a linear path. [142]

Low Dispersible Radioactive Material (Transport of Radioactive Materials)

A solid radioactive material or a solid radioactive material in a sealed capsule (not in powder form) and which meets the requirements laid down by the competent authority in this regard. [90M]

Low Specific Activity (LSA) Material (Transport of Radioactive Materials)

Radioactive material which by its nature has a limited specific activity, or radioactive material for which limits of estimated average specific activity apply. External shielding materials surrounding the LSA material shall not be considered in determining the estimated average specific activity. LSA material shall be in one of the following three groups:

- a) **LSA-I**
 - i) uranium or thorium ores and concentrates of such ores, and other ores containing naturally occurring radionuclides which are intended to be processed for the use of these radionuclides; or
 - ii) solid unirradiated natural uranium or depleted uranium or natural thorium or their solid or liquid compounds or mixtures; or

- iii) radioactive material for which the A_2 value is unlimited, excluding fissile material in quantities not excepted under the relevant paragraphs of safety code on “Transport of Radioactive Materials AERB/SC/TR-1”; or
- iv) other radioactive material in which the activity is distributed throughout and the estimated average specific activity does not exceed 30 times the values for activity concentration specified in the relevant schedules of AERB safety code (AERB/SC/TR-1).

b) **LSA-II**

- i) water with tritium concentration up to 0.8 TBq.l^{-1} or
- ii) other material in which the activity is distributed throughout and the estimated average specific activity does not exceed $10^{-4} \text{ A}_2.\text{g}^{-1}$ for solids and gases, and $10^{-5} \text{ A}_2.\text{g}^{-1}$ for liquids.

c) **LSA-III**

solids, (e.g. consolidated waste, activated materials), excluding powders in which :

- i) the radioactive material is distributed throughout a solid or a collection of solid objects, or is essentially uniformly distributed in a solid compact binding agent (such as concrete, bitumen and ceramic);
- ii) the radioactive material is relatively insoluble, or it is intrinsically contained in an insoluble matrix, so that, even under loss of packaging, the loss of radioactive material per package by leaching when placed in water for seven days would not exceed 0.1 A_2 ; and
- iii) the estimated average specific activity of the solid, excluding any shielding material, does not exceed $2 \times 10^{-3} \text{ A}_2.\text{g}^{-1}$. [90]

Low Toxicity Alpha Emitters (Transport of Radioactive Materials)

Natural uranium, depleted uranium, natural thorium, uranium-235 or uranium-238, thorium-232, thorium-228 and thorium-230 when contained in ores or physical and chemical concentrates, or alpha emitters with half-lives of less than 10 days. [90]

Luminescence

Phenomenon in which atoms of certain substances, when excited, emit light of wavelength that is characteristic of the substance. [142]

Maximum Normal Operating Pressure (Transport of Radioactive Materials)

The maximum pressure above atmospheric pressure at mean sea level that would develop in the containment system in a period of one year under the conditions of temperature and solar radiation corresponding to environmental conditions of transport in the absence of venting, external cooling by an ancillary system, or operational controls during transport. [90]

Microtron

A cyclic accelerator in which electrons are guided by a constant magnetic field in circular orbits of increasing radii, tangential to each other and accelerated at the beginning of each orbit, by traversing an electric field produced by a radio frequency generator.[142]

Milliamperere Seconds-X-ray (mAs)

The product of the current through an X-ray tube and the duration of the exposure in seconds. [113]

Modulation Transfer Function (Diagnostic X-rays)

A curve plotting spatial frequency on the horizontal axis against a modulation transfer value on the vertical axis which is a measure of how well a sine wave, that describes the transmission of X-rays through an object, is represented faithfully in the image. [113]

Monitoring

The continuous or periodic measurement of parameters for determination, assessment in respect of structure, system or component in a facility or control of radiation. [6M]

Multilateral Approval (Transport of Radioactive Materials)

Approval by the competent authority of the country of origin of the design or shipment and of each country through or into which the consignment is to be transported. The term 'through or into' specifically excludes over, that is, the approval and notification requirements shall not apply to a consignment which is carried in an aircraft, provided there is no scheduled stop in that country. [90]

Non-fixed Contamination (Transport of Radioactive Materials)

Contamination that can be removed from a surface during routine conditions of transport.[90]

Non-leachable

Form of radioactive material contained in the source which is virtually insoluble in water and not convertible into dispersible products. [144]

Nuclear Medicine

The speciality that utilises radio-pharmaceuticals to investigate disorders of anatomy, physiology and patho-physiology, for diagnosis and/or treatment of diseases. [141M]

Nuclear Safety

The achievement of proper operating conditions, prevention of accidents or mitigation of accident consequences, resulting in protection of site personnel, the public and the environment from undue radiation hazards. [96]

Nuclear Security

All preventive measures taken to minimize the residual risk of unauthorised transfer of nuclear material and/or sabotage, which could lead to release of radioactivity and/or adverse impact on the safety of the plant, plant personnel, public and environment. [157]

Occupancy Factor (T)

For the purpose of calculating protective shielding, the factor by which workload is multiplied, in order to take account of the degree of occupancy. [86M]

Occupational Exposure

All exposures of personnel incurred in the course of their work. [43M]

Occupational Worker

Any person, working full time or part time in a nuclear or radiation facility, who may be employed directly by the "consentee" or through a contractor. [114]

Occupier

One who has been given the ultimate control over the affairs of the installation. [117]

Off-site

Area in public domain beyond the site boundary. [20M]

Operational Limits (Radiation)

Limits on levels of radiation or levels of contamination as the competent authority may specify from time to time. However, in the case of diagnostic X-ray equipment and installation, contamination levels are not relevant. [113]

Overpack

An enclosure, such as a box or bag, which need not meet the requirements for a freight container, and which is used by a single consignor as a single handling unit containing two or more packages for convenience of handling, stowage and carriage. [90M]

Package

The packaging with its radioactive contents as prescribed for transport. [78]

Packaging

The assembly of components necessary to enclose the radioactive contents completely. It may, in particular, consist of one or more receptacles, absorbent materials, spacing structures, radiation shielding, service equipment for filling, emptying, venting and pressure relief devices for cooling, absorbing mechanical shocks, providing handling and tie-down capability, thermal insulation; and service devices integral to the package. The packaging may be a box, drum, or similar receptacle, or a freight container, tank or intermediate bulk container. [90M]

