CODE NO. AERB/NRF/SC/NRE

GOVERNMENT OF INDIA

AERB SAFETY CODE

SAFETY CODE ON

MANAGEMENT OF NUCLEAR AND RADIOLOGICAL EMERGENCIES

ATOMIC ENERGY REGULATORY BOARD

AERB SAFETY CODE NO. AERB/NRF/SC/NRE

Safety Code on

Management of Nuclear and Radiological Emergencies

Atomic Energy Regulatory Board
Mumbai –400094
India

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FOREWORD

Activities concerning establishment and utilisation of nuclear facilities and use of radioactive sources are to be carried out in India in accordance with the relevant provisions of the Atomic Energy Act, 1962. In pursuance of the objective of ensuring safety of occupational workers and members of the public, as well as protection of environment, the Atomic Energy Regulatory Board (AERB) has been entrusted with the responsibility of laying down safety standards and enforcing rules and regulations for such activities. The Board has, therefore, undertaken a programme of developing safety codes, safety standards and related guides and manuals for the purpose. While some of the documents cover aspects such as siting, design, construction, operation, quality assurance and decommissioning of nuclear and radiation facilities, other documents cover regulatory obligations of the licensee and the responsibilities of the regulatory body.

This safety code on Management of Nuclear and Radiological Emergencies is issued under the enabling provision of Atomic Energy (Radiation Protection) Rules, 2004 and as mandated in National Disaster Management Plan (NDMP) issued by National Disaster Management Authority (NDMA). AERB safety codes are used to specify regulatory requirements specific to nuclear and radiological safety that are to be fulfilled by the Licensee. Provisions corresponding to this Code are wider, as this Safety Code specifies the requirements that are to be fulfilled by the licensees and various other authorities / agencies responsible for management of nuclear and radiological emergencies, in line with those prescribed by NDMA in NDMP. The name of concerned regulatory bodies which are responsible for stipulating specific requirements that are to be complied by their Licensee are mentioned in the respective safety guides that provide detailed guidance to fulfil the requirements of this safety code

The requirements prescribed in this code are derived from relevant national and international safety standards, developments including the change in the approach to public protection during emergency conditions as elaborated in ICRP publications, IAEA general safety requirements, lessons learnt from the Fukushima accident among others and subsequent safety review of Indian nuclear power plants (NPPs). Further, the requirements are drafted based on various basis documents developed by AERB in consultation with DAE Units towards framing the regulations and guidance in management of nuclear and radiological emergencies. This code also consolidates and supersedes the existing AERB requirements on emergency preparedness and response.

This safety code has been drafted by in-house working group. The draft was further reviewed by a task force with specialists drawn from relevant national organizations and institutions, and other consultants. Comments have been obtained from all major stake holders and they have been suitably incorporated. The safety code has been reviewed by the AERB Advisory Committee on Nuclear and Radiation Safety (ACNRS).

AERB wishes to thank all individuals and organisations who have contributed towards the review and finalization of the code. The list of persons, who have participated in this task is included for information.

(G Nageswara Rao)

Chairman, AERB

DEFINITIONS

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 and safety.

Assessment[1]
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.

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. .

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

Deterministic Effect
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.

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

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.

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

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

the basis for the development of other plans, procedures and checklists.

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.

Emergency Response
The performance of actions to mitigate the consequences of an emergency for human life and health, property and the environment.

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 response organizations, such as police officers, firefighters, medical personnel, and drivers and crews of evacuation vehicles.

Note: Emergency workers may or may not be designated as such in advance of an emergency. Emergency workers not designated as such in advance of an emergency are not necessarily workers prior to the emergency.

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. (*Also see protection of environment)*

Environmental Monitoring
The measurement of external dose rates due to sources in the environment or of radionuclide concentrations in environmental media.

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

Event
An event is 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.

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.

Licensee [2]

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

Long Term Protective Action

See 'Protective Action' Notification

(1) A set of actions taken upon detection of emergency conditions with the purpose of alerting all organizations with responsibility for emergency response in the event of such conditions.

