



GOVERNMENT OF INDIA

AERB SAFETY GLOSSARY

2022 Edition

GLOSSARY OF TERMS

FOR

**NUCLEAR AND RADIATION FACILITIES AND
ASSOCIATED ACTIVITIES**



ATOMIC ENERGY REGULATORY BOARD

AERB SAFETY GLOSSARY: AERB/GLO, Rev.1

GLOSSARY OF TERMS
FOR
NUCLEAR AND RADIATION FACILITIES AND
ASSOCIATED ACTIVITIES

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**This document is subject to review, after a period of one year from the
date of issue, based on the feedback received**

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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, safety standards, safety guides and associated safety manuals for both nuclear and radiation facilities, covering different stages of facilities such as siting, design, construction, operation, decommissioning and thematic areas such as quality assurance, radiation protection, radioactive waste management and regulation including transport of radioactive materials. In all these regulatory documents, a large number of scientific and technical terms are used which are applicable to various fields.

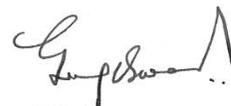
In order to avoid ambiguity in the definitions of these terms appearing in different regulatory documents, it was decided by AERB to bring out a normalized Glossary of terms applicable to nuclear and radiation safety.

The Safety Glossary is a compilation of terms used in various AERB regulatory safety documents for nuclear and radiation facilities. In drafting this document, extensive use has been made of the information available in national and international publications, including those of the International Atomic Energy Agency (IAEA).

AERB has undertaken review of the definitions in the Safety Glossary (AERB/SG/GLO, 2005) with the involvement of AERB officers. Subsequently, AERB reconstituted Glossary Review Committee (AERB-GRC) with a mandate to review all glossary definitions used in regulatory documents and updating them keeping in view of the latest international standards. Taking inputs from the earlier reviews and considering the latest version of IAEA safety glossary 2018, Waste Management Safety Glossary 2003 Edition and IAEA-SSR-6 2018 Edition (Transport of Radioactive Material), AERB-GRC has updated the existing definitions. During this process, the existing legal framework in India has also been taken into account and necessary changes are made keeping the intent of the original definitions. This Safety Glossary supersedes AERB/SG/GLO published in 2005).

In addition to the terms defined in this Safety 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 as 'Special Definitions'.

AERB acknowledges the contribution of all individuals who have prepared and reviewed the draft of this Safety Glossary and helped in its finalization.



(G. Nageswara Rao)
Chairman, AERB

DISCLAIMER

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. Since these regulatory documents are prepared over a long period of time, it is possible that 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 update the existing definitions in line with the latest version of IAEA safety glossary 2018, Waste Management Safety Glossary 2003 Edition and IAEA-SSR-6 2018 Edition (Transport of Radioactive Material).

The existing legal framework in India has been taken into account and necessary changes are made keeping the intent of the original definitions/interpretation of the existing Acts and Rules framed thereunder. The reference from where the original definition is taken is mentioned in square bracket at the end of definition along with 'M' (as applicable), indicating some modification in the original definition. Wherever, definition of a specific term or its interpretation is provided in more than one rules (e.g. Authorisation), appropriate modifications are made in the definition with explanatory note for clarity. The harmonised definitions are provided in the safety glossary for ease of explanation to the users, in the case of any discrepancies, legal interpretation about specific term, as given in relevant Acts and Rules, will be considered, as appropriate.

This safety glossary contains all terms, which are 'Generic' (i.e. applicable to more than one facility or activity and covers more than one subject area) and used in AERB regulatory documents. The specific definitions, applicable to particular thematic area, facility or activity is covered as 'special definitions' in particular REGDOC.

GLOSSARY

A1 (Transport of Radioactive Materials)

The activity value of special form radioactive material that is listed in Table 2 or derived in Section IV of IAEA SSR-6 and is used to determine the activity limits for the requirements of the IAEA Transport Regulations (SSR-6). [1]

A2 (Transport of Radioactive Materials)

Maximum activity of radioactive material, other than special form radioactive material that is permitted to be transported in a Type A package. [1M]

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). [1]

Acceptable Limits

Limits acceptable to the regulatory body on the predicted radiological consequences of an accident (or on potential exposure if they occur). [1M]

Accelerator

A device in which, charged particles are accelerated. Conventional X-ray tube is not considered as an accelerator. [2]

Acceptance Criteria

Specified bounds on the value of a functional indicator or condition indicator used to assess the ability of a structure, system or component to perform its design function. [1]

Accident

Any unintended event, including operating errors, equipment failures and other mishaps, the consequences or potential consequences of which are not negligible from the point of view of protection or safety. [1]

Accident Conditions

Deviations from normal operation which are less frequent and more severe than anticipated operational occurrences, and which include design basis accidents and design extension conditions. [1M]

Accident management

The taking of a set of actions during the evolution of an accident:

- (a) To prevent escalation to a severe accident;
- (b) To mitigate the consequences of a severe accident;
- (c) To achieve a long term safe stable state. [1]

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

Event tree developed for accident sequence analysis in Level 2 PSA with containment systems and physical phenomena within containment as function events for various plant damage states. [3M]

Activation

The process of inducing radioactivity (intentional or unintentional) in matter by irradiation of that matter. [1M]

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. [1M]

Activity

The average number of spontaneous nuclear transformations taking place per unit time in a radioactive substance or material.

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

$$A(t) = - (dN/dt)$$

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). 1 Bq = 1 nuclear transformation per second. [1M]

Activity Median Aerodynamic Diameter (AMAD)

The value of aerodynamic diameter such that 50% of the airborne activity in a specified aerosol is associated with particles smaller than the AMAD, and 50% of the activity is associated with particles larger than the AMAD. [4]

Additional Safety Features

The design features that are introduced to perform a safety function in DEC-A. [38]

Adequate Protection

Protection against radiation so provided that the prescribed limits on levels of radiation or contamination in the defined area are not exceeded. [6M]

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. [7M]

Adolescent

It shall have the same meaning as assigned to it in section 2 of Factories Act, 1948.

Adult

It shall have the same meaning as assigned to it in section 2 of Factories Act, 1948.

Aerodynamic Diameter

The aerodynamic diameter of an airborne particle is the diameter that a sphere of unit density would need to have in order to have the same terminal velocity when settling in air as the particle of interest. [4]

Ageing

General process in which characteristics of structures, systems or component gradually change with time or use. [1]

Ageing Management

The engineering, operations and maintenance actions to control ageing degradation of systems, structures or components within acceptable limits. [1]

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. [7]

Air Kerma

Under charged particle equilibrium conditions, the air kerma (in gray) is numerically approximately equal to the absorbed dose in air (in gray). [1]

ALARA

An acronym for 'As Low As Reasonably Achievable'. A principle of radiation protection that ensures that exposures to radiation are optimized taking account of socioeconomic considerations and state of the technology. [1M]

Alpha-bearing Waste

Waste containing one or more alpha-emitting radionuclides. Alpha bearing waste can be long lived or short lived. [8]

Ambient Dose Equivalent

The dose equivalent that would be produced by the corresponding aligned and expanded field in the ICRU sphere at a depth d on the radius vector opposing the direction of the aligned field. The recommended value of d for strongly penetrating radiation is 10 mm. [1]

Analysis

A process and result of a study, using a specific technique, aimed at understanding the subject under consideration. [1M]

Anchor

A structural member embedded in the concrete or attachment to other structures to which a liner, embedment, or surface mounted item is attached. [9]

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. [7]

Anchor Head

A nut, flat washer, plate, stud or bolt head used to transmit loads from the stress component to the supporting structure by bearing. [9]

Annual Limit on Intake (ALI)

The intake of a given radionuclide in a year by the reference individual by inhalation, ingestion or through the skin, which would result in a committed effective dose equal to the relevant dose limit. The ALI is expressed in units of activity. [1]

Anomaly

Deviations from normal operating conditions which could be due to equipment failure, human error or procedural inadequacies and may exceed authorised operational limits and conditions but not involving significant failures in safety provisions, significant spread of contamination or overexposure of workers. [10M]

Anticipated Operational Occurrence

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. [1M]

Anticipated Transient without Scram (ATWS)

For a nuclear reactor, an accident for which the initiating event is an anticipated operational occurrence and in which the fast shutdown system of the reactor fails to function. [1]

Appeal

Request to the appellate authority against any decision of the regulatory body. [11M]

Applicant¹

An 'employer' or a 'person' authorised by employer under Atomic Energy (Radiation Protection) Rules, 2004, or 'Occupier' under Factory Rules, 1996, or 'applicant' under Atomic Energy (Safe Disposal of Radioactive Wastes) Rules, 1987 who applies to the competent authority for obtaining, 'License', 'Authorisation', 'Registration' 'Consent or 'Approval' as appropriate, to undertake any activity for which Regulatory instrument (Licence/Authorisation/Registration/Consent/Approval) is required. [12M]

Approval²

See Licence

Aquifer

A water-bearing formation (bed or stratum) of permeable rock, sand and gravel capable of yielding significant quantities of water. [13]

Arrangements³

The integrated set of infrastructural elements necessary to provide the capability for performing a specified function or task required to carry out a specified operation. [1]

Assessment⁴

The process, and the result, of analysing systematically and evaluating the arrangements and activities and making judgments for acceptability or rejection against pre-defined criteria. [1M]

Atomic Energy Regulatory Board (AERB)

The 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. [11]

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. [14M]

¹As a pre-requisite, the person is required to obtain Licence under section 14 of the Atomic Energy Act 1962 from the Central Government, as applicable.

²The term 'Approval' is also used in regulatory process in the context of 'regulatory acceptance' of dose budget proposal, approval of Technical Specification for Operation, approval of Radiation Safety Officer etc. It is to be distinguished from the term 'Approval' used as a 'regulatory instrument'.

³ The infrastructural elements may include authorities and responsibilities, organization, coordination, personnel, plans, procedures, facilities, equipment or training.

⁴Various kinds of analysis may be used as tools in doing this. Hence an assessment may include a number of analyses.

Attenuation

The reduction in intensity of radiation passing through matter due to processes like absorption and scattering. [1]

Atomic energy

Energy released from atomic nuclei as a result of any process, including the fission and fusion processes. [6]

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 [28]

Authorisation⁵

A type of regulatory instrument issued by the regulatory body for:

- i. all sources, practices and uses involving radioactive materials and radiation-generating equipment and
- ii. disposal or transfer of radioactive waste [15M]

Authorised Limits

A limit on a measurable quantity, established or formally accepted by a regulatory body. [16M]

Authorised person⁶

A person authorised by the competent authority for disposal of radioactive waste in accordance with the provisions of Atomic Energy (Safe Disposal of Radioactive Waste) Rules, 1987. [98M]

Availability

The ability of an item or a system to be in a state to perform a required function under given conditions at a given instant of time or over a given time interval, given that the necessary external resources are provided. [1M]

Averted dose

The dose prevented by protective actions. [1]

Basic Event

An event in a fault tree model that requires no further development, because the appropriate limit of resolution has been reached. [17]

Beam Limiting Device

Shielding device located at the working position designed to reduce the radiation dose rate in directions other than the directions intended for use. [18]

Becquerel

See "activity"

⁵ The 'Authorisation', in the form of 'Licence' is issued in conformity with the Atomic Energy (Radiation Protection) Rules, 2004.

The 'Authorisation' is also issued in conformity with Atomic Energy (Safe Disposal of Radioactive Waste) Rules, 1987 also.

⁶The person to whom an 'Authorisation' is issued can be termed as 'Licensee' as well as 'Authorised Person'. As per AE (RP) Rules, roles and responsibilities are defined for Licensee, which may not be applicable in-toto to 'Authorised Person'.