Passenger Aircraft

An aircraft that carries any person other than a crew member, or a carrier's employee in an official capacity, or an authorised representative of an appropriate national authority, or a person accompanying a consignment. [90 M]

Patrol (Security)

A function carried out by guards to inspect elements of physical protection at regular or irregular intervals. [150]

Personal Monitoring

Determination or estimation of the dose received by a person from external and internal radiation. [44]

Penumbra (Teletherapy)

The zone of decreasing radiation intensity of the useful beam area, lying within the isodose boundaries defined by the 90% and 10% (telegrapha beams) and 80% to 20% (high energy photon beams, however) of the central axis dose, in a plane perpendicular to it and at a depth where the dose is maximum for the designated treatment distance. [110M]

Physical Barrier

A fence or wall or a similar impediment, which provides penetration delay and complements access control. [150]

Physical Protection

Measures for the protection of nuclear/radiation facility designed to prevent unauthorised access or removal of radioactive material, or sabotage. [96M]

Practice

Any human activity that introduces additional sources of exposure or exposure pathways or extends exposure to additional people or modifies the network of exposure pathways from existing sources, so as to increase the exposure or the likelihood of exposure of people, or the number of people exposed. [43]

Protected Area

An area under surveillance, containing Category I or II nuclear material, and/or vital/ inner areas surrounded by a physical barrier. [1M]

Protective Barrier or Shielding (Radiation)

A barrier of appropriate thickness used to reduce radiation levels to specified values. [154]

Protective Device

Device used for the purpose of radiological protection. [91]

Quality

The totality of features and characteristics of an item or service that have the ability to satisfy stated or implied needs. [46M]

Quality Assurance

Planned and systematic actions necessary to provide adequate confidence that an item or a facility will perform satisfactorily in service as per design specifications. [46M]

Quality Assurance (Transport of Radioactive Materials)

A systematic programme of controls and inspections applied by any organisation or body involved in the transport of radioactive material, with the aim of providing adequate confidence that the standard of safety prescribed in the code on “Safe Transport of Radioactive Materials” is achieved in practice. [90M]

Quality Control (QC)

Quality assurance actions, which provide a means to control and measure the characteristics of an item, process or facility in accordance with established requirements. [46]

Radiation

Gamma rays, X-rays, or rays consisting of alpha particles, beta particles, neutrons, protons and other nuclear, sub-atomic particles, but not sound or radio waves, or visible, infrared, ultra-violet light. [50]

Radiation Facility

Any installation/equipment or a practice involving the use of radiation-generating units or radioisotopes in the field of research, industry, medicine and agriculture. [114M]

Radiation Generating Equipment

Device capable of generating radiation, such as X-rays, neutrons, electrons or other charged particles. [114]

Radiation Level

The dose rate expressed in mSv/h. [90]

Radiation Output

Number of particles and/or photons of ionising radiation emitted per unit time from a source in a defined geometry. Radiation output may also be stated in terms of air kerma rate at a specified distance from the source of radiation. [144]

Radiation Protection Survey/Radiological Survey

An evaluation of radiation safety, using appropriate radiation measuring instruments. [113]

Radiation Safety

(See ‘Nuclear Safety’).

Radiation Surveillance

Measures that may be specified by the competent authority to provide adequate protection either generally or in an individual case. [113]

Radiation Worker

Any person who is occupationally exposed to radiation, and who in the opinion of the regulatory body, should be subjected to radiation surveillance. [44].

Radioactive Contents

Radioactive material together with any contaminated or activated solids, liquids and gases within the packaging. [90]

Radioactive Material or Radioactive Substance

Any substance or material, which spontaneously emits radiation in excess of the levels prescribed by notification by the Central Government. [111]

Radioactive Waste

Material, whatever be its physical form, remaining from practices or interventions and for which no further use is foreseen. It can be (a) that contains or is contaminated with radioactive substances and has an activity or activity concentration higher than the level for clearance from regulatory requirements, and (b) exposure to which is not excluded from regulatory control. [41]

Radioactive Waste Management Facility

Facility specifically designed to handle, treat, condition, temporarily store or permanently dispose of radioactive waste. [43]

Radioactivity

The phenomenon whereby atoms undergo spontaneous random disintegration, usually accompanied by the emission of radiation. [42M]

Radiograph

A permanent record of a transmission image, produced by a beam of radiation after passing through the subject/specimen. [113]

Radiography (Medical)

Technique for obtaining, recording and optionally processing, directly or after transfer, information contained in an X-ray pattern at an image receptor area. [86]

Radiography Source

A source sealed in one or more capsules, or an X-ray tube, or an electron accelerator or a neutron source used for industrial radiography. [87]

Radiography Technician/ Radiography Technologist/Radiographer

A worker, who performs radiography operations employing radiography sources and possesses valid qualification, duly recognised by the competent authority for the specific purpose. [87]

Radiological Safety Officer (or Radiation Safety Officer)

Any person who is so designated by the employer and who, in the opinion of the competent authority, is qualified to discharge the functions outlined in the Radiation Protection Rules, 1971. [113]

Radiotherapy/Radiation Therapy

Medical treatment by ionising radiation [91]

Registration

The consent shall be the registration for sources and practices that include:

- (i) medical diagnostic X-ray equipment, including computed tomography (CT) and therapy simulator;
- (ii) analytical X-ray equipment used for research;
- (iii) nucleonic gauges;
- (iv) radioactive sources in tracer studies;
- (v) bio-medical application and research using radioactive materials; and
- (vi) any other source and practice notified by the competent authority.[67M]

Regulatory Authority

(See “Competent Authority”).

Regulatory Body

(See “Atomic Energy Regulatory Board”).

Regulatory Consent

(See “Consent”).