(2) A document submitted to the regulatory body by a person or organization to notify an intention to carry out a practice or other use of a source.

Note: This includes the notification of appropriate competent authorities by a consignor that a shipment will pass through or into their countries, as required in Transport Regulations.

(3) A report submitted promptly to a national or international authority providing details of an emergency or a possible emergency; for example, as required by the Convention on Early Notification of a Nuclear Accident.

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.

Nuclear Fuel Cycle

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

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[2] 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 'Authorization' is issued can be termed as 'Licensee' as well as 'Authorized Person'. As per AE (RP) Rules, roles and responsibilities are defined for Licensee, which may not be applicable in-toto to 'Authorized Person'

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.

Off-Site
Area in public domain beyond the site boundary.

Off-Site Emergency
An emergency due to an event resulting in an actual release, or potential of imminent release, requiring implementation of protective actions and other response actions off the site.

Note: The term 'off-site emergency' is synonymous to the term 'general emergency' used in international documents.

On-site
See 'Site'

Projected Dose
The dose that would be expected to be received if planned protective actions were not taken.

Protective Action
An emergency response action for the purposes of avoiding or reducing doses that might otherwise be received in an emergency exposure situation or an existing exposure situation.

Urgent protective action. A protective action in the event of a nuclear or radiological emergency which must be taken promptly (usually within hours to a day) in order to be effective, and the effectiveness of which will be markedly reduced if it is delayed.

Note : Urgent protective actions include iodine thyroid blocking, evacuation, short term sheltering, actions to reduce inadvertent ingestion, decontamination of individuals and prevention of ingestion of food, milk or drinking water possibly with contamination.

A precautionary urgent protective action is an urgent protective action taken before or shortly after a release of radioactive material, or an exposure, on the basis of the prevailing conditions to avoid or to minimise severe deterministic effects.

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 restriction of the consumption of food potentially affected by contamination.

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.

Other response action. An emergency response action other than a protective action.

Note : The most common other response actions are: medical examination, consultation and treatment; registration and longer term medical follow-up; providing psychological counselling; and public information and other actions for mitigating non-radiological consequences and for public reassurance.

Precautionary urgent protective action
See 'Protective Action'

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

Radioactive Waste[3]
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. .

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

[3] It should be recognized 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

an existing exposure situation, and below which optimization of protection and safety would continue to be implemented. .

Note: The chosen value for a reference level will depend upon the prevailing circumstances for the exposure under consideration.

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.

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. .

Site

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

Special Definitions

Command
The act of directing, coordinating, ordering and controlling resources by virtue of explicit legal delegated authority.

Control
The function or power or (usually as controls) means of directing, regulating or restraining.

Dangerous Source
A source that could, if not under control, give rise to exposure sufficient to cause severe deterministic effects. This categorization is used for determining the need for emergency arrangements and is not to be confused with categorizations of sources for other purposes.

Note: The term dangerous source relates to dangerous quantities of radioactive material (D values).

Disaster
A catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or manmade causes, or by accident or negligence which results in substantial loss of life or human suffering or damage to, and destruction of, property, or damage to, or degradation of, environment, and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area

Emergency Action Levels (EALs)
A specific, predetermined criterion for observable conditions used to detect, recognize and determine the emergency class.

Note: An emergency action level could represent an instrument reading, the status of a process system/equipment or any observable event, such as a fire release of hazardous chemical, storms and earthquake.

Emergency class
A set of conditions that warrant a similar immediate emergency response.

Note: This is the term used for communicating to the response organizations and to the public the level of response needed. The events that belong to a given emergency class are defined by criteria specific to the installation, source or activities, which, if exceeded, indicate classification at the prescribed level. For each emergency class, the initial actions of the response organizations are predefined.

Emergency Classification
The process whereby an authorized official classifies an emergency in order to declare the applicable emergency class.

Note: Upon declaration of the emergency class, the response organizations initiate the predefined emergency response actions for that emergency class.