Betatron

An electron accelerator in which electrons are accelerated in an increasing magnetic field maintaining a stable orbit of electrons. [67]

Bio-assay

Any procedure used to determine the nature, activity, location or retention of radionuclides in the body by direct (in vivo) measurement or by in vitro analysis of material excreted or otherwise removed from the body. [1]

Brachytherapy

That branch of radiation therapy which relates to the uses of sealed sources (a) for 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. ³²P coated stents and ¹⁹²Ir wires may not comply with all the regulatory requirements for sealed sources. [19]

Burnable absorber

For a nuclear reactor, an accident for which the initiating event is an anticipated operational occurrence and in which the fast shutdown system of the reactor fails to function. [1]

Calibration

A set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by measurement standards. [1]

Capacity (Source Housing)

The maximum activity in Becquerel specified for a given radionuclide that shall not exceed in a source housing or a source changer. [21]

Cargo Aircraft

Any aircraft, other than a passenger aircraft, which is carrying goods or property. [1]

Carrier

Any person, organization or government undertaking the carriage of radioactive material by any means of transport. The term includes both carriers for hire or reward (known as common or contract carriers) and carriers on own account (known as private carriers) [22].

Certification (of personnel)

The formal process of certifying personnel by an authority for performing the various activities in nuclear and radiation facilities. [28]

Certifying Surgeon

The medical officer of the factory concerned with requisite qualifications and approvals. [71M]

Channel (Coolant)

The primary heat-transport coolant tube and accessories through which the reactor coolant flows in a reactor. [24]

Channel (Instrumentation)

An arrangement of interconnected components within a system that initiates an output. [24]

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. [25]

Child

A person who has not completed his fifteenth year of age. [71]

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. [26M]

Classification (Radioactive Waste)

Determination of the physical, chemical and radiological properties of the waste to establish the need for further adjustment, treatment, conditioning, or its suitability for further handling, processing, storage or disposal. [8]

Classified worker

The radiation worker, who is likely to receive an effective dose in excess of three-tenths of the average annual dose limits notified by the competent authority. [50]

Clearance⁷

The process of removal of the regulatory control from the radioactive material or radioactive substance within the licensed facilities or activities. [1]

Clearance level

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. [1M]

Cliff edge effect

An instance of severely abnormal conditions caused by an abrupt transition from one status of a facility to another following a small deviation in a parameter or a small variation in an input value. [1]

Closure

Administrative and technical actions directed at a disposal facility or a mine at the end of its operating lifetime — for example, covering of the disposed waste (for a near surface disposal facility) or backfilling and/or sealing (for a geological disposal facility and the passages leading to it) — and the termination and completion of activities in any associated structures. [1]

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

A number assigned to a package, overpack or freight container containing fissile material that is used to provide control over the accumulation of packages, overpacks or freight containers containing fissile material. [1]

Coarse Aggregate

Aggregate most of which is retained on 4.75 mm IS Sieve and containing only so much finer material as is permitted for the various types described in Indian Standard-383 (2016). [27]

⁷ The phrase 'Release from Regulatory Control' is used for removal of regulatory control from the premises or sites. Clearance Levels

Cold Shutdown (Reactor)

Reactor state in which the temperature of the primary heat transport system at core inlet is less than the specified value. [28M]

Collective Dose

The total radiation dose incurred by a population over the time period or during the operation being considered. [1M]

Collimator or Field Limiting Diaphragm

A device used for limiting the size and shape of the primary radiation beam. [21]

Collimator Zone

The portion of the source/tube-housing of radiotherapy/radio-diagnostic equipment, which includes the mechanism for defining the useful beam. [19M]

Combustible Liquid

A liquid that has a closed-cup flash point at or above 37.8°C. [59]

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. [29]

Commencement of Operation (NPPs)

The specific activity/activities in the commissioning phase of a nuclear power plant towards first approach to criticality, starting from fuel loading. [16]

Commissioning

The process by means of which systems and components of nuclear and radiation facilities, having been constructed, are made operational and verified to be in accordance with the design intent and to have met the required performance criteria. [1M]

Committed Effective Dose, E (τ)

The lifetime effective dose expected from an intake of a radionuclide.
The committed effective dose, quantity E(τ), defined as:

$$E(\tau) = \sum^{E(\tau)} W_T \cdot H_T(\tau)$$

Where $H_T(\tau)$ is the committed equivalent dose to tissue or organ T over the integration time τ elapsed after an intake of radioactive substances and W_T is the tissue weighting factor for tissue or organ T. Where τ is not specified, it will be taken to be 50 years for adults and the time to the age of 70 years for intakes by children. [1]

Committed Equivalent Dose, $H_T(\tau)$

The committed equivalent dose, quantity ' $H_T(\tau)$ ' is defined as

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

where 't₀' is the time of intake, 'H_τ(t) dt' is the equivalent dose rate at time t in tissue or organ T and τ is the integration time elapsed after an intake of radioactive substances. Where τ is not specified, it is taken to be 50 years for adults and the time to the age of 70 years for intakes by children. [1]

Common Cause Failure (CCF)

Failure of two or more structures, systems, components or equipment due to a single specific event or cause. [1]

Common Mode Failure (CMF)

Failure of two or more structures, systems, components or equipment in the same manner or mode due to a single event or cause. [1]

Competent Authority

Any officer or authority as referred in section 27 of Atomic Energy Act, 1962 and designated by notification in official gazette as competent authority, for the purpose of the rules framed under the Atomic Energy Act, 1962. [6M]

Competent Person

A person, who is having the degree in the discipline mentioned or equivalent, followed by experience as specified in Rule 31 of Atomic Energy (Factories) Rules, 1996, in responsible position in the field and designated by the competent authority. [71M]

Compliance Assurance (Transport of Radioactive Material)

A systematic programme of measures applied by a regulatory body that is aimed at ensuring that the provisions of regulations are met in practice. [1]

Component

The discrete element of a system necessary and sufficient to consider for system analysis. [30]

Complementary Safety Features

The design features that are introduced to cope with DEC-B. [38]

Computed Tomography (CT)

A diagnostic imaging procedure that uses a combination of special X-ray equipment and computer technology to produce cross-sectional images of the body. [28]

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. [31]

Conditioning of Radioactive Waste

The processes that transform waste into a form suitable for handling, 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, if necessary. [1M]

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 operational states and accident states'. [32M] (see "Containment Structure" also)

Confinement System (Transport of Radioactive Material)

The assembly of fissile material and packaging components specified by the designer and agreed to by the competent authority as intended to preserve criticality safety. [1]

Configuration management

The process of identifying and documenting the characteristics of structures, systems and components (including computer systems and software), and of ensuring that changes to these characteristics are properly developed, assessed, approved, issued, implemented, verified, recorded and incorporated into the facility records and submissions to the regulatory body. [1]

Consent

See Licence

Consentee

See Licensee

Consignee

Any person, organization or government that is entitled to take delivery of a consignment. [1]

Consignment

Any package or packages, or load of radioactive material, presented by a consignor for transport. [1]

Consignor

Any person, organisation or government that prepares a consignment for transport, and is named as consignor in the transport documents. [23]

Construction

The process of manufacturing 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. [1M]

Containment Energy Management

It is a term used to describe the management of those design features of the containment that affect the energy balance within the containment and thereby play a part in maintaining pressure and temperature within acceptable limits. The elements for energy management used in water cooled reactors of extant and new designs are as follows:

- a) Inherent energy management features (e.g. the free volume of the containment and structural heat sinks
- b) Spray systems
- c) Air cooler systems
- d) Suppression pool systems
- e) Ice condenser systems
- f) Vacuum pressure reduction systems
- g) External recirculation cooling systems
- h) Passive containment cooling systems [35]

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. [28]

Containment Penetrations

Openings in the containment envelope for passage of personnel, materials, process piping, ducts and cables. [36M]

Containment Structure

The structure enveloping the reactor and associated SSCs that acts as a physical barrier to

prevent or limit the release of radioactive materials to the environment, provide shielding and also protects the reactor and associated SSCs from external effects. It includes containment structure and its access openings, penetrations and those systems or portions thereof, which are connected to the containment atmosphere (See "Primary Containment"/ "Secondary Containment"/ "Confinement"). [34M]

Containment System (Transport of Radioactive Material)

The assembly of components of the packaging specified by the designer as intended to retain the radioactive material during transport. [1]

Contamination

The presence of a radioactive substance in or on a material or in the human body or other place in excess of quantities specified by the competent authority. [15M]

Contamination (Transport of Radioactive Material)

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. [23]

Control System

A system performing actions needed for maintaining plant/ equipment variables within prescribed limits. [37]

Controlled Area

A defined area in which specific protection measures and safety provisions are or could be required for controlling exposures or preventing the spread of contamination in normal working conditions, and preventing or limiting the extent of potential exposures. [1]

Controlled State

This is a state of the plant, following an anticipated operational occurrence or accident condition, in which the fundamental safety functions can be ensured and can be maintained for a time sufficient to implement provisions to reach a safe state/safe shutdown state. [5]

Conveyance

- (a) For transport by road or rail: any vehicle;
- (b) For transport by water: any vessel, or any hold, compartment, or defined deck area of a vessel;
- (c) For transport by air: any aircraft. [1]

Core Components

The elements of a reactor core, other than fuel assemblies, that are used to provide structural support of the core construction, or the tools, devices or other items that are inserted into the reactor core for monitoring, flow control or other technological purposes and are treated as core elements. [1]

Core Damage (FBR)

Severe overstressing/overheating of the reactor core or its components to the extent that it leads to loss of structural integrity of clad⁸, a large fraction of fuel melt or their combination occurs. [38]

Core Damage (LWR)

Uncovery and heat up of the reactor core, due to loss of core cooling leading to loss of coolable geometry involving large fraction of the core/fuel melt. [38]

⁸Structural failure of more than one Fuel Assemblies

Core Damage (PHWR)

Extensive physical damage due to overheating of reactor core or its components leading to loss of core structural integrity⁹. Core Damage may include core/fuel melt. [38]

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. [26M]

Core Melt

Reactor state involving melting of the reactor fuel and core internal structures. [38]

Corrective Maintenance

Actions that restore, by repair, overhaul or replacement, the capability of a failed structure, system or component to function within acceptance criteria. [1]

Countermeasures

An action aimed at alleviating or mitigating the consequences of accidental release of radioactive material into the environment. [28]

Criteria

Principles or standards on which a decision or judgment can be based. They may be quantitative or qualitative. [8]

Critical Component

Component, whose failure, in a given operating state of the system, results in the system failure. [39]

Critical Group

A group of members of the public which is reasonably homogeneous with respect to its exposure for a given radiation source and is typical of individuals receiving the highest effective dose or equivalent dose (as applicable) from the given source. [1]

Critical Nuclides

Nuclide(s) that contributes to a major fraction of effective (equivalent) dose to the critical group of population. [40]

Critical Pathway

The dominant environmental route by which members of the critical group are exposed to radiation. For example, the critical pathway for iodine discharged with gaseous effluents is from pasture to cows and then to milk. Consumption of the milk by individuals gives rise to exposure to radiation. [8]

Critical Target

Component/System which when affected by a PIE causes Primary or Secondary effects which may lead to unacceptable consequences.