Regulatory Constraints

Restrictions on radiation protection parameters specified by the regulatory body. [44M]

Regulatory Inspection

An examination by review of documents, observation, measurement or test undertaken by or on behalf of the regulatory body during any stage of the regulatory consenting process, to ensure conformance of materials, components, systems and structures, as well as operational and maintenance activities, processes, procedures, practices and personnel competence with predetermined requirements. [114]

Remote Afterloading Equipment

Brachytherapy equipment in which the sources(s) is transferred from their storage to the treatment positions and back by remote operation using an appropriate mechanism for the source movement. [66M]

Repository

A facility where radioactive waste is emplaced for disposal. Future retrieval of waste from the repository is not intended. [42M]

Repository, geological

A facility for radioactive waste disposal located underground (usually more than several hundred meters below the surface) in a stable geological formation to provide long term isolation of radionuclides from the biosphere. Usually such a repository would be used for long-lived and/or high level waste. [42M]

Repository, near surface

A facility for radioactive waste disposal located at or within a few tens of meters from the Earth’s surface. Such repository is suitable for the disposal of short-lived low and intermediate level waste. [42M]

Reserve Sheath (IGRED)

Sheath containing the length of the control cable, necessary for driving the source assembly. [156]

Response Forces / Quick Response Team

Persons, on-site or off-site, who are armed and appropriately equipped and trained to counter an attempted unauthorised removal of nuclear material or an act of sabotage. [150]

Sabotage (Security)

Any deliberate act directed against a nuclear/radiation facility or nuclear material in use, storage or transport which could directly or indirectly endanger the health and safety of personnel, the public and the environment by exposure to radiation or release of radioactive substances. [150]

Safety

(See 'Nuclear Safety').

Safety Assessment

Review of the aspects of design and operation of a source, which are relevant to the protection of persons or the safety of the source, including the analysis of the provisions for safety and protection established in the design and operation of the source and the analysis of risks associated with normal conditions and accident situations. [43]

Safety Site-in-Charge

A person who has the qualifications and training prescribed for Level 2 radiological safety officer and who is appointed by the 'consentee' as the person supervising industrial radiography operations at an authorised radiography site with approval of the competent authority. [149]

Scattered Radiation

Radiation that, during passage through matter, gets deviated in direction. (It may have been modified by a decrease in energy). [87]

Sealed Source

Radioactive source material that is (a) permanently sealed in a capsule, or (b) closely bounded and in a solid form. The capsule or material of a sealed source shall be strong enough to maintain leak tightness under the conditions of use and wear for which the source was designed, as also under foreseeable mishaps. [43]

Secured Position (IGRED)

Condition of the exposure device and source assembly when the source is fully shielded in the source housing and the exposure device is rendered inoperable by locking and/or other means. [156]

Security Survey

A detailed examination, made by the competent authority, of proposed physical protection measures in order to evaluate them for approval. [150M]

Simulated Source

Facsimile of a radioactive sealed source, the encapsulation of which has the same construction and is made with exactly the same material as those of the sealed source that it represents, but containing, in place of the radioactive material, a substance with mechanical, physical and chemical properties, as close as possible to those of the radioactive material and containing radioactive material of tracer quantity only. [144]

Source

Anything that may cause radiation exposure, either by emitting ionising radiation or releasing radioactive substances or materials. [41M]

Source Assembly

An assembly of components consisting of gamma radiography source and a mechanism for connection with the drive system. [87]

Source Changer

A device for transferring radiography sources from or to exposure device, and suitable for transport and storage of the source. [87M]

Source Drive Mechanism

A remotely-operating mechanism, which drives a radiography source out of, or into, a storage container. [86M]

Source Guide Tube

A flexible or rigid tube, through which the source holder moves from its secured position in the source housing to its working position. [86]

Source Holder

A device used to support and retain the source in position. [143]

Source Housing

Shielding provided in any device containing a sealed source, in order to :

- define the useful beam; and
- limit the radiation level outside the useful beam to maximum permissible leakage levels, as specified by the competent authority. [142M]

Source in Device

Sealed source which remains captive in a device, thereby providing mechanical protection from damage during use. [144]

Source Storage

A container of approved design in which the sealed sources are kept when not in use. [66M]

Source Transfer

The procedure by which the sealed source is transferred from the source housing to a shielded container and vice versa. [110]

Special Arrangement

The provisions, approved by the competent authority, under which a consignment that does not satisfy all the applicable requirements of the relevant code may be transported. [90M]

Special Form Radioactive Material

It is either an indispersible solid radioactive material or a sealed capsule containing radioactive material, conforming to the requirements specified and approved by the competent authority for special form radioactive material. [89M]

Specific Activity

The activity per unit mass of a radionuclide. Specific activity pertains to activity per unit mass of the material in which the radionuclides are essentially uniformly distributed. [90M]

Stray Radiation

The sum of leakage and scattered radiations. [143]

Supervised Area

Any area not designated as a controlled area but for which occupational exposure conditions are kept under review even though specific protective measures and safety provisions are not normally needed. [43]

Surface Contaminated Object (SCO) (Transport of Radioactive Materials)

A solid object which is not radioactive but which has radioactive material distributed on its surface. SCO shall be in one of the following two groups:

a) SCO-I:

A solid object on which

- i) the non-fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface, if less than 300 cm^2) does not exceed 4 Bq/cm^2 for beta and gamma emitters, and for low-toxicity alpha emitters, or 0.4 Bq/cm^2 for all other alpha emitters; and
- ii) the fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface, if less than 300 cm^2) does not exceed $4 \times 10^4 \text{ Bq/cm}^2$ for beta and gamma emitters and for low-toxicity alpha emitters, or $4 \times 10^3 \text{ Bq/cm}^2$ for all other alpha emitters; and
- iii) the non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm^2 (or the area of the surface, if less than 300 cm^2) does not exceed $4 \times 10^4 \text{ Bq/cm}^2$ for beta and gamma emitters and for low-toxicity alpha emitters, or $4 \times 10^3 \text{ Bq/cm}^2$ for all other alpha emitters.

b) SCO-II:

A solid object on which either the fixed or non-fixed contamination on the surface exceeds the applicable limits specified for SCO-I in (a) above and on which

- i) the non-fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface, if less than 300 cm^2) does not exceed 400 Bq/cm^2 for beta and gamma emitters and for low-toxicity alpha emitters, or 40 Bq/cm^2 for all other alpha emitters; and
- ii) the fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface, if less than 300 cm^2) does not exceed $8 \times 10^5 \text{ Bq/cm}^2$ for beta and gamma emitters and for low-toxicity alpha emitters, or $8 \times 10^4 \text{ Bq/cm}^2$ for all other alpha emitters; and