Emergency Response Action
An action to be taken in response to a nuclear or radiological emergency to mitigate the consequences of an emergency for human life and health, property and the environment.

Note: Emergency response actions comprise protective actions and other emergency response actions.

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 or training.

Emergency Services
The local off-site response organizations that are generally available and that perform emergency response functions. These may include police, firefighters and rescue brigades, ambulance services and control teams for hazardous materials.

Exposure situations
The exposure situation is indicated by the circumstances of exposure of the individual(s) undergoing exposure.

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.

Note: Exposure in an emergency can include both occupational exposure and public exposure, and can include unplanned exposures resulting directly in the emergency exposure situation and planned exposures to emergency workers and helpers in an emergency undertaking actions to mitigate the consequences of the emergency.

Exposure in an emergency can be reduced only by protective actions and other response actions.

Existing Exposure Situation

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

Note: 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.

Planned Exposure Situation

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.

Note: Since provision for protection and safety can be made before embarking on the activity concerned, associated exposures and their probabilities of occurrence can be restricted from the outset.

The primary means of controlling exposure in planned exposure situations is by good design of installations, equipment and operating procedures. In planned exposure situations, a certain level of exposure is expected to occur.

Hazard Assessment

Assessment of hazards associated with facilities, activities or sources within or beyond the borders of a Country in order to identify:

(a) those events and the associated areas for which protective actions and other emergency response actions may be required within the Country;
(b) actions that would be effective in mitigating the consequences of such events.

Inner Cordoned Off Area

An area established by first responders in an emergency around a potential radiation hazard, within which protective actions and other response actions are taken to protect first responders and the public from possible exposure and contamination.

Interested Parties

A person, company, etc. with a concern or interest in the activities and performance of an organization, business, system, etc.

Local Authority

Local authorities would include Panchayat Raj Institutions (PRI), Municipalities, District and Cantonment Boards, and Town Planning Authorities or Zila Parishad or any other body or authority, by whatever name called, invested by

law, for rendering essential services or, with the control and management of civic services within a specified local area.

Mitigatory Action

Immediate action by the operator or other party:

(1) To reduce the potential for conditions to develop that would result in exposure or a release of radioactive material requiring emergency actions on or off the site; or

(2) To mitigate source conditions that may result in exposure or a release of radioactive material requiring emergency actions on or off the site.

Note: Source conditions refer to the status of core and confinement of radioactive material.

Non-radiological Consequences

Adverse psychological, societal or economic consequences of a nuclear or radiological emergency or of an emergency response affecting human life, health, property or the environment.

Observables / Indicators

Observables / indicators are instrument readings or other parameters which provide information on the conditions on the scene.

Operational Criteria

Values of measurable quantities or observable conditions (i.e. observables) to be used in the response to a nuclear or radiological emergency in order to determine the need for appropriate protective actions and other response actions.

Note: Operational criteria used in an emergency include operational intervention levels (OILs), emergency action levels (EALs), specific observable conditions (i.e. observables) and other indicators of conditions on the site. Operational criteria are sometimes referred to as triggers.

Operational Interventional Levels

A set level of a measurable quantity that corresponds to a generic criterion.

Note: Operational intervention levels are typically expressed in terms of dose rates or of activity of radioactive material released, time integrated air activity concentrations, ground or surface concentrations, or activity concentrations of radionuclides in environmental, food or water samples.

Note: An Operational intervention level is used immediately and directly (without further assessment) to determine the appropriate protective actions on the basis of an environmental measurement.

Other Response Action

See 'Protective Action'

Persons with disability
Persons with disabilities include those who have long -term physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others.

Protection of environment
Protection and conservation of: non-human species, both animal and plant, and their biodiversity; environmental goods and services such as the production of food and feed; resources used in agriculture, forestry, fisheries and tourism; amenities used in spiritual, cultural and recreational activities; media such as soil, water and air; and natural processes such as carbon, nitrogen and water cycles.