- Damage caused directly by the PIE is called Primary Effect.
- Damage caused indirectly by means of failure mechanisms that can propagate the damage is termed a Secondary Effect. [41M]

⁹Structural failure of more than one fuel channel

Criticality

The state of a nuclear chain reacting medium when the chain reaction is just self-sustaining (or critical), i.e. when the reactivity is zero. [1]

Cyclotron

A device in which charged particles (other than electrons) travel in a succession of semi-circular 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. [2]

Decay Heat

The heat produced by the decay of radioactive nuclides. [28]

Decommissioning

The process by which the use of radiation equipment or installation is discontinued on a permanent basis, with or without dismantling the equipment, including removal or containment of radioactive materials. [15M]

Decontamination

The complete or partial removal of contamination by a deliberate physical, chemical or biological process. [1]

Decontamination Factor

The ratio of the activity per unit area (or per unit mass or volume) before a particular decontamination technique is applied to the activity per unit area (or per unit mass or volume) after application of the technique. [1]

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. [1]

Deep Water

Water of a depth greater than $L/2$, where 'L' is the wavelength of the surface wave under consideration. [44]

Defence-in-Depth

A hierarchical deployment of different levels of diverse equipment and procedures to prevent the escalation of anticipated operational occurrences and to maintain the effectiveness of physical barriers placed between a radiation source or radioactive material and workers, members of the public or the environment, in operational states and, for some barriers, in accident conditions. [1]

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. [1]

Deflagration

The chemical reaction of a substance, involving vigorous burning with emission of large heat and intense light, in which the reaction front advances into the unreacted substance at less than sonic velocity. [28M]

Degree of Occupancy

A typical fraction of the time for which a location is occupied by an individual or group. [1]

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. [29]

Derived Air Concentration (DAC)

That activity concentration of the radionuclide in air (Bq/m^3) which, if breathed by reference individual 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 one annual limit on intake. [28M]

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. [28]

Derived Limits

A limit on a measurable quantity set, on the basis of a model, such that compliance with the derived limit may be assumed to ensure compliance with a primary limit. [1]

Design

The process and results of developing the concept, detailed plans, supporting calculations and specifications for a nuclear or radiation facility. [11]

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. [1]

Design Authority

The defined function of a licensee's organisation with requisite knowledge and with responsibility for maintaining the design integrity and the overall basis for safety of its nuclear facilities throughout the full lifecycle of those facilities. Design authority relates to the attributes of an organisation rather than the capabilities of individual post holders. [5]

Design Basis Accidents (DBAs)

A set of postulated accidents leading to accident conditions for which a facility is designed in accordance with established design criteria and conservative methodology, and for which releases of radioactive material are kept within acceptable limits. [1]

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"). [45M]

Design Basis External Events (DBEEs)

The external event(s) or combination(s) of external events considered in the design basis of all or any part of a facility. [1]

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. [29]

Design Basis Flood

The flood selected for deriving a design basis for a nuclear facility. [46]

Design Basis Ground Motion (DBGM)

The ground motion parameter values associated with postulated earthquake considered for the purpose of the design of a facility from safety consideration. [47M]

Design Basis Storm

The storm selected for deriving design basis for a nuclear facility. [44]

Design Conditions

The service conditions used as the basis for ratings or design qualification of structures, systems, components or any other item. [28]

Design Extension Conditions

Accident conditions, beyond design basis, but that are considered in the design process of the facility in accordance with best estimate methodology, and for which releases of radioactive material are kept within acceptable limits. [38]

Design Extension Conditions – A¹⁰ (Without Core Damage / Without Core Melt)

Accident conditions, beyond design basis, in which significant core damage does not occur, though significant fuel¹¹ degradation is expected but the geometry that allows for adequate fuel cooling is maintained and reactor core is in long term sub-critical state. [38]

Design Extension Conditions – B¹² (With Core Damage/ With Core Melt)

Accident conditions, beyond design basis, in which significant core degradation, involving melting of reactor core structures and reactor fuel, is expected. [38]

Design Extension Condition-Power Source (DEC-PS)

Power Source reserved for supplying power to the plant when there is total loss of power in all the emergency electric power supply systems during station blackout and also during other design extension conditions (DECs). [57]

Design Life

The period of time during which a facility or component is expected to perform satisfactorily according to the design specifications. [1]

Design Limits

Limits on the design parameters within which the design of the structures, systems, equipment and components of a nuclear facility have been shown to be safe. [45]

Deterministic Analysis

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

Deterministic Effects

A health effect of radiation for which generally a threshold level of dose exists, above which the severity of the effect is greater for a higher dose. [1]

¹⁰ ‘without Core Damage’ to be used for PHWRs and ‘without Core melt’ to be used for LWRs/FBRs

¹¹ Fuel stored in fuel pool as well as fuel within reactor core shall be considered

¹² ‘with Core Damage’ to be used for PHWRs and ‘with Core melt’ to be used for LWRs/FBRs

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. [37]

Detonation

An extremely rapid chemical reaction resulting into release of energy due to combustion of a substance, in which the reaction front advances into un-reacted substance at greater than sonic velocity. [28M]

Discharge (Radioactive)

Planned and controlled release of (gaseous or liquid) radioactive material into the environment from nuclear/ radiation facilities. [1]

Discharge Limits

The limits prescribed by the regulatory body for effluent discharges into atmosphere/aquatic environment from nuclear/radiation facilities. [50]

Disposal (Radioactive Waste)

Emplacement of waste in an appropriate facility without the intention of retrieval. [1]

Disposition (QA)

An act to determine how a departure from a specified requirement is to be handled or settled. [51]

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. [52]

Disused source

A radioactive source that is no longer used, and is not intended to be used, for the practice for which licence has been granted. [1M]

Diversity

The presence of two or more redundant systems or components to perform an identified function, where the different systems or components have different attributes so as to reduce the possibility of common cause failure, including common mode failure. [1M]

Document

Recorded or pictorial information describing, defining, specifying, reporting or certifying activities, requirements, procedures or results. [51]

Documentation

See "document"

Document Control

The act of assuring that documents are reviewed for adequacy, approved for release by authorised personnel and distributed to and used at the location where the prescribed activity is performed. [51]

Dose

A measure of the energy deposited by radiation in 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. [1M]

Dose Constraint

A prospective and source-related restriction on the individual dose from a source, which provides a basic level of protection for the most highly exposed individuals and serves as an upper bound on the dose in optimization of protection for that source. For occupational exposures, the dose constraint is a value of individual dose used to limit the range of options considered in the process of optimization. For public exposure, the dose constraint is an upper bound on the annual doses that members of the public may receive from the planned operation of any controlled source. For medical exposure the dose constraint level should be interpreted as a guidance level, except when used in optimizing the protection of persons, other than workers, who assist in the care, support or comfort of exposed patients. [53M]

Dose Limit

The value of the effective dose or the equivalent dose to individuals in planned exposure situations that is not to be exceeded. [1]

Dosimetry

A system adopted to measure the absorbed dose in the irradiated volume. Dosimetry is used for both on person and on the product. [43M]

Dummy Sealed Source

Facsimile of a sealed source, the capsule of which has the same construction and is made of exactly the same materials as those of the sealed source it represents but containing, in place of the radioactive material, a substance resembling it as closely as is practical in physical and chemical properties. [89]

Early Protective Action

See "Protective Action"

Effective Dose, E

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'. [1]

Effluent

Gaseous or liquid radioactive materials which are discharged to the environment from a facility. [1]

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. [57]

Electrical Separation

Means for preventing one electric circuit from influencing another through electrical phenomena. [57]

Embedment

The embedment is that portion of the component in contact with the concrete or grout used to transmit applied loads to the concrete structure through direct bond or other anchors. The embedment may be fabricated lugs, bolts, plates, reinforcing bars, shear connectors, expansion anchors, inserts or any combination thereof. [49]

Embedded Parts (EPs)

Any structural member, plate, angle, channel, pipe sleeve, penetrations or other section anchored to a concrete structure through a direct bond or other anchors. (See "Embedment") [47M]

Emergency

A non-routine situation or event that necessitates prompt action, primarily to mitigate a hazard or adverse consequences for human life, health, property and the environment. This includes nuclear and radiological emergencies and conventional emergencies such as fires, releases of hazardous chemicals, storms, tsunamis or earthquakes. It includes situations for which prompt action is warranted to mitigate the effects of a perceived hazard. [1]

Emergency Action Level (EAL)

A specific, predetermined criterion for observable conditions used to detect, recognize and determine the emergency class. [1]

Emergency Alert

Declared abnormal condition with the possibility of leading to plant/site/off-site emergency. [56]

Emergency Electric Power System

That portion of electrical power system provided for supplying electric power to safety-related and safety systems of an NPP during its operational states as well as during accident conditions. [57]

Emergency Exercise

A test of an emergency plan with particular emphasis on the co-ordination 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. [54]

Emergency Exposure Situation

A situation of exposure that arises as a result of an accident, a malicious act or other unexpected event, and requires prompt action in order to avoid or to reduce adverse consequences. [1]

Emergency Plan

A description of the objectives, policy and concept of operations for the response to an emergency and of the structure, authorities and responsibilities for a systematic, coordinated and effective response. The emergency plan serves as the basis for the development of other plans, procedures and checklists. [54]

Emergency Planning Zones (EPZ)

Areas around the plant, 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. [1]

Precautionary Action Zone (PAZ)

An area around a facility for which arrangements have been made to take precautionary urgent protective actions in the event of a nuclear or radiological emergency to prevent or reduce the risk of severe deterministic effects in public domain. Protective actions within this area are to be taken before or shortly after a release of radioactive material or an exposure on the basis of the prevailing conditions at the facility.

Urgent Protective Action Planning Zone (UPZ)

An area around a facility for which arrangements have been made to take urgent protective actions in the event of a nuclear or radiological emergency to avert doses in public domain in accordance with international safety standards. Protective actions within this area are to be taken on the basis of environmental monitoring or, as appropriate, prevailing conditions at the facility.

Emergency Preparedness

The capability to take actions that will effectively mitigate the consequences of an emergency for human health and safety, quality of life, property and the environment. [54]

Emergency Procedures

A set of instructions describing in detail the actions to be taken by emergency workers in an emergency. [54]

Emergency Response

The performance of actions to mitigate the consequences of an emergency for human life, health, property and the environment. [1]

Emergency Response arrangements

The integrated set of infrastructural elements necessary to provide the capability for performing a specified function or task required in response to a nuclear or radiation emergency. These elements may include authorities and responsibilities, organization, coordination, personnel, plans, procedures, facilities, equipment, training etc. [54]

Emergency Shelters

Rooms/buildings where people can be accommodated during emergencies as an interim protective measure. [58]

Emergency Worker

A person having specified duties as a worker in response to an emergency. Emergency workers may include workers employed both directly and indirectly in the facility as well as personnel of responding organizations, such as police officers, firefighters, medical personnel, and drivers and crews of evacuation vehicles. [54]

Employer

Any person¹³ who employs workers or imparts training using sources or who is self-employed as a worker, in a radiation installation. [15]

Enforcement

The action taken by regulatory body intended to correct non-compliance by a consentee/licensee or initiating process for penal actions for non-compliance with the relevant regulations and conditions stipulated in the consent/license. [38]

¹³Person shall include an individual or a company or association or body of individuals, whether incorporated or not; or Central Government or a State Government

Engineered Safety Features

Systems, components, or structures specifically engineered that mitigate the consequences of postulated design basis accidents, e.g. containment systems, core cooling systems, habitability systems, etc.

Environment

The conditions under which people, animals and plants live or develop and which sustain all life and development; especially such conditions as affected by human activities. [54]

Environmental Monitoring

The measurement of external dose rates due to sources in the environment or of radionuclide concentrations in environmental media. [60M]

Equilibrium Core (On Line Refueling)

The condition of the core of an operating reactor wherein the macroscopic/global distribution of power and fuel burn-up within the core does not vary significantly in time and remain close to the design value. Consequently, averaged over sufficiently long periods, the fuel discharge burn-up and fuelling rate (by new fuel) become almost constant. [61]

Equilibrium Cycle (Batch Refueling)

The condition of the core of an operating reactor wherein the distribution of neutron flux and fuel -burn ups over the core follow same patten from Beginning of Cycle to End of Cycle. [62]

Equivalent Dose (H_T)

The quantity 'H_T' is defined as

$$H_T = W_R \cdot D_{T,R}$$

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

$$H_T = \sum_R W_R \cdot D_{T,R} [1]$$

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. [63]

Ethical Review Committee

A committee of independent, qualified persons to advice 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. [28]

Evacuation

The rapid, temporary removal of people from an area to avoid or reduce short term radiation exposure in an emergency. [1]

Event¹⁴

Any occurrence unintended by the operator, including operating error, equipment failure or other mishap, and deliberate action on the part of others, the consequences or potential consequences of which are not negligible from the point of view of protection and safety. [1]

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. [64]

Excepted Package (Transport of Radioactive Materials)

See "Package"

Exclusion

The deliberate excluding of a particular type of exposure from the scope of an instrument of regulatory control on the grounds that it is not considered amenable to control through the relevant regulatory instrument. [1]

Exclusion Zone

An area extending up to 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. [46]

Exemption

The determination by a regulatory body that a source or practice need not be subject to some or all aspects of regulatory control on the basis that the exposure (including potential exposure) due to the source or practice are too small to warrant the application of those aspects. [65]

Exemption Level

A value, established by regulatory body and expressed in terms of activity concentration, total activity, dose rate or radiation energy, at or below which a source of radiation may be granted exemption from regulatory control without further consideration. [1]

Exempt Waste

Radioactive waste for which regulatory control is not warranted in accordance with exemption principles. [8M]

Existing exposure situation

A situation of exposure that already exists when a decision on the need for control needs to be taken.