- iii) the non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm² (or the area of the surface, if less than 300 cm²) does not exceed 8 x 10⁵ Bq/cm² for beta and gamma emitters and for low-toxicity alpha emitters, or 8 x 10⁴ Bq/cm² for all other alpha emitters. [90]

Synchrotron

Particle accelerator in which charged particles travel in circular orbits of constant radius guided by an increasing magnetic field and accelerated by traversing a number of times an electric field produced by a high frequency generator in synchronism with the orbital motion. [142M]

Tank (Transport of Radioactive Materials)

A tank-container, portable tank, a road tank vehicle, a rail tank wagon or a receptacle with a capacity of not less than 450 litres intended to contain liquids, powders, granules, slurries or solids which are loaded as gas or liquid and subsequently solidified, and of not less than 1,000 litres to contain gases. A tank-container shall be capable of being carried on land or on sea and of being loaded and discharged without removing its structural equipment and shall possess stabilising members and tie-down attachments external to the shell, and shall be capable of being lifted when full. [90M]

Teletherapy

Treatment with external radiation beam(s) where the distance from source to skin is greater than 5 cm. [142]

Tomography

Radiography of one or more sections/layers within an object. [142]

Transport (Nuclear Material)

International or domestic carriage of nuclear material by any means of transportation beginning with the departure from a facility of the consignor and ending with the arrival at a facility of the consignee. [150M]

Transport Control Centre (Nuclear Material)

An installation which provides for the continuous monitoring of transport vehicle location and security status and for communication with the transport vehicle, its guards, the response forces and the consignor/consignee. [150M]

Transport Index (TI)

A number assigned to a package, overpack, or freight container, or to un-packaged LSA-I or SCO-I used to provide control over radiation exposures. [90M]

Treatment Planning (Radiotherapy)

Planning of the techniques for radiation therapy, which may include treatment simulation and dosimetry. [113]

Treatment Simulation

Methods by which the techniques and patient positioning for radiotherapy are simulated without delivering the therapy dose. [113]

Tube Housing

A shielding enclosure provided around an X-ray tube, in order to :

- (i) define the useful beam; and
- (ii) limit the radiation levels outside the useful beam so as not to exceed the radiation leakage levels, as prescribed by the competent authority. [86]

Type Approval

Approval, issued by the competent authority, based on evaluation of the device to ensure that it conforms to safety standards, [87]

Type A Package

A package designed to withstand normal and accidental conditions of transport without loss or dispersal of its contents or loss of shielding integrity. The radioactive material may be transported in Type A package, either in special form radioactive material or other form, with the provision that the activity shall not exceed the applicable limits prescribed in the relevant code on "Transport of Radioactive Materials". [90M]

Type B(M) Package

A package, whose design or shipment requires multilateral approval because it does not meet all requirements of a Type B(U) package. [90M]

Type B(U) Package

A package designed to contain an activity in excess of A_1 , if special form radioactive material, or in excess of A_2 if not special form radioactive material, that is designed to

withstand normal and accidental conditions of transport specified in the relevant code on “Transport of Radioactive Materials”. [90M]

Type C Package

A package designed to contain an activity in excess of the limits specified for transportation by air of a Type B(U)/Type B(M) package in accordance with the relevant code on “Safe Transport of Radioactive Materials” (AERB/SC/TR-1). [90M]

Unilateral Approval

Approval of design issued by the competent authority of the country of origin of design only. [90]

Unirradiated Thorium

Thorium containing not more than 10^{-7} g of ^{233}U per gram of ^{232}Th . [96]

Unirradiated Uranium

Uranium containing not more than 2 kBq of ^{239}Pu per gram of ^{235}U and not more than 9 MBq of fission products per gram of ^{235}U and not more than 5 mg of ^{236}U per gram of ^{235}U . [96]

Unprotected Source

Sealed source which, for use, is removed from a device and hence may not have mechanical protection from damage during use. [144]

Unusual Occurrence

Any occurrence which has the potential to impair or impairs the plant safety, radiological safety, industrial safety and/or environmental safety. [114M]

Uranium (Natural, Depleted, Enriched)

Natural uranium: Chemically separated uranium containing the naturally occurring distribution of uranium isotopes (approximately 99.28% ^{238}U and 0.72% ^{235}U by mass).

Depleted uranium: Uranium containing a lesser mass percentage of ^{235}U than in natural uranium.

Enriched uranium: Uranium containing a greater mass percentage of ^{235}U than in natural uranium (i.e. 0.72%). [96M]

Useful Beam or Primary Beam

Part of the emergent radiation from a source housing, which is capable of being used for the purpose for which the equipment is intended. [113]

Useful Beam Controls

The device(s) that control(s) the intensity, quality, and direction of the useful radiation beam, which is emitted from the source. [143]

Vital Area

An area inside a protected area containing equipment, systems or devices, or nuclear material, the sabotage of which could directly or indirectly lead to unacceptable radiological consequences. [150]

Workload (W)

For the purpose of shielding computation, the radiation output or equivalent quantity integrated usually over a working week. [86 M]

X-ray Source

A source producing penetrating electromagnetic radiation of wavelengths shorter than those of ultraviolet light, either emanating from a radioactive source or produced by bombarding a metallic target with fast electrons in X-ray tube. [143M]