- Existing exposure situations include exposure to natural background radiation that is amenable to control; exposure due to residual radioactive material that derives from past practices that were never subject to regulatory control; and exposure due to residual radioactive material deriving from a nuclear or radiological emergency after an emergency has been declared to be ended. [1M]

Explosion

An abrupt oxidation or decomposition reaction producing rapid increase in temperature, or in pressure, or in both simultaneously. [29M]

¹⁴ Depending on the severity in deviations and consequences event may be classified as anomaly, incident or accident in ascending order.

Exposure

The act or condition of being subject to irradiation.

Exposure to ionizing radiation can be broadly divided into exposure categories according to the status of the individual(s) exposed (Medical, Public and Occupational); into exposure situations (Planned, Emergency and Existing); and according to the source of the exposure (external or internal). [1M]

Exposure Pathway

A route by which radiation or radionuclides can reach humans and cause exposure. [1]

External Events

Events unconnected with the operation of a facility or the conduct of an activity that could have an effect on the safety of the facility or activity. [1]

Extended Planning Distance (EPD)

The area around a facility within which emergency arrangements are made to conduct monitoring following the declaration of a general emergency and to identify areas warranting emergency response actions to be taken off the site within a period following a significant radioactive release that would allow the risk of stochastic effects among members of the public to be effectively reduced. [1M]

Factory

Any premises including the precincts thereof-(i) whereon ten or more workers are working, or were working on any day of the preceding twelve months, and in any part of which a manufacturing process is being carried on with the aid of power, or is ordinarily so carried on, or (ii) whereon twenty or more workers are working, or were working on any day of the preceding twelve months, and in any part of which a manufacturing process is being carried on without the aid of power, or is ordinarily so carried on, but does not include a mine subject to the operation of the Mines Act, 1952 (35 of 1952) or a mobile unit belonging to the armed forces of the Union, a railway running shed or a hotel, restaurant or eating place. [71]

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. [37]

Failure Mode

The manner or state in which a structure, system or component fails. [1]

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. [68]

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. [68]

Fault Tolerance

The attribute of an entity that enables it to perform a required function in the presence of certain given sub-entity faults. [68]

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. [64]

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. [66]

Final Safety Analysis Report

Safety analysis report submitted to the regulatory body for obtaining license for operation of a nuclear/radiation facility. [38M]

Fire Barrier

A structural barrier, partially or completely limiting the spread and thus the consequences of a fire. [29]

Note: Unless otherwise specified 'adequate' barrier rating means, rating as calculated as per fire hazard analysis (FHA), or a minimum of 1 hour rating, whichever is more. Wherever FHA is not performed, the specified barrier rating shall be installed, subject to approval of regulatory authority. In such case where FHA is not performed the rating shall not be less than 3 hours for safety related items and 1 hour for non-safety related items.

Fire Cell

A subdivision of a fire compartment in which fire separation between items important to safety is provided by fire protection features (such as limitation of combustible materials, spatial separation, fixed fire extinguishing systems, fireproof coatings or other features) so that consequential damage to the other separated systems is not expected. [69]

Fire Compartment

A building or part of a building comprising one or more rooms or spaces, constructed to prevent the spread of fire to or from the remainder of the building for a given period of time. The fire compartment is completely surrounded by fire barrier. [69]

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. [69]

Fire Load

The calorific potential of combustible materials contained in a space, including the facings of the walls, partitions, floors and ceilings. [69]

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. [29]

Fire Retardant

The quality of substance for suppressing, reducing or delaying markedly the combustion of certain materials. [69]

Fire Stop

Physical barrier designed to restrict the spread of fire in cavities within or between the elements of installation. [69]

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. [6]

Fixed Contamination (Transport of Radioactive Material)

Contamination, other than non-fixed contamination (see also "Non-fixed Contamination"). [23]

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. [29]

Flammable Liquid

A liquid that has a closed-cup flash point that is below 37.8°C and a maximum vapour pressure of 40 psi at 37.8°C. [59M]

Fluoroscopy

The technique of imaging by using a fluorescent screen. [67]

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. [66]

Freight Container

An article of transport equipment that is of a permanent character and is strong enough to be suitable for repeated use; specially designed to facilitate the transport of goods by one or other modes of transport without intermediate reloading, designed to be secured and/or readily handled, and having fittings for these purposes. The term freight container does not include the vehicle. [22]

Fresh Core

The state of the core after initial fuel loading, which contains all fresh fuel with zero burn up. [61]

Fuel Assembly

A set of fuel elements and associated components which are loaded into and subsequently removed from a reactor core as a single unit. [1]

Fuel Bundle

A set of fuel elements and associated components which are loaded into and subsequently removed from a reactor core as a single unit. [61]

- In horizontal channel reactors, the term is known as 'Fuel Bundle' whereas in vertical channel reactors, the term is known as 'Fuel assembly'."

Fuel Element

A rod of nuclear fuel (single component or a string of small fuel pellets), its cladding and any associated components necessary to form a structural entity. [1]

Fuel Failure (Failed Fuel)

A fuel bundle/assembly having loss of integrity of clad or end-plug in one or more fuel elements, leading to release of radioactive material. [70M]

Fuel Handling

All activities relating to receipt, inspection, storage and loading of un-irradiated fuel into the core and unloading of irradiated fuel from the core, its transfer, inspection and storage in NPP and subsequent dispatch from NPP. [26M]

Functional Isolation

Prevention of adverse consequences from the mode of operation or failure of one circuit or system on another. [1]

Functions, Systems, Structure and Equipment Important to Safety

A general term encompassing all of the elements (items) of a facility or activity which contribute to protection and safety, except human factors.

Structures are the passive elements: buildings, vessels, shielding, etc. A system comprises several components, assembled in such a way as to perform a specific (active) function. A component is a discrete element of a system. Examples of components are wires, transistors, integrated circuits, motors, relays, solenoids, pipes, fittings, pumps, tanks and valves. [1M]

Fundamental Safety Functions (NPP)¹⁵

These functions are:

- (a) Control of reactivity;
- (b) Cooling of radioactive material;
- (c) Confinement of radioactive material. [1]

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)”. [42]

Generic Criteria

Levels for the projected dose or the dose that has been received at which protective actions and other response actions are to be taken. [1]

Grading (QA)

Category or rank given to entities having the same functional use but different requirements for quality. [51]

Gray (Gy)

The SI unit of kerma and absorbed dose, equal to 1 J/kg. [1]

Guaranteed Shutdown State (GSS)¹⁶

A specified shutdown state of the reactor with sufficiently large reactivity shutdown margin, established usually by 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. [61M]

¹⁵There are alternatively named ‘main safety functions’

¹⁶ The term is more commonly used in the context of PHWR based NPPs.

Handle

Manufacture, possess, store, use, transfer by sale or otherwise, export, import, transport or dispose of. [15]

Hazard

Situation or source, which is potentially dangerous for human, society and/or the environment. [30M]

Hazardous Process

Any process or activity in relation to an industry where unless special care is taken, raw materials used therein or the intermediate or finished products, by products, waste or effluent thereof would –

- (i) cause material impairment to the health of the persons engaged in or connected therewith, or
- (ii) result in the pollution of the general environment. [71M]

HAZOP

A structured and systematic technique for examining a defined system, with the objective of: identifying potential hazards and potential operability problems with the system'. [48]

Health Surveillance

Medical supervision intended to ensure the initial and continuous fitness of workers for their intended task. [1]

Heat Detector

A device, which detects and indicates temperature or rate of temperature rise. [29]

High Level Waste (HLW)

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

- a) 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;
- b) Solidified high level waste from above and spent reactor fuel (if it is declared a waste);
- c) Any other waste with similar radiological characteristics. [1M]

Hot Shutdown (Reactor)

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. [28]

House Load Operation

Operation of a unit, isolated from the grid, which provides power supply only to the station loads from its main generator. [57]

Human Reliability

The probability that a person correctly performs some system-required activity in a required time period (if time is a limiting factor) and performs no extraneous activity that can degrade the system. [72]

Incident

Events that are distinguished from accidents in terms of being less severe. [52]

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. [37]

Indication

The response or evidence from an examination that requires interpretation to determine relevance. [74M]

Industrial Radiography

Non-destructive testing of materials employing ionising radiation. [73]

Ingestion (of Radioactive Materials)

Intake of radioactive material by way of the gastro-intestinal system. [75]

Ingestion and Commodities Planning Distance (ICPD)

The area around a facility for which emergency arrangements are made to take effective emergency response actions following the declaration of a general emergency in order to reduce the risk of stochastic effects among members of the public and to mitigate non-radiological consequences as a result of the distribution, sale and consumption of food, milk and drinking water and the use of commodities other than food that may have contamination from a significant radioactive release. [1]

Inhalation (of Radioactive Materials)

Intake of radioactive material by way of the respiratory system. [75]

Initial Operation

All activities, following commissioning, starting from Initial Fuel Loading, performed to demonstrate the stable operation of NPP for the specified period at the specified power level, and subsequently to achieve the purpose for which a Licensed nuclear/radiation facility is constructed and commissioned. [12]

In-service Inspection (ISI)

Inspection of structures, systems and components undertaken over the operating lifetime by or on behalf of the operating organization for the purpose of identifying age related degradation or conditions that, if not addressed, might lead to the failure of structures, systems or components. [1]

Inspection (QA)

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. [51]

Inspection (Regulatory)

An examination, observation, surveillance, measurement or test undertaken to assess structures, systems and components and materials, as well as operational activities, technical processes, organizational processes, procedures and personnel competence. [1]

Inspector

An officer appointed under section 8 of the Factories Act, 1948 and includes the Competent Authority. [71]

Inspector (Regulatory)

Any person duly authorised under sub-Section (4) of Section 17 of the Atomic Energy Act, 1962, to carry out regulatory inspection. [15M]

Institutional Control (Radioactive Waste)

The process of controlling the radioactive waste site by a national 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. [1M]

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. [1M]

Integrated Leakage Rate Test (Containment)

The leakage test performed on the containment by pressurizing the same to particular leakage rate test pressure, and determining the overall integrated leakage rate. [76]

Interim Storage

(See "Storage").

Intermediate Bulk Container (IBC) (Transport of Radioactive Material)**A portable packaging that:**

- (a) Has a capacity of not more than 3 m³;
- (b) Is designed for mechanical handling;
- (c) Is resistant to the stresses produced in handling and transport, as determined by tests. [23]

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'. [77M]

Internal Exposure

Exposure to radiation from a source within the body. [1]

Intervention

Any action intended to reduce or avert exposure or the likelihood of exposure due to sources that are not part of a controlled practice or that are out of control as a consequence of an accident. [1]

Intervention Level

A level of avertable dose at which a specific protective or remedial action is taken in an emergency or chronic exposure situation. [78]

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 would be conducted. [1]

Ionisation

Formation of ions by the division of molecules or by the addition or removal of electrons from atoms or molecules. [67]

Ionising radiation

For the purposes of radiation protection, radiation capable of producing ion pairs in biological material(s). [1]

Irradiation

The process by which an object is exposed to ionising radiation. [67M]

Irradiators

A facility that houses a particle accelerator, X-ray machine or large radioactive sources for imparting high radiation dose to materials. [79]

Islanding Mode of Operation

In the event of severe grid disturbances, to prevent catastrophic failure of the whole electric grid, a pre-identified part of the electric grid along with one or more generating units separates from the main grid and operates in an isolated mode with its voltage and frequency within acceptable limits. [57]

Isolation Device

The device which isolates one circuit from others to prevent malfunctions in one circuit causing unacceptable conditions in the other. [57]

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. [1M]

Justification

The process of determining for a planned exposure situation whether a practice is, overall, beneficial; that is, whether the expected benefits to individuals and to society from introducing or continuing the practice outweigh the harm (including radiation detriment) resulting from the practice.[1]

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 kilogram (J.kg⁻¹) termed Gray (Gy). [1]

Lead Equivalence

The thickness of lead, which under specified conditions of irradiation, affords the same attenuation as the material under consideration. [66]

Leak

It may constitute an unintended opening, however minute, that allows the unintended passage of a fluid. [81M]

Leak Tightness

The ability of a system, structure or component to maintain leakage rate within a prescribed value. [82]

Leakage

The quantity of fluid escaping from a leak. [81M]

Leakage Radiation

Any radiation coming out of the source/tube housing, other than the useful beam or primary beam. [66]

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. [68]

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. [68]

Level 3 PSA (Nuclear Reactor)

Taking inputs from Level 2 analysis, it evaluates frequency and magnitude of radiological consequences to the public and environment considering meteorological conditions, topography, demographic data, radiological release and dispersion models. [68]

Licence¹⁷

A type of Regulatory instrument issued by the regulatory body to perform specified activities relating to particular 'sources' and 'practices' specified in Rule 3 of Atomic Energy (Radiation Protection) Rules, 2004 [15M].