REFERENCES

1. International Atomic Energy Agency, Safety Standard on the Principles of Radioactive Waste Management, IAEA SS-111-F (1995)
2. Atomic Energy Regulatory Board, Code of Practice on Safety in Nuclear Power Plant Siting, AERB/SC/S, Mumbai, India (1990)
3. International Atomic Energy Agency, Safety Standard on Radiation Protection and the Safety of Radiation Sources IAEA SS-120-F (1996)
4. International Atomic Energy Agency, Safety Guide on Safety Functions and Component Classification for BWR, PWR and PTR, IAEA SS-50-SG-D1 (1979)
5. Atomic Energy Regulatory Board, Code on Governmental Organisation for Regulation of Radiation Facilities, AERB/SC/G, Mumbai, India (2000)
6. International Atomic Energy Agency, Code on the Safety of Nuclear Research Reactors: Design, IAEA SS-35-S1 (1992)
7. International Atomic Energy Agency, Code on the Safety of Nuclear Research Reactors: Operation, IAEA SS-35-S2 (1992)
8. International Atomic Energy Agency, Safety Assessment for Spent Fuel Storage Facilities, IAEA SS-118 (1994)
9. International Atomic Energy Agency, Establishing a National System for Radioactive Waste Management, IAEA SS-111-S-1 (1995)
10. International Atomic Energy Agency, Data Collection and Record Keeping for the Management of Nuclear Power Plant Ageing, IAEA SS-50-P3 (1991)
11. International Atomic Energy Agency, Inspection and Enforcement by the Regulatory Body for Nuclear Power Plants, IAEA SS-50-SG-G4 (Rev.1) (1996)
12. International Atomic Energy Agency, Safety Guide on Safety Assessment of Research Reactors and Preparation of the Safety Analysis Report, IAEA SS-35-SG-G1 (1994)
13. International Atomic Energy Agency, Safety Guide on Surveillance of Items Important to Safety in Nuclear Power Plants (NPPs), IAEA SS-50-SG-O8 (1990)
14. International Atomic Energy Agency, Safety Guide on Emergency Power Systems at Nuclear Power Plants, IAEA SS-50-SG-D7 (1991)
15. International Atomic Energy Agency, Safety Guide on Safety in the Utilisation and Modification of Research Reactors, IAEA SS-35-SG-G2 (1994)

16. International Atomic Energy Agency, Design of Spent Fuel Storage Facilities, IAEA SS-116 (1994)
17. International Atomic Energy Agency, Safety Guide on Seismic Design and Qualification for Nuclear Power Plants, IAEA SS-50-SG-D15 (1992)
18. International Atomic Energy Agency, Evaluation of Fire Hazard Analyses for Nuclear Power Plants, IAEA SS 50-P-9 (1995)
19. Atomic Energy Regulatory Board, Safety Manual for Decommissioning of Nuclear Facilities, AERB/SM/DECOM-1, Mumbai, India (1998)
20. Atomic Energy Regulatory Board, Safety Guide for Preparation of Site Emergency Plan for Nuclear Facilities, AERB/SG/EP-1, Mumbai, India (1998)
21. Atomic Energy Regulatory Board, Safety Guide for the Preparation of Off-site Emergency Preparedness Plan for Nuclear Facilities, AERB/SG/EP-2, Mumbai, India (1998)
22. Atomic Energy Regulatory Board, Safety Guide on Population Distribution and Analysis in Relation to Siting of Nuclear Power Plants, AERB/SG/S-9, Mumbai, India (1998)
23. Atomic Energy Regulatory Board, Safety Guide on Hydrological Dispersion of Radioactive Materials in Relation to Nuclear Power Plant Siting, AERB/SG/S-2, Mumbai, India (1998)
24. International Atomic Energy Agency, Safety Code on Governmental Organisation for the Regulation of Nuclear Power Plants, IAEA SS 50-C-G (1978)
25. International Atomic Energy Agency, Safety Code on Design for Safety of Nuclear Power Plants, IAEA SS 50-C-D (1978)
26. International Atomic Energy Agency, Safety Code on Safety in Nuclear Power Plant Operation, including Commissioning and Decommissioning, IAEA SS 50-C-O (1978)
27. International Atomic Energy Agency, Safety Guide on Quality Assurance Auditing for Nuclear Power Plants IAEA SS 50-SG-QA10 (1980)
28. International Atomic Energy Agency, Safety Guide on Quality Assurance in the Manufacture of Items for Nuclear Power Plants, IAEA SS 50-SG-QA8 (1981)
29. International Atomic Energy Agency, Safety Guide on Quality Assurance for Safety in Nuclear Power Plants and other Nuclear Installations, IAEA SS-50-C/SG-Q (1996)

30. International Atomic Energy Agency, Safety Guide on Earthquakes and Associated Topics in relation to Nuclear Power Plant Siting, IAEA SS 50-SG-S1 (1979)
31. International Atomic Energy Agency, Safety Guide on Seismic Analysis and Testing of Nuclear Power Plants, IAEA SS 50-SG-S2 (1979)
32. International Atomic Energy Agency, Safety Guide on External Man-Induced Events in Relation to Nuclear Power Plant Siting, IAEA SS 50-SG-S5 (1981)
33. International Atomic Energy Agency, Safety Guide on Design Basis Flood for Nuclear Power Plants on Coastal Sites, IAEA SS 50-SG-S10B (1983)
34. International Atomic Energy Agency, Safety Guide on Extreme Meteorological Events in Nuclear Power Plant Siting, Excluding Tropical Cyclones, IAEA SS 50-SG-S11A (1981)
35. International Atomic Energy Agency, Safety Guide on Establishing the Quality Assurance Programme for a Nuclear Power Plant Project, IAEA SS 50-SG-QA1 (1984)
36. International Atomic Energy Agency, Safety Guide on Seismic Design and Qualification for Nuclear Power Plants, IAEA SS 50-SG-D15 (1992)
37. International Atomic Energy Agency, Safety Guide on Maintenance of Nuclear Power Plants, IAEA SS 50-SG-O7 (1982)
38. International Atomic Energy Agency, Safety Guide on Staffing of Nuclear Power Plants and the Recruitment, Training and Authorisation of Operating Personnel, IAEA SS 50-SG-O1 (Rev.1) (1991)
39. International Atomic Energy Agency, Safety Code on the Safety of Nuclear Power Plants: Design, IAEA SS 50-C-D (Rev 1) (1988)
40. International Atomic Energy Agency, Radiation Protection Glossary, IAEA SS No. 76 (1986)
41. International Atomic Energy Agency, Glossary of Terms used in Radiation Protection, IAEA RASSAC/3/WP5, Draft (1997)
42. International Atomic Energy Agency, Radioactive Waste Management Glossary, IAEA (1996)
43. International Atomic Energy Agency, International Basic Safety Standards for Protection Against Ionising Radiation and for the Safety of Radiation Sources, IAEA SS-115 (1996)