Licensee¹⁸

A holder of the current 'Licence' granted by the competent authority under the relevant Rules. The licensee is the person or organization having overall responsibility for a facility or activity. [1M]

Licensed Person

A person who has been licensed to hold certain licensed position of a nuclear power plant after due compliance with authorised procedure of certification by the regulatory body. [16]

Licensed Position

A position, which can be held only by person certified by the regulatory body or a body, designated by it. [16]

Life limiting components

Components of NPP systems, which are irreplaceable from the technological or economic considerations. These components are designed, manufactured, substantiated, and maintained to have a specified service life throughout the lifetime. [12]

Limit

The value of a parameter or attribute used in certain specific activities or circumstances that must not be exceeded. [1]

¹⁷ The Licence may take other forms, such as 'Authorisation', 'Registration', 'Consent' or 'Approval' in conformity with the Atomic Energy (Radiation Protection) Rules, 2004.

Authorisation is also issued in conformity with Atomic Energy (Safe Disposal of Radioactive Waste) Rules, 1987 also.

¹⁸ For the purpose of regulatory licensing process, the persons or organizations holding current 'Authorisation', 'Registration', 'Approval' or 'Consent' granted by the competent authority are considered as 'Licensee'.

The person to whom an 'Authorisation' is issued can be termed as 'Licensee' as well as 'Authorised Person'. As per AE (RP) Rules, roles and responsibilities are defined for Licensee, which may not be applicable in-toto to 'Authorised Person'.

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. [16]

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. [16]

Linear Accelerator

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

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 of the SSCs for the intended service conditions. [36M]

Line Type Detector

A device in which detection is continuous along a path. [29]

Liquefaction (of Soil)

Sudden loss of shear strength and rigidity of saturated and cohesionless soils due to vibratory ground motion. [46]

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. [68]

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/dampers. [81M]

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. [41]

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. [68]

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. [83]

Long term operation

The operation of NPP beyond originally established time frame set forth by applicant to the satisfaction

of AERB. [12]

Long Term Protective Action

See “Protective Action”

Loss of Coolant Accident (LOCA)

An accident in which coolant is lost from primary heat transport system at a rate greater than the rate which make-up system can cater to. [84]

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. [85]

Low Dispersible Radioactive Material (Transport of Radioactive Material)

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. [23]

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

Radioactive material that 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 should not be considered in determining the estimated average specific activity. [23]

Low Toxicity Alpha Emitters (Transport of Radioactive Material)

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. [23]

Main Control Room

Room all the time supervised by the licensed personnel for operation of the facility and equipped with for performing intended functions for all the plant states of the facility. [28M]

Maintenance

Organised activities covering all preventive and corrective 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. [1M]

Main Structural Members

The structural members, which are primarily responsible to withstand, carry and distribute the applied load. [25]

Management System

A set of interrelated or interacting elements (system) for establishing policies and objectives and enabling the objectives to be achieved in an efficient and effective manner. [1]

Manager

The person responsible to the occupier for the working of the factory for the purposes of the Factories Act, 1948. [71]

Man Machine Interface (MMI)

The abstract boundary between operators and the hardware or software they interact with. This is also referred as Human Machine Interface (HMI). [86M]

Mathematical Model

A set of mathematical equations designed to represent a conceptual model. [68]

Maximum Normal Operating Pressure (Transport of Radioactive Material)

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. [23]

Mean Down Time (MDT)

The expectation value of the down time. [68]

Mean Time Between Failures (MTBF)

The expected operating time between two successive failures. [68]

Mean Time to Failure (MTTF)

The expected operating time to first failure. The MTTF is also called MTTF (mean time to first failure). [68]

Mean Time to Repair (MTTR)

The expectation of the time for restoration (or repair). [68]

Mean Recurrence Interval (MRI)

The mean interval during which the design external event is expected to reoccur. [44M]

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. [87]

Medical Exposure

Exposure incurred by -patients as part of their own medical diagnosis or treatment; persons, other than occupationally exposed, while knowingly and willingly helping in the support and comfort of patients; and volunteers in biomedical research. [15]

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. [1M]

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. [14]

Metal-Water Reaction

Reaction of water/steam with nuclear fuel's metal cladding as a function of time and temperature during accident conditions [88]

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. [67]

Minimal Cut Set

Combination of a minimum number of basic events such that, if one of the events in a minimal cut set does not occur, then the undesirable top event will not happen. [68]

Missile

A mass that has kinetic energy and has left its design location in the facility, after which it moves under the force of gravity. [41]

Mission Time

Duration/period for which the operation of the system must be ensured. [68]

Mitigation

Process of minimizing the severity of a consequence following an incident/accident. [88]

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. [1]

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. [37]

Multilateral Approval (Transport of Radioactive Material)

Approval by the relevant competent authority of the country of origin of the design or shipment, as applicable, and also, where the consignment is to be transported through or into any other country, approval by the Competent Authority of that country.[23]

Natural background¹⁹

The doses, dose rates or activity concentrations associated with natural sources, or any other sources in the environment that are not amenable to control. [1]

Natural Exposure

Exposure due to natural sources present in the environment. [28M]

Natural source

A naturally occurring source of radiation, such as the sun and stars (sources of cosmic radiation) and rocks and soil (terrestrial sources of radiation), or any other material whose radioactivity is for all intents and purposes due only to radionuclides of natural origin, such as products or residues from the processing of minerals; but excluding radioactive material for use in a nuclear installation and radioactive waste generated in a nuclear installation. [1]

Naturally Occurring Radioactive Material (NORM)

Radioactive material containing no significant amounts of radionuclides other than naturally occurring radionuclides. [1]

Near Surface Disposal

Disposal of waste with/without engineered barriers, or below the ground surface with adequate

¹⁹This is normally considered to include doses, dose rates or activity concentrations associated with natural sources, global fallout (but not local fallout) from atmospheric nuclear weapon tests and the Chernobyl accident.

final protection covering to bring the surface dose rate within prescribed limits. [1M]

Non-fixed Contamination (Transport of Radioactive Material)

Contamination that can be removed from a surface during routine conditions of transport. [1]

Non-leachable

Insoluble in water yielding quantities less than 0.1 mg/g in 100 ml of still water maintained at 50°C for 4 h. [89]

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 refueling. [1]

Notification²⁰

Notification published in the Official Gazette. [6]

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. [11]

Nuclear Fuel Cycle

All operations associated with the production of nuclear energy, including mining, milling, processing of uranium or thorium; enrichment of uranium; manufacture of nuclear fuel; operation of reactors; reprocessing of nuclear fuel; decommissioning; radioactive waste management and any research or development activity related to any of the foregoing. [15]

Nuclear Material

Plutonium except that with isotopic concentration exceeding 80% in plutonium-238, uranium-233, uranium enriched in the isotope 235, irradiated fuel (depleted or natural uranium, thorium or low enriched fuel of less than 10% fissile content), uranium containing the mixture of isotopes as occurring in nature other than in the form of ore or ore-residue, any material containing one or more of the foregoing. [1]

Nuclear Medicine

The speciality that utilises radio-pharmaceuticals to investigate disorders of anatomy, physiology and patho-physiology, for diagnosis and/or treatment of diseases. [90]

Nuclear or Radiological Emergency

An emergency in which there is, or is perceived to be, a hazard due to:

- (1) The energy resulting from a nuclear chain reaction or from the decay of the products of a chain reaction; or
- (2) Radiation exposure. [1]

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. [11]

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 risks. [1M]

²⁰ The notification under IAEA GSR Part-3, 2014 (Requirement No. 7) is different than expressed here.

Nuclear Security

Prevention, detection and response measure taken to minimise the residual risk of theft, sabotage, unauthorised access, illegal transfer or other malicious acts associated with nuclear material, radioactive material or other radioactive substance, which could lead to adverse impact on the safety of the Nuclear / Radiation facility, site personnel, public or environment. [1M]

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. [91M]

Observed Cause

The failure, action, omission or condition, which directly leads to an initiating event. [1]

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. [73]

Occupational Exposure

All exposures of personnel incurred in the course of their work with ionizing radiation. [1M]

Occupational Worker

Any person, working full time or part time in a nuclear or radiation facility, who may be employed directly by the “employer” or through a contractor. [11M]

Occupier²¹

One, who has been given the ultimate control over the affairs of the factory. [71M]

Off-site

Area in public domain beyond the site boundary. [1]

Off-site Emergency

Accident condition or emergency situation involving excessive release of radioactive materials/hazardous chemicals from the plant into public domain calling for an intervention. [15]

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. [92]

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. [57]

On-site Power Source

The electric power supply source located within the nuclear power plant and controlled by the nuclear power station operators. [57]

Operating Basis Earthquake (OBE)

An earthquake which, considering the regional and local geology and seismology and specific

²¹ In the case of a factory owned or controlled by the Central Government, the person or persons appointed to manage the affairs of the factory by the Central Government, shall be deemed to be the occupier.

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. [46]

Operating Organisation

The organisation so designated by responsible organisation and authorised by the regulatory body to operate the facility. [16M]

Operating Personnel

Members of the site personnel who are involved in operation of the nuclear/radiation facility. [93M]

Operation

All activities following commissioning (after initial fuel loading) performed to achieve, in a safe manner, the purpose for which a nuclear/radiation facility is constructed. For nuclear power plants, this includes maintenance, refueling, in-service inspection and other associated activities performed during initial operation, regular operation or long term operation. 1M]

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 licensed nuclear/radiation facility (see also “Technical Specifications for Operation”). [94M]

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. [94M]

Operational States

The states defined under “normal operation” and “anticipated operational occurrences”. [1]

Optimization of Protection (Radiological)

The process of determining what level of protection and safety would result in the magnitude of individual doses, the number of individuals (site personnel and members of the public) subject to exposure and the likelihood of exposure being as low as reasonably achievable, economic and social factors being taken into account (ALARA). [1M]

Orphan source

A radioactive source which is not under regulatory control, either because it has never been under regulatory control or because it has been abandoned, lost, misplaced, stolen or otherwise transferred without proper authorisation. [1]

Overpack

An enclosure used by a single consignor to contain one or more packages, and to form one unit for convenience of handling and stowage during transport. [22]

Package

The complete product of the packing operation, consisting of the packaging and its contents prepared for transport. The types of packages, as mentioned below, are subject to the activity limits, material restrictions and corresponding requirements as specified in Regulations for Safe Transport of Radioactive material, IAEA SSR-6 [23M]:

- (a) Excepted package
- (b) Industrial package Type 1 (Type IP-1)
- (c) Industrial package Type 2 (Type IP-2)
- (d) Industrial package Type 3 (Type IP-3)

- (e) Type A package
- (f) Type B(U) package
- (g) Type B(M) package
- (h) Type C package.