44. Atomic Energy Regulatory Board, Safety Manual on Radiation Protection for Nuclear Facilities, AERB/SM, Mumbai, India (1996)
45. Atomic Energy Regulatory Board, Safety Guide on Intervention Levels and Derived Intervention Levels for Off-site Radiation Emergencies, AERB/SG/HS-1, Mumbai, India (1992)
46. Atomic Energy Regulatory Board, Code of Practice on Quality Assurance for Safety in Nuclear Power Plants, AERB/SC/QA, Mumbai, India (1988)
47. Atomic Energy Regulatory Board, Code of Practice on Safety in Nuclear Power Plant Operation, AERB/SC/O, Mumbai, India (1989)
48. Atomic Energy Regulatory Board, Code of Practice on Design for Safety in PHWR based Nuclear Power Plants, AERB/SC/D, Mumbai, India (1989)
49. Atomic Energy Regulatory Board, Safety Manual on Civil Engineering and Building Works of Nuclear Power Plants, AERB/SM/S-1, Mumbai, India (1988)
50. Atomic Energy Regulatory Board, Glossary of Terms in Radiation Protection compiled by Dr. Masood Ahmad, Mumbai, India (1997)
51. Atomic Energy Regulatory Board, Safety Guide on Quality Assurance during Commissioning and Operation of Nuclear Power Plants, AERB/SG/QA-5, Mumbai, India (1993)
52. Atomic Energy Regulatory Board, Draft Safety Guide on Fire Protection for Nuclear Power Plants, AERB/SG/D-4, Mumbai, India (1999)
53. Atomic Energy Regulatory Board, Draft Safety Guide on Primary Heat Transport System, AERB/SG/D-8, Mumbai, India (1999)
54. Atomic Energy Regulatory Board, Draft Safety Guide on ISI of Nuclear Power Plants, AERB/SG/O-2, Mumbai, India (1996)
55. Atomic Energy Regulatory Board, Safety Guide on Operational Limits and Conditions for Nuclear Power Plants, AERB/SG/O-3, Mumbai, India (1998)
56. Atomic Energy Regulatory Board, Safety Guide on Commissioning Procedures for Pressurised Heavy Water Reactor Based Nuclear Power Plants, AERB/SG/O-4, Mumbai, India (1998)
57. Atomic Energy Regulatory Board, Safety Guide on Radiation Protection during Operation of Nuclear Power Plants, AERB/SG/O-5, Mumbai, India (1998)
58. Atomic Energy Regulatory Board, Safety Guide on Preparedness of the Operating Organisation for Emergencies at Nuclear Power Plants, AER/SG/O-6, Mumbai, India (1999)

59. Atomic Energy Regulatory Board, Safety Guide on Maintenance of Nuclear Power Plants, AERB/SG/O-7, Mumbai, India (1998)
60. Atomic Energy Regulatory Board, Safety Guide on Surveillance of Items Important to Safety in Nuclear Power Plants, AERB/SG/O-8, Mumbai, India (1998)
61. Atomic Energy Regulatory Board, Safety Guide on Management of NPPs for Safe Operation, AERB/SG/O-9, Mumbai, India (1998)
62. Atomic Energy Regulatory Board, Safety Guide on Core Management and Fuel Handling for Pressurised Heavy Water Reactor Based Nuclear Power Plants, AERB/SG/O-10B, Mumbai, India (1999)
63. Atomic Energy Regulatory Board, Safety Guide on Design Basis Floods for Inland Sites, AERB/SG/S-6A, Mumbai, India (2000)
64. Atomic Energy Regulatory Board, Safety Guide on Design Basis Floods for Coastal Sites, AERB/SG/S-6B, Mumbai, India (2001)
65. Atomic Energy Regulatory Board, Draft Safety Guide on Single Failure Criterion, AERB/SG/D-2, Mumbai, India, Mumbai, India (1997)
66. Atomic Energy (Factories) Rules, India (1996)
67. Radiation Protection Rules, Revised (Under Review) (Draft No.13), Mumbai, India (1996)
68. Atomic Energy Regulatory Board, Safety Guide on Design Basis Ground Motion for Nuclear Power Plant Sites, AERB/SG/S-11, Mumbai, India (1990)
69. Atomic Energy Regulatory Board, Safety Guide on Role of Regulatory Body Concerning Emergency Response at Nuclear and Raiation Facilities, AERB/SG/G-5, Mumbai, India (1999)
70. Atomic Energy Regulatory Board, Safety Guide on Core Reactivity Control in Pressurised Heavy Water Reactors, AERB/SG/D-7, Mumbai, India (1999)
71. Atomic Energy Regulatory Board, Safety Guide on Regulations and Guides to be Prepared by the Regulatory Body for Nclear and Radiation Facilities, AERB/SG/G-6, Mumbai, India (2002)
72. Atomic Energy Regulatory Board, Safety Guide on Regulations and Criteria for Health and Safety of Nuclear Power Plant Peronnel, Public and Environment, AERB/SG/G-8, Mumbai, India (2000)
73. International Atomic Energy Agency, Safety Guide on Safety Related

- Instrumentation and Control System for Nuclear Power Plants, IAEA-50-SG-D8 (1984)
74. Atomic Energy Regulatory Board, Draft Safety Guide on Safety Related Instrumentation and Control for PHWR based Nuclear Power Plants, AERB/SG/D-20, Mumbai, India (1997)
 75. Atomic Energy Regulatory Board, Safety Standard for Nuclear Safety Related Civil Engineering Structures, AERB/SS/CSE, Mumbai, India (2000)
 76. International Electrotechnical Commission, Nuclear Power Plants Instrumentation and Control Systems Important for Safety Classification, IEC/1226 (1993)
 77. Atomic Energy Regulatory Board, AERB Glossary Committee and Glossary Review Committee Formulated/Recommended Definitions, AERB/GC/GRC, Mumbai, India (2000)
 78. International Atomic Energy Agency, Working Material - Draft IAEA Safety Glossary (1998)
 79. American Concrete Institute, Code Requirements for Nuclear Safety-related Concrete Structures, ACI 349-85 (1985)
 80. Atomic Energy Regulatory Board, Code Committee for Civil and Structural Engineering Suggested Definitions, Mumbai, India (1998)
 81. American Society of Mechanical Engineers, ASME Boiler and Pressure Vessel Code, Section III, Rules for Construction of Nuclear Power Plant Components, Division 1 - NB (1998)
 82. Government of India, Indian Standard 383, India (1970)
 83. Atomic Energy Regulatory Board, Fire Safety Standards for Nuclear Installations, Mumbai, India (1997)
 84. Canadian Standards Association, CAN/CSA/N-285.4-94 (1994)
 85. International Atomic Energy Agency, Regulations for the Safe Transport of Radioactive Materials, IAEA/SS-6 (1990)
 86. International Electrotechnical Commission, Medical Radiology Terminology, IEC-788 (1984)

87. Atomic Energy Regulatory Board, AERB Safety Guide on Radiological Safety in Enclosed Radiography Installations AERB/SG/IN-1, Mumbai, India (1986)
88. Atomic Energy Regulatory Board, NAPS TG Incident Review - Task Group Recommendations, Mumbai, India (1994)
89. International Atomic Energy Agency, Regulations for the Safe Transport of Radioactive Materials, IAEA/ST-1(1996)
90. Atomic Energy Regulatory Board, Safety Code for the Transport of Radioactive Materials, AERB/SC/TR-1, Mumbai, India (1986)
91. Atomic Energy Regulatory Board, Draft AERB Glossary on Radiological Protection prepared by Shri. A. Nagaratnam Committee, Mumbai, India (1994)
92. US Army Coastal Engineering Research Centre, Department of the Army Corps of Engineers, Sore Protection Manual, Vol. I, II & III (1977)
93. American National Standards Institute (ANSI), Standard on Pressure and Temperature Transient Analysis for LWR Containment ANSI/ANS-56.4 (1983)
94. American National Standards Institute (ANSI), Standard on Containment System Leakage Testing Requirements;ANSI/ANS-56.8 (1983)
95. International Atomic Energy Agency, IAEA Safety Guide on Quality Assurance in the Design of Nuclear Power Plants, SS No. 50-SG-QA6 (1981)
96. International Atomic Energy Agency, IAEA Safety Glossary: Terminology used in Radiation Protection and in Nuclear, radiation, Waste and Transport Safety; Version 0.9 (22 November 1999)
97. Atomic Energy Regulatory Board, Draft Safety Guide on Safety Critical Systems, AERB/SG/D-10, Mumbai, India (1997)
98. Atomic Energy Regulatory Board, AERB Draft Safety Guide on Fuel Machine and Controls, AERB/SG/D-24, Mumbai, India (1998)
99. Atomic Energy Regulatory Board, AERB Draft Safety Guide on Hydrogen Mitigation Aspects for PHWRs, AERB/SG/D-19, Mumbai, India (1998)
100. International Atomic Energy Agency, IAEA Design Safety Guide for Nuclear Power Plants 50-C-D (revised) (1999)
101. American National Standards Institute (ANSI), Standard on Pressure and Temperature Transient Analysis for LWR Containment; ANSI/ANS-56.8 (1984)

102. The Institute of Electrical and Electronics Engineers, Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations, IEEE 308 (1991)
103. Atomic Energy Regulatory Board, Safety Guide on Design Basis Events for Pressurised Heavy Water Reactor, AERB/SG/D-5, Mumbai, India (2000)
104. Atomic Energy Regulatory Board, Safety Guide on Control of Airborne Radioactive Materials, AERB/SG/D-14, Mumbai, India (2001)
105. Atomic Energy Regulatory Board, Safety Guide on Electrical System Design, AERB/SG/D-11, Mumbai, India (2001)
106. Atomic Energy Regulatory Board, Draft Guide on Containment System Design, AERB/SG/D-21, Mumbai, India (1999)
107. The Institute of Electrical and Electronics Engineers, IEEE Standard for Preferred Power Supply for Nuclear Power Generating Stations, IEEE 765 (1995)
108. International Atomic Energy Agency, Safety Aspects of Station Blackout at Nuclear Power Plants, IAEA-TECDOC-332 (1985)
109. The Institute of Electrical and Electronics Engineers, Application and Testing of Uninterruptible Parts for Class 1E Equipment in Nuclear Power Generating Stations, IEEE 944 (1986)
110. Atomic Energy Regulatory Board, Safety Code for Telegamma Therapy Equipment and Installations, AERB/SC/MED-1, Mumbai, India (1987)
111. Government of India, Atomic Energy Commission, Atomic Energy Act and Associated Rules, Mumbai, India(1962)
112. Atomic Energy Regulatory Board, Safety Code for Brachytherapy Sources, Equipment and Installations, AERB/SC/MED-3, Mumbai, India (1987)
113. Atomic Energy Regulatory Board, Safety Code for Medical Diagnostic X-Ray Equipment and Installations, AERB/SC/MED-2, Mumbai, India (1990)
114. Atomic Energy Regulatory Board, ACCGORN Committee Suggested Definition of Terms, Mumbai, India (1999)
115. Course on Environmental Management, Administrative Staff College of India (1996)
116. Government of India, Factories Act, India (1948)
117. Government of India, Manufacture, Storage and Import of Hazardous Chemicals Rules, India(1989)

118. European Vocabulary Standards, Quality Management and Quality Assurance, ISO-8402 (1994)
119. International Atomic Energy Agency, Safety Guide on Protection Against Internally Generated Missiles and their Secondary Effects in Nuclear Power Plants, IAEA/SG/D4 (1980)
120. International Atomic Energy Agency, IAEA Safety Glossary (2000)
121. Atomic Energy Regulatory Board, Working Group (AERB/WG/O-15) Suggested Definitions, AERB/WG/O-15, Mumbai, India (2002)
122. US Nuclear Regulatory Commission, Regulatory Guide on Procedures for Treating Common Cause Failures in Safety and Reliability studies, NUREG/CR/4780, Final report (1988)
123. US Nuclear Regulatory Commission, Regulatory Guide on Procedure for Analysis of Common Cause Failures in Probabilistic Safety Assessment, NUREG/CR/5801, SAND91-7087, RG, USNRC (1993)
124. France, Reliability, Availability, Maintainability and Safety Assessment, Vol. 2, Alian Villemeur, John Wiley and Sons, PP. 687-715, France (1992)
125. Human Reliability Analysis, Training Seminar Course Documentation by A.D.Swain (November, 1991)
126. New York, Statistical Analysis with Business and Economic Applications, Yalon Chou, New York (1968)
127. RISØ National Laboratory, Denmark, Taxonomy for Describing Human Malfunctioning Industrial Installation, RISØ-M-2034 by Rasmussen J, Human Errors, Denmark (August, 1981)
128. New York, Human Reliability Analysis: A System Engineering Approach with Nuclear Power Plant Applications, by Daugherty. E. M. and J. R. Fragola, Wiley, New York (1988)
129. International Electrochemical Commission, IEC 880, 2nd IEEE Software Engineering Standards Symposium, Feedback of Experience and Guidelines for Future Work (August 21-25, 1995)
130. International Atomic Energy Agency, Procedures for Conducting Probabilistic Safety Assessments of Nuclear Power Plants (Level 2), IAEA-50 P-8 (1995)