Packaging (Radioactive waste)

Any container prepared for containing the conditioned waste for handling, transportation, storage or disposal and may be permanent part of the waste package or it may be a reusable cask or overpack. [98]

Packaging (Transport of Radioactive Materials)

One or more receptacles and any other components or materials necessary for the receptacles to perform containment and other safety functions. [1]

Passenger Aircraft

An aircraft that carries any person other than a crew member, a carrier's employee in an official capacity, an authorised representative of an appropriate national authority, or a person accompanying a consignment or other cargo. [23]

Passive Component

A component, functioning of which, does not depend on an external input such as actuation, mechanical movement or supply of power. [1]

Peak Stress

See "Stress categorisation"

Periodic Safety Review

A systematic reassessment of the safety of an existing facility (or activity) carried out at regular intervals to deal with the cumulative effects of ageing, modifications, operating experience, technical developments and siting aspects, and aimed at ensuring a high level of safety throughout the service life of the facility (or activity). [1]

Permission

A type of regulatory instrument, which is issued for a nuclear facility during the intermediate stages of consenting process.

Person

Any individual, or a company, or association, or body of individuals, whether incorporated or not or central government or a state government. [15]

Personnel Monitoring

Determination or estimation of the dose received by a person from external and internal radiation. [15]

Physical Barrier

A fence or wall or a similar impediment, which provides penetration delay and complements access control. [20]

Physical Protection

Measures for the protection of nuclear/radiation facility designed to prevent unauthorised access or removal of radioactive material, or sabotage. [1]

Physical Separation

A means of ensuring independence of equipment through separation by geometry (distance, orientation, etc.), appropriate barriers or a combination of both. [37]

Planned Exposure

The situation of exposure that arises from the planned operation of a source or from a planned activity that results in an exposure due to a source. [1M]

Plant

It includes machinery, equipment or appliance whether affixed to land or not. [6]

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. [68]

Plant Emergency

Declared emergency conditions in which the radiological/other consequences, confined to the plant or a section of the plant and warrants taking protective actions and other response actions at the plant and on the site but does not warrant taking protective actions off the site. [1M]

Plant Parameter Envelope (PPE)

A set of parameters that are derived from a combination of NPP design (reactor thermal power, fuel burn up, normal and accident source-term etc.) and other parameters having effect on the Site (cooling water consumption, switchyard and transmission system etc.). These parameters are expected to bind the characteristics of NPP that would be constructed at the Site. When more than one NPP technologies are under consideration to be constructed at the Site, a bounding value of all the NPP technologies must be selected to represent the NPP design. [12]

Plant Management

The members of site personnel who have been delegated responsibility and authority by the Operating Organization for directing the safe operation of the plant. [28]

Plant States (Considered in Design)

Plant Design Envelope					Practically Eliminated Conditions ²²
Operational States		Accident Conditions			Highly unlikely conditions
Normal Operation	Anticipated Operational Occurrences	Design Basis Accidents	Design Extension Conditions ²³		
			DEC-A Without Core Damage/ Without Core Melt	DEC-B With Core Damage /With Core Melt	Physically impossible conditions
					Severe accidents

Decreasing order of Frequency -----▶

[38]

Poison (Neutron Poison)

A substance used to reduce reactivity in a reactor core, by virtue of its high neutron absorption cross-section. [1]

²² Any accident sequence, which may lead to 'Early' or 'Large' radioactive release, shall be 'Practically eliminated'. Highly unlikely conditions, physically impossible conditions, to be demonstrated in the relevant DID provisions, Design Practice following standards, material selection, degradation mechanism and its monitoring. These aspects can be accomplished using appropriate DSA, PSA insights and experimental evidences

²³ For LWRs/FBRs, 'Core melt' and for PHWRs 'Core Damage' shall be used. Fuel stored in fuel pool as well as fuel within reactor core shall be considered. Further, in case of PHWRs, as an exception, single channel events resulting in fuel failure/melt in the affected channel shall not cause failure/melt of other channel and it comes under DBAs.

Postulated Initiating Events (PIE)

A postulated event identified in design as capable of leading to anticipated operational occurrences or accident conditions. [1]

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. [15]

Power Operation

Operation at a power level exceeding the conditional trip values as stipulated by the regulatory body for plant operation. [16]

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. [1]

Predictive Maintenance

Form of preventive maintenance performed continuously or at intervals governed by observed condition to monitor, diagnose or trend condition indicators of a structure, system or component; results indicate present and future functional ability or the nature of and schedule for planned maintenance. [1]

Precautionary Action Zone

See "Emergency Planning Zones"

Precautionary Urgent Protective Action (PUA)

See "Protective Action"

Preferred Power Supply

Power supply from transmission system or main plant generator or a combination of both, to Emergency Electric Power supply system. Some portions of the preferred power supply are not part of the safety classification. [57]

Preliminary Safety Analysis Report (PSAR)

Safety analysis report submitted to regulatory body for obtaining consent for construction. [52]

Prescribed equipment

Any property which the Central Government may, by notification, prescribe, being a property which in its opinion is specially designed or adapted or which is used or intended to be used for the production or utilisation of atomic energy, radioactive substances, or radiation, but does not include mining, milling, laboratory and other equipment not so specially designed or adapted and not incorporated in equipment used or intended to be used for any of the purposes aforesaid. [6]

Prescribed Limits

Limits established or accepted by the regulatory body. [1M]

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. [6]

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. [95]

Pre-treatment (Radioactive Waste)

Any or all of the operations prior to final treatment before disposal, such as collection, segregation, chemical adjustment and decontamination. [1M]

Preventive Action

Action to eliminate the cause of a potential nonconformity (non-fulfilment of requirements) or other undesirable situation. [96]

Preventive Maintenance

Actions that detect, preclude or mitigate degradation of a functional structure, system or component to sustain or extend its useful life by controlling degradation and failures to an acceptable level. [1]

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. [34M]

Primary Limits

A limit on the dose or risk to an individual. [1]

Primary Stress

See "Stress Categorisation"

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. [63]

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. [87M]

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. [87]

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, geo-seismic 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. [87M]

Projected Dose

The dose that would be expected to be received if planned protective actions were not taken. [1]

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 KIO₃ (Potassium Iodate) to reduce the uptake of radioiodines (particularly I-131) in thyroid gland [28]

Protected Area

An area under surveillance, containing Category I or II nuclear material, and/or vital/inner areas surrounded by a physical barrier. [83M]

Protection System

System that monitors the operation of a reactor and which, on sensing an abnormal condition, automatically initiates actions to prevent an unsafe or potentially unsafe condition. [1]

Protective Action

An action for the purposes of avoiding or reducing doses that might otherwise be received in an emergency exposure situation or an existing exposure situation. [1]

Precautionary Urgent Protective Action (PUA)

A protective action in the event of a nuclear or radiation emergency which must be taken before or shortly after a release of radioactive material, or before an exposure, on the basis of the prevailing conditions to prevent or to reduce the risk of severe deterministic effects.

Urgent Protective Action (UPA)

A protective action in the event of an emergency which must be taken promptly (normally within hours) in order to be effective, and the effectiveness of which will be markedly reduced if it is delayed.

Early Protective Action

A protective action in the event of a nuclear or radiological emergency that can be implemented within days to weeks and still be effective. (*Note: The most common early protective actions are relocation and longer term restrictions on consuming contaminated food*).

Long Term Protective Action

A protective action that is not an urgent protective action. Such protective actions are likely to be prolonged over weeks, months or years. These include measures such as relocation, agricultural countermeasures and remedial actions.

Protective Barrier or Shielding (Radiation)

A barrier of appropriate thickness used to reduce radiation levels to specified values. [66]

Public Exposure

Exposure incurred by members of the public due to sources in planned exposure situations, emergency exposure situations and existing exposure situations, excluding any occupational exposure or medical exposure. [1]

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. [28]

Qualified Person

An individual who, by virtue of certification by appropriate boards or societies, professional licence or academic qualifications and experience, is duly recognised as having expertise in a relevant field of specialization, for example medical physics, radiation protection, occupational health, fire safety, quality management or any relevant engineering or safety specialty. [1]

Quality

The totality of features and characteristics of an item or service that have the ability to satisfy stated or implied needs. [51]

Quality Assurance

The function of a management system that provides confidence that specified requirements will be fulfilled [1]

Quality Control

Part of quality management intended to verify that structures, systems and components correspond to predetermined requirements [1]

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 radiowaves, or visible, infrared, ultra-violet light. [6]

Radiation Equipment

Device housing radioactive source or X-ray tube, and capable of emitting gamma, beta, alpha rays or generating radiation, such as, X-rays, neutrons, electrons or other charged particles.[55]

Radiation Installation

Any location or facility, including a mobile facility, in which a radiation generating equipment or plant or radioactive material is present and which in the opinion of the competent authority requires radiation surveillance for ensuring adequate protection against radiation. [15]

Radiation Facility

Any equipment at designated location involving the use of radiation sources or radioactive material in the field of research, industry, medicine and agriculture. [11M]

Radiation Generating Equipment

Device capable of generating radiation, such as X-rays, neutrons, electrons or other charged particles. [11]

Radiation Level

The corresponding dose rate expressed in millisieverts per hour or microsieverts per hour. [1]

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. [97]

Radiation Protection Survey/Radiological Survey

An evaluation of radiation safety, using appropriate radiation measuring instruments. [66]

Radiation Safety

(See “Nuclear Safety”).

Radiation Surveillance

Measures specified by the competent authority to ensure adequate protection [15M]

Radiation Weighting Factor

A number by which the absorbed dose in a tissue or organ is multiplied to reflect the relative biological effectiveness of the radiation in inducing stochastic effects at low doses, the result being the equivalent dose. [1]

Radiation Worker

Any person who is occupationally exposed to radiation. [15]

Radioactive Contents

Radioactive material together with any contaminated or activated solids, liquids and gases within the packaging. [23]

Radioactive Material/Radioactive Substance

Any substance or material, which spontaneously emits radiation in excess of the levels prescribed by notification by the Central Government. [6]

Radioactive Waste²⁴

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. [98M]

Radioactive Waste Management Facility

Facility specifically designed to handle, treat, condition, temporarily store or permanently dispose of radioactive waste. [1]

Radioactivity

The phenomenon whereby atoms undergo spontaneous random disintegration, usually accompanied by the emission of radiation. [1]

Radiograph

A permanent record of a transmission image, produced by a beam of radiation after passing through the subject/specimen. [99]

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. [100]

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. [73]

Radiography Technician/ Radiography Technologist/Radiographer

A worker, who performs radiography operations employing radiography sources and

²⁴It should be recognised that this definition is purely for regulatory purposes and that material with activity concentrations equal to or less than clearance levels is radioactive from a physical viewpoint although the associated radiological hazards are considered negligible

possesses valid qualification, duly recognised by the competent authority for the specific purpose. [101]

Radiological Protection

The protection of people from the effects of exposure to ionising radiation or radioactive materials and the safety of radiation sources, including the means for achieving this, and the means for preventing accidents and for mitigating the consequences of accidents should they occur. [1]

Radiological Safety Officer (RSO)

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 rules promulgated under Atomic Energy Act, 1962. [6M]

Radiotherapy/Radiation Therapy

Medical treatment by ionising radiation. [28]

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. [68]

Random Variable

Variable which can take any one of a given set of values, each with an associated distribution. [68]

Reactivity

For a nuclear chain reacting medium:

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

where, k_{eff} is the ratio between the number of fissions in two succeeding generations (later to earlier) of the chain reaction.

A measure of the deviation from criticality of a nuclear chain reacting medium, such that positive values correspond to a supercritical state and negative values correspond to a subcritical state. [1]

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). [61M]

Reactor Trip

Actuation of a shutdown system to bring the reactor to shutdown state. [16]

Reactor Trip (Absolute)

That comes into action at all reactor power levels. [16]

Reactor Trip (Conditional)

That comes into action when reactor power is at or above the specified value approved by the regulatory body. [16]

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. [1]

Records

Documents which furnish objective evidence of the quality of items and activities affecting quality. It also includes logging of events and other measurements. [16]

Redundancy

Provision of alternative (identical or diverse) structures, systems and components, so that any single structure, system or component can perform the required function regardless of the state of operation or failure of any other. [1]

Reference Individual

An idealised human with characteristics defined by the International Commission on Radiological Protection for radiation protection purposes. [1]

Reference Level

The level of dose, risk or activity concentration above which it is not appropriate to plan to allow exposures to occur during an emergency exposure situation or an existing exposure situation, and below which optimization of protection and safety would continue to be implemented. [1M]

Reference NPP

A Nuclear Power Plant with same basic design (design philosophy, architecture and design standards and safety concepts) and the experience feedback of which can be utilised for further enhancing the safety of the proposed NPP. [102]

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. [46]

Registration

See Licence

Regular operation

All activities, following Initial Operation, performed to achieve the purpose for which a NPP is constructed. [12]

Regulatory Authority

(See "Competent Authority").

Regulatory Body

(See "Atomic Energy Regulatory Board").

Regulatory Constraints

Restrictions on radiation protection parameters as specified by the competent authority. [15M]

Regulatory Inspection

An examination, observation, surveillance, measurement or test undertaken to assess structures, systems and components and materials, as well as operational activities, technical processes, organizational processes, procedures and personnel competence. [1]

Release from Regulatory Control

The process by which licensee is relieved of further regulatory responsibility upon verifying that regulatory criteria for removal of regulatory controls over the decommissioned NPP or closure of Waste disposal facility and the release of site are fulfilled. [12]

Reliability

The probability that a structure, system, component or facility will perform its intended (specified) function satisfactorily for a specified period under specified conditions. [68]

Relocation (Off-site Emergency)

The non-urgent removal or extended exclusion of members of public from an area to avoid long term exposure from deposited radioactive material. [1]

Remedial Action

The removal of a source or the reduction of its magnitude (in terms of activity or amount) for the purposes of preventing or reducing exposures that might otherwise occur in an emergency or in an existing exposure situation. [1]

Remediation

Any measures that may be carried out to reduce the radiation exposure due to existing contamination of land areas through actions applied to the contamination itself (the source) or to the exposure pathways to humans. [1]

Representative Person

An individual receiving a dose that is representative of the doses to the more highly exposed individuals in the population. [1]

²⁵Repository

A facility where radioactive waste is emplaced for disposal. Future retrieval of waste from the repository is not intended. [8]

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. [8]

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. [8]

Research Reactor

A nuclear reactor used mainly for the generation and utilization of neutron flux and ionizing radiation for research and other purposes, including experimental facilities associated with the reactor and storage, handling and treatment facilities for radioactive material on the same site that are directly related to safe operation of the research reactor. Facilities commonly known as critical assemblies are included. [1]

Residual Dose

The dose expected to be incurred in the future after implemented protective actions have been terminated (or a decision has been taken not to implement protective actions). This applies in an existing exposure situation or an emergency exposure situation. [1]

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. [37]

²⁵ For the assessment of dose to the member of public, the concept of critical group remains valid.

Response Time

The period of time necessary for a component to achieve a specified output state from the time that it receives a signal requiring it to assume that output state.[1]

Responsible Organisation

An organisation having overall responsibility for siting, design, construction, commissioning, operation and decommissioning of a facility. [16]

Restorable Detector

A device, whose sensing element is not ordinarily destroyed by the process of detecting a fire. Restoration may be manual or automatic. [29]

Restricted area

Any area access to which is controlled by the employer and approved as such by the competent authority for purposes of protection of individuals from exposure to radiation and radioactive contamination. [98]

Review

Documented, comprehensive and systematic evaluation of the fulfillment of requirements, identification of issues, if any. [51]

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. [1]

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. [68]

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. [68]

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. [68]

Root Cause

The fundamental cause of an initiating event, correction of which will prevent recurrence of the initiating event (i.e. the root cause is the failure to detect and correct the relevant latent weakness(es) and the reasons for that failure).[1]

Run-up

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. [87]

Run-off

Overland flow of water during precipitation. [44]

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. [46]

Safe shutdown state

Safe shutdown state is the state of the plant, following an anticipated operational occurrence or accident conditions, in which the fundamental safety functions can be ensured and maintained continuously. [5]

Safe State

State of plant, following design extension condition without core melt, in which the reactor is subcritical and the fundamental safety functions can be ensured and maintained stable for a long time. [5]

Safety

(See "Nuclear Safety").

Safety Actuation System

A set of equipment required to accomplish the necessary safety actions when initiated by the protection system. [1]

Safety Analysis

Evaluation of the potential hazards associated with the operation of a facility or the conduct of an activity. [1]

Safety Assessment

Assessment of all aspects of a practice that are relevant to protection and safety, for a licensed facility. This includes siting, design, construction, commissioning, operation and decommissioning. [1M]

Safety Case

A collection of arguments and evidence in support of the safety of a facility or activity.

1. This will normally include the findings of a safety assessment and a statement of confidence in these findings.
2. For a disposal facility, the safety case may relate to a given stage of development. In such cases, the safety case should acknowledge the existence of any unresolved issues and should provide guidance for work to resolve these issues in future development stages. [5]

Safety Categorization

For nuclear power plants, the categorization into a limited number of safety categories of the functions that are required for fulfilling the main safety functions in different plant states, including all modes of normal operation, on the basis of their safety significance.

Safety Classification. [1]

The assignment to a limited number of safety classes of systems and components and other items of equipment on the basis of their functions and their safety significance. [1]

Safety Code

A document stating the basic regulatory safety requirements, which must be complied with for sources and practices. This is issued under the authority of the regulatory body and mandatory to be followed by the respective utilities. [28M]

Safety Critical System

(See "Safety System").

Safety Culture

The assembly of characteristics and attitudes in organizations and individuals which establishes that as an overriding priority, the protection and safety issues receive the attention warranted by their significance. [1]

Safety Function

A specific purpose that must be accomplished for safety for a facility or activity to prevent or to mitigate radiological consequences of normal operation, anticipated operational occurrences and accident conditions. [1]

Safety Group

Assembly of structures, systems and components designated to perform all actions required for a particular postulated initiating event to ensure that the specified limits for anticipated operational occurrences and design basis accidents are not exceeded. It may include certain safety and safety support systems, and any interacting process system. [5]

Safety Guide

A document containing detailed guidance on approaches, methods and procedures 'acceptable' to the regulatory body in order to meet the safety requirements specified in Safety Codes and/or Standards. This is issued under the authority of regulatory body and is of non-mandatory nature. [28M]

Safety Limits

Limits on operational parameters within which facility has been shown to be safe. [1M]

Safety Manual

A document containing technical information on recommended practices, descriptions of different methods and approaches, worked out examples, computational tools, data etc. This is issued as supporting document to relevant Safety Guide. [28M]

Safety Related Systems

Systems important to safety that are not included in 'Safety Systems'. [1M]

Safety Standard

A document providing quantitative technical requirements on any particular aspect/ practice / equipment (specific methods, specific formulae, empirical mathematical models, data libraries, standard curves/graphs, computational aids and tools, look-up tables etc.). This is issued under the authority of the regulatory body and mandatory to be followed by the respective utilities.

[28M]

Safety Support System

Systems which encompass all equipment that provide services, such as cooling, lubrication and energy supply (pneumatic or electric) required by the protection system and safety actuation systems. [1M]

Safety System

System important to safety; provided to ensure during and following anticipated operational occurrences and design basis accident:

- Capability to shut down the reactor and maintain it in safe shutdown state; and/or
- Integrity of the reactor coolant pressure boundary; and/or,
- residual heat removal from the core; and/or
- containment of radioactivity to limit the consequences.

“Safety system” may also be called “safety critical system”. [1M]

Safety System Settings

The set-points on parameters at which protective devices are automatically actuated in the event of anticipated operational occurrences or design basis accident conditions, so as to prevent safety limit(s) being exceeded. [1M]

Scattered Radiation

Radiation that, during passage through matter, gets deviated in direction. (It may have been modified by a decrease in energy). [73]

Scram

The sudden shutting down of a nuclear reactor, usually by rapid insertion of control rods. [1M]

Screening Distance Value (SDV)

The distance from a facility beyond which, for screening purposes, potential origins of a particular type of external event can be ignored. [1]

Sealed Source

Radioactive material that is

- (a) (i) permanently sealed in a capsule or (ii) in solid form which is closely bounded.
- (b) is designed to meet the safety standards prescribed by the competent authority[15]

Secondary Containment

The structure enveloping the primary containment that acts as a further barrier to limit the release of radioactive materials, provide shielding 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 atmosphere. [34]

Secondary Stress

(See Stress categorization)

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. [85]

Seiche

An oscillation of a standing wave in an enclosed or semi enclosed water body in response to an atmospheric, oceanographic or seismic disturbing force. [103M]

Seismic Hazard

Any physical phenomenon (e.g. ground vibration, ground failure) associated with an earthquake that may produce adverse effects. [64]

Seismogenic Structure

A structure that displays earthquake activity or that manifests historical surface rupture or the effects of palaeo seismicity, and is likely to generate macro-earthquakes within a time period of concern. [1]

Sensitivity Analysis

A quantitative examination of how the behaviour of a system varies with change, usually in the values of governing parameters. [28M]

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. [61M]

Severe Accident

Accident conditions more severe than design basis accident and involving significant core degradation including core melt. [1M]

Severe Accident Safe State

This is a state which shall be achieved subsequent to a design extension condition with significant core damage or core melt phenomena. Severe Accident Safe State shall be reached at the earliest after an accident initiation and can be maintained indefinitely. This state is characterized by (a)No possibility of re-criticality (b)Fuel or debris are continuously cooled (c)Uncontrolled release of radioactivity to environment is arrested (d)Means to maintain above conditions are available for long term, including critical parameter monitoring (e)Monitoring of radiological releases and containment conditions.[108]

Severe Deterministic Effect

A deterministic effect that is fatal or life threatening or results in a permanent injury that reduces quality of life. [1]

Shallow Water

Water of depth less than $L/25$, where 'L' is the wavelength of the surface wave under consideration. [103M]

Sheltering

The short term use of a structure for protection from an airborne plume and/or deposited radioactive material. [1]

Shipment

The specific movement of a consignment from origin to destination [1].

Shipment Approval

A type of regulatory instrument issued by regulatory body for shipment of radioactive consignment based on International/national regulations pertaining to consignor, consignee and design of package. [105]

Short-lived Waste

Radioactive waste in quantities and/or concentrations, containing radionuclides with half-lives shorter than 30 years, which is expected to decay to activity levels considered acceptably low within the period of administrative controls. [1M]

Shutdown State

State of a reactor when it is maintained subcritical with specified negative sub-criticality margin. [28]

Significant Events (Nuclear Facility)

Unusual occurrences exceeding the limits and conditions stipulated by the regulatory body. [16]

Single Failure

A failure which results in the loss of capability of a single system or component to perform its intended safety function(s), and any consequential failure(s) which result from it.[1]

Single Failure Criteria

A criterion (or requirement) applied to a system such that it must be capable of performing its task in the presence of any single failure. To ensure that the single failure criterion is met, usually two or more independent (redundant) systems or trains are provided by design to achieve the same safety function. [1]

Site

The area defined by a boundary, containing facility or source and are under effective control of the management of the facility or activity [1]

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. [56]

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 [38]

Site Personnel

All persons working at the site, either permanently or temporarily.[16]

Site Selection Stage

Stage at which final site is selected through the ranking of candidate sites. [46]

Siting

The process of selecting a suitable site for a facility including appropriate assessment and derivation of the related design bases. The selected site is evaluated throughout the lifetime of facility. [46]

Small Leak

Any leak due to break size smaller than small break LOCA, which can be handled within the capability of control system engineered for such purpose. [84]

Solidification (Radioactive Waste)

Immobilization 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, bituminization and vitrification are some of the typical ways of solidifying liquid radioactive waste (See also "Conditioning of Waste"). [8]

Source

A radioactive material or a radiation generating plant or equipment. [15]

Source Assembly

An assembly of sealed source and associated components which acts as a single unit for its intended purposes. [73]

Source Changer

A device for transferring radiography source(s) from or to exposure device, and suitable for transport and storage of the source. [73]

Special Arrangement

The provisions, approved by the competent authority, under which a consignment that does not satisfy all the applicable requirements for safe transport of radioactive material, may be transported. [23]

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. [23]

Specific Activity

Activity per unit mass of the material in which the radionuclides are essentially uniformly distributed. [1]

Spent Fuel

Irradiated nuclear fuel, removed from a reactor, not intended for further use in reactors in its present form because of depletion of fissile material, poison build up or radiation damage or any other phenomena which precludes its further use as fuel. [1M]

Station Blackout (SBO)

The complete loss of alternating current (AC) electric power to the essential and nonessential switchgear buses (i.e., simultaneous loss of the preferred power supply and unavailability of the emergency electric power supply system). Station blackout does not include the loss of available AC power to buses fed by station batteries through inverters or by DEC power sources. [57]

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). [1]

Stochastic Effects (Radiation)

Radiation induced health effect effects generally occurring without a threshold level of dose whose probability of occurrence is proportional to the dose and whose severity is independent

of the dose. [1M]

Storage (Radioactive Waste)

The holding of radioactive waste in an appropriate facility that provides for its containment with the intention of retrieval. Hence, waste storage is by definition an interim measure and the term storage should not be described as 'interim storage'. [8]

Storm

Abnormal state of the atmosphere due to strong wind, hail, tornados, heavy precipitation (snowstorm, rainstorm), thunder and lightning (a thunderstorm), heavy freezing rain (ice storm), strong winds (tropical cyclone, windstorm), or wind transporting some substance through the atmosphere as in a dust storm, sandstorm, etc. [103M]

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. [87M]

Stray Radiation

The sum of leakage and scattered radiations. [42]

Stress Categorization

ASME section-III, Subsections (Design by Analysis) - NB, NC, ND requires stresses evaluated by FEA (Finite Element Analysis) of components to be categorised and compared with allowable values for different groups of categories.