131. International Atomic Energy Agency, International Nuclear Events Scale Handbook, Vienna (1990)
132. US Nuclear Regulatory Commission, Probabilistic Risk Assessment Procedures Guides, A Guide to the Performance of Probabilistic Risk Assessments for Nuclear Power Plants, Vol. 1, NUREG/CR-2300-V1 (1983)
133. International Atomic Energy Agency, Procedures for Conducting Probabilistic Safety Assessments of Nuclear Power Plants (Level 1), IAEA-50 P4 (1992)
134. International Atomic Energy Agency, Waste Management Glossary, IAEA-TECDOC-264(1982)
135. International Atomic Energy Agency, Management of Radioactive Wastes from Nuclear Power Plants, IAEA SS-69 (1985)
136. Atomic Energy Regulatory Board, Draft Safety Guide on “Computer Based Systems”, AERB/SG/D-25, Mumbai, India (1998)
137. Atomic Energy Regulatory Board, Draft Safety Guide on “Environmental and Missile Effects”, AERB/SG/D-3, Mumbai, India (1997)
138. Atomic Energy Regulatory Board, Draft Safety Guide on “Safety Classification and Seismic Categorisation”, AERB/SG/D-1, Mumbai, India (1999)
139. Atomic Energy Regulatory Board, Safety Standard on “Design of Concrete Structures Important to Safety of Nuclear Facilities”, AERB/SS/CSE-1, Mumbai, India (2002)
140. Atomic Energy Regulatory Board, Safety Guidelines on “Preparation of Site Emergency Plans for Non-Nuclear Installations”, AERB/SG/EP-3, Mumbai, India (2000)
141. Atomic Energy Regulatory Board, Safety Code on “Nuclear Medicine Facilities”, AERB/SC/MED-4, Mumbai, India (1989)
142. Atomic Energy Regulatory Board, Draft Safety Guide on “Consenting Process for Radiation Facilities”, AERB/SG/G-3, Mumbai, India (2002)
143. Atomic Energy Regulatory Board, Standard Specifications for Radiological Safety in the Design, Construction and Use of Industrial Ionising Radiation Gauging Devices, AERB/SS-2(Rev-1), Mumbai, India (2001)
144. Atomic Energy Regulatory Board, Standard Specification for Testing and Classification of Sealed Radioactive Sources, AERB/SS-3(Rev-1), Mumbai, India (2001)

145. Atomic Energy Regulatory Board, Safety Guide on “Quality Assurance in the Design of Nuclear Power Plants”, AERB/SG/QA-1, Mumbai, India (2001)
146. Atomic Energy Regulatory Board, Draft Safety Guide on “Fuel Design”, AERB/SG/D-6, Mumbai, India (2002)
147. Atomic Energy Regulatory Board, Safety Guide on “LOCA Analysis Methods for Pressurised Heavy Water Reactors”, AERB/SG/D-18, Mumbai, India (2001)
148. Atomic Energy Regulatory Board, Draft Safety Standard on “Design, Fabrication and Erection of Embedded Parts and Penetrations Important to Safety of Nuclear Power Plants”, AERB/SS/CSE-4, Mumbai, India (2002)
149. Atomic Energy Regulatory Board, Safety Code for Industrial Radiography, AERB/SC/IR, Mumbai, India (2001)
150. International Atomic Energy Agency, The Physical Protection of Nuclear Material and Nuclear Facilities, INFCIRC/225/Rev. 4 (1999)
151. Sandia National Laboratories, Physical Protection System Design
152. Atomic Energy Regulatory Board, AERB Subcommittee on Security (2003)
153. Atomic Energy Regulatory Board, Draft Safety Guide AERB/SG/QA-7, Mumbai, India (2002)
154. Atomic Energy Regulatory Board, Draft Safety Codes on Radiotherapy Installations, Mumbai, India (2003)
155. Government of India, Indian Standard for Personal Eye Protection, IS-3: 5983 (1980)
156. International Standard ISO 3999-1, First Edition 2000-04-15. Radiation Protection Apparatus for Industrial Gamma Radiography, Part 1: Specifications for Performance, Design and Tests.
157. Suggested Glossary, which is modified by GRC

GLOSSARY COMMITTEE (GC)

Dates of meeting	:	September 15, 19 & 23, 1997,	December. 12, 1997
		January, 6 & 9, 1998	August. 25, 1998
		December. 21, 1998	May 13 & 21, 1999
		July 8, 1999	August. 31, 1999
		January 14, 2000	February 29, 2000
		March 21, 2000,	May 10, 2000
		June 30, 2000	July 10, 2000
		September 7, 2000	May 15, 2001
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(** Shri M.Sundaram had chaired the Committee till his demise in September' 1999).

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	September 21 & 31, 1998,	October 30 & November 3, 1998,
	November 26, 1998,	January 18, 1999,
	January 25, 1999,	March 16 & 17, 1999,
	July 17, 1999,	October 21, 1999,
	December 16, 1999,	April 16 & 17, 1999,
	June 21 & 22, 2000,	October 12 & 13, 2000.
	June 25 & July 2, 2001	August 10, 2001
	September 24, 2001	December 28, 2001
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Published by : Atomic Energy Regulatory Board
Niyamak Bhavan, Anushaktinagar
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