The stress categories are as follows

- a) Primary Stress*: Primary stress is any normal stress or shear stress developed by an imposed loading that 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. Primary stresses that considerably exceed the yield strength will result in failure or, at least, in gross distortion.
- b) Secondary Stress: Secondary stress is a normal stress or a shear stress developed by the constraint of adjacent material or by self-constraint of the structure. The basic characteristic of a secondary stress is that it is self-limiting. Local yielding and minor distortions can satisfy the conditions that cause the stress to occur and failure from one application of the stress is not to be expected.
- c) Peak Stress: Peak stress is that increment of stress that 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. The basic characteristic of a peak stress is that it does not cause any noticeable distortion and is objectionable only as a possible source of a fatigue crack or a brittle fracture. [105]

Stress Relaxation

A phenomenon in which loss of stress occurs when a constant strain is maintained at a constant temperature. [7]

Structures, Systems and Components (SSCs)

A general term encompassing all of the elements (items) of a facility or activity which contribute to protection and safety, except human factors.

Structures are the passive elements: buildings, vessels, shielding, etc. A system comprises several components, assembled in such a way as to perform a specific (active) function. A component is a discrete element of a system. Examples of components are wires, transistors,

integrated circuits, motors, relays, solenoids, pipes, fittings, pumps, tanks and valves. [1]

Supervised Area

Any area not already 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. [15]

Support Systems
(See Safety Support system)

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. [36]

Surface Contaminated Object (SCO) (Transport of Radioactive Material)

Solid object that is not itself radioactive but which has radioactive material distributed on its surface. [1]

Surface Faulting

Permanent deformation or tearing of the ground surface by differential movement across a fault in an earthquake. [1]

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. [50]

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. [104]

Tank (Transport of Radioactive Material)

Portable tank (including a tank container), a road tank vehicle, a rail tank wagon or a receptacle that contains solids, liquids, or gases, having a capacity of not less than 450 L when used for the transport of gases. [1]

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. [92]

Teletherapy

Treatment with external radiation beam(s) where the distance from source to skin is greater than 5 cm. [1]

Termination of Responsibility²⁶

The release by the regulatory body of a licensee from any further regulatory responsibilities in relation to the licenced facility or licenced activity. [1M]

²⁶ This may be a separate process from termination of a Licence of a facility / activity or Release of premise or site from regulatory control.

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. [1]

Tomography

Radiography of one or more sections/layers within an object. [67]

Topography

The configuration of a terrain giving general description of physical features like hills, valleys, slopes, water bodies and other man-made structures. [87]

Toxic Material

Material that causes ill health or fatality of human being at or above a specified concentration. [106M]

Transport

The deliberate physical movement of radioactive material (other than that forming part of the means of propulsion) from one place to another for carriage by any mode of transport. [1M]

Transport Index (TI)

Transport index (TI) assigned to a package, overpack or freight container, or to unpackaged LSA-I, SCO-I or SCO-III, shall mean a number that is used to provide control over radiation exposure. [1]

Treatment Planning (Radiotherapy)

Planning of the techniques for radiation therapy, which may include treatment simulation and dosimetry. [19]

Treatment Simulation

Methods by which the techniques and patient positioning for radiotherapy are simulated without delivering the therapy dose. [19]

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. [87]

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. [87]

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. [100]

Type Approval

A type of regulatory instrument issued by the regulatory body for sealed sources, radiation generating equipment, equipment containing radioactive sources, and package design for transport of radioactive material for the purposes of manufacture and supply or any other sources or practice as notified under Rule 3 of Atomic Energy (Radiation Protection) Rules, 2004. [15]

Type A Package

(See Package)

Type B(M) Package

(See Package)

Type B(U) Package

(See Package)

Type C Package

(See Package)

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. [90]

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. [68]

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. [68]

Unilateral approval

Unilateral approval shall mean an approval of a design that is required to be given by the competent authority of the country of origin of the design only. [22]

Uninterrupted Power Supply (UPS)

A system that converts input AC electric power to controlled and filtered AC power that provides uninterrupted power supply for a defined duration, even with deterioration/loss of input AC power. [57]

Unirradiated Thorium

Thorium containing not more than 10^{-7} g of ^{233}U per gram of ^{232}Th . [1]

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 . [1M]

Unrestricted Use

Any release or use of materials, equipment, buildings or site without any restriction imposed by the regulatory body. [107]

Unsealed source

Any radioactive material that is not a sealed source. [15]

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%). [1]

Urgent Protective Action (UPA)

See "Protective Action"

Urgent Protective Action Planning Zone (UPZ)

See "Emergency Planning Zones"

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. [66]

Validation

The process of determining whether a product or service is adequate to perform its intended function satisfactorily. [1]

Validation (Computer Code)

Assessment of the accuracy of values predicted by the computer code against relevant experimental data or observations from operational transients for the important phenomena expected to occur. [1M]

Verification

The act of reviewing, inspecting, testing, checking, auditing, or otherwise determining and documenting whether items, processes, services or documents conform to specified requirements. [51]

Verification (Computer Code)

The process of determining that the controlling physical and logical equations have been correctly translated into computer code. [108]

Waste

Waste means radioactive waste. [38]

Waste Form

The waste in its physical and chemical form after treatment and/or conditioning (resulting in a solid product) prior to packaging. [1]

Waste Immobilisation

Conversion of waste into a waste form by solidification, embedding or encapsulation. The aim is to reduce the potential for migration or dispersion of radionuclides during handling, transport, storage and/or disposal. [8]

Waste Management

All administrative and operational activities involved in the handling, pre-treatment, treatment, conditioning, transport, storage and disposal of radioactive waste. [1]

Waste Package

The product of conditioning that includes the waste form and any container(s) and internal barriers (e.g. absorbing materials and liner), as prepared in accordance with requirements for handling, transport, storage and/or disposal. [1]

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. [85]

Wave Run-up

The rush of water of a structure or beach on the breaking of a wave, also called uprush. The amount of run-up is the vertical height above the still water level that the rush of water reaches. [48]

Worker

See "radiation worker"

Worker (Factories Act, 1948)

A person employed, directly or by or through any agency (including a contractor) with or without the knowledge of the principal employer, whether for remuneration or not, in any manufacturing process, or in cleaning any part of the machinery or premises used for a manufacturing process, or in any other kind of work incidental to, or connected with, the manufacturing process, or the subject of the manufacturing process, [but does not include any member of the armed forces of the Union;] [71]

Working Level (WL)

A unit of potential alpha energy concentration (i.e. the potential alpha energy per unit volume of air) resulting from the presence of radon progeny or thoron progeny, equal to 1.3×10^5 MeV per litre. In SI units, a working level is 2.1×10^{-5} J/m³. [60]

Note: The term working level is now obsolete and its use is discouraged.

Working Level Month (WLM)

The exposure to radon progeny or thoron progeny which would be incurred during a working month (170 hours) in a constant potential alpha energy concentration of one working level. In SI units, a working level month is 3.54×10^{-3} Jh/m³. [60]

Note: The term working level is now obsolete and its use is discouraged.

Workload (W)

A parameter described, in terms of radiation output integrated over a period of time used for radiation protection calculations, expressed as Roentgen (or Sv) per week at reference distance from the source. [66M]

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. [42]

X-ray tube

An evacuated vessel for the production of X-rays by the bombardment of a target, usually contained in an anode with electrons accelerated from a cathode by an electric field.[109]

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Reconstituted (CH/AERB/COMM/25/2017/3312 dated December 22, 2017)

AERB GLOSSARY REVIEW COMMITTEE (AERB-GRC)

Dates of Meetings

January 23, 2018	February 7, 2019
February 15, 2018	May 23, 2019
March 15, 2018	July 24, 2019
April 17 & 24, 2018	August 7, 2019
May 02, 2018	August 28, 2019
May 11, 2018	September 25, 2019
June 08, 2018	October 15, 2019
June 19, 2018	November 6, 2019
July 01, 2018	December 11, 2019
August 01, 2018	December 23, 2019,
August 31, 2018	February 5, 2020
September 14, 2018	
October 29, 2018	

April-September, 2020-Work from Home

November 3, 2020
November 10, 2020
December 14, 2020.

Members of Reconstituted GRC

Dr. R.B. Solanki, RDD	Convener
Shri Soumen Sinha, DRA&C	Member
Shri V.R. Dhotre, NPSD	Member
Shri Surendra Jain, NPSD	Member
Shri Dinesh M. Rane, RSD	Member
Dr. MayankVerma, NPSD	Member
Smt. Bharti Ingavale, NPSD	Member
Shri R.K. Chaturvedi, RSD	Member
Shri C. Nachiketa, NPSD	Member
Smt. Debanwita Paul, NPSD	Member
Dr. Alok Pandey, RSD	Member
Shri T. Ramesh, NPSD	Member
Smt. Poorva Kaushik, OPSD	Member
Shri SomnathJha, NPSD	Member
Shri Rajoo Kumar, RDD	Member-Secretary
Shri Kavi Upreti, RDD	Permanent Invitee (Partly)
Shri Sameer Sheikh, RDD	Permanent Invitee (Partly)

ADVISORY COMMITTEE ON NUCLEAR AND RADIATION SAFETY (ACNRS)

Date of meeting: March 22, 2022

Shri S.S. Bajaj, Former Chairman, AERB	-	Chairman
Shri C.S. Varghese, ED & Chairman SARCOP, AERB	-	Member
Shri D.K. Shukla, Former Chairman, SARCOP, AERB	-	Member
Dr. M.R. Iyer, Former Head, RSSD, BARC	-	Member
Prof. C.V.R. Murty, Dept. of Civil Engg, IIT, Chennai	-	Member
Shri S.C. Chetal, Former Director, IGCAR	-	Member
Shri H.S. Kushwaha, Former Dir(HS&E Grp.), BARC	-	Member
Shri S.K. Ghosh, Former Dir (Ch. Engg. Grp.), BARC	-	Member
Shri K. K. Vaze, Former Dir (RD&D Group), BARC	-	Member
Dr. N. Ramamoorthy, Former CE, BRIT & AD, BARC	-	Member
Shri A. R. Sundararajan, Former Dir (RSD), AERB	-	Member
Shri Atul Bhandarkar, Director (T), NPCIL	-	Member
Shri Sanjay Kumar, Director (T-LWR), NPCIL	-	Member
Dr. A. N. Nandakumar, Former Head, RSD, AERB	-	Member
Shri A Jyothish Kumar, Director (O), BHAVINI	-	Member
Shri H. Ansari, Head, RDS, R&DD, AERB	-	Mem-Secy

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