Protection strategy
The set of combined protective actions that are implemented, for a given exposure situation and prevailing circumstance, to keep or reduce exposure as low as reasonably achievable.

Response Organization
An organization designated or recognized as being responsible for managing or implementing any aspect of an emergency response.

Note: This also includes those organizations or services necessary to support the management and/or conduct of an emergency response, such as meteorological services.

Scenario
A postulated or assumed set of conditions and/or events.

Note: Most commonly used in analysis or assessment to represent possible future conditions and/or events to be modelled, such as possible accidents at a nuclear facility, or the possible future evolution of a disposal facility and its surroundings. A scenario may represent the conditions at a single point in time or a single event, or a time history of conditions and/or events (including processes).

Site Area
A geographical area that contains an authorized facility, authorized activity or source, and within which the management of the authorized facility or authorized activity may directly initiate emergency actions.

Special Facility
A facility for which predetermined facility specific actions need to be taken if urgent protective actions are ordered in its locality in the event of a nuclear or radiological emergency.

Examples include chemical plants that cannot be evacuated until certain actions have been taken to prevent fire or explosions and telecommunications centres that must be staffed in order to maintain telephone services.

Special Population Groups
Members of the public for whom special arrangements are necessary in order for effective protective actions to be taken in the event of a nuclear or radiological emergency. Examples include persons with disabilities, hospital patients and prisoners.

Transient Population Group
Those members of the public who are residing for a short period of time (days to weeks) in a location (such as a camping ground) that can be identified in advance. This does not include members of the public who may be travelling through an area.

Trigger
A level or condition that is selected to act as an initiator for setting off an event or action (especially a response)

Urgent Protective Action
See 'Protective Action'

Volunteer
Member of the public who willingly and voluntarily helps in the response to a nuclear or radiological emergency.

Note: volunteer in an emergency are protected and are aware that they could be exposed to radiation while helping in response to a nuclear or radiological emergency.

Contents

1. INTRODUCTION

1.1. General

1.1.1. Radiation and radioactive substances have many beneficial applications, ranging from power generation to uses in medicine, industry and agriculture. Nuclear fuel cycle and radiation facilities are designed, sited, constructed and operated under regulatory control with utmost consideration of safety. However, there is still a small residual potential for the occurrence of an accident resulting in radioactive releases that could affect the safety of workers and members of the public, as well as property and environment.

1.1.2. Emergencies can occur at nuclear fuel cycle facilities, radiation facilities and during transport of radioactive material. To deal with any emergency and also to mitigate the consequences if any, emergency preparedness and response plan are required to be established depending on the nature and type of facilities and activities, and in accordance to the potential hazard.

1.1.3. Management of nuclear or radiological emergencies involves various agencies including the operating organization and response organizations at the local[4], state and national levels depending on severity of emergencies. It might also involve specialized agencies and technical experts.

1.1.4. Licensee shall comply with relevant regulatory requirements as specified by the concerned regulatory body as mandated by NDMP. The fulfilment of requirements at local, state and national level is to be overseen by the respective authorities.

1.2. Objective

1.2.1. Objective of this safety code is to specify the requirements that are intended to mitigate the consequences of a nuclear or radiological emergency if such an emergency arises despite efforts made to prevent it.

1.3. Scope

1.3.1 The requirements specified in the code apply for preparedness and response phases for a nuclear and radiological emergency in relation to all those facilities (including nuclear power plants) and activities, as

[4] Local level include, village panchayat/ward, block/municipality/ municipal corporation/city council, District/Zila parishad

well as sources, including fallout from nuclear accident in neighbouring countries with the potential for causing radiation exposure to the individual (workers and public), environmental contamination or concern on the part of the public warranting protective actions and other response actions. This code applies to on-site and off-site preparedness and response for nuclear and radiological emergencies including emergencies during transport of radioactive material.

1.3.2 This safety code applies to the preparedness and response for a nuclear and radiological emergency irrespective of the initiating cause of the emergency, whether the emergency follows a natural event, human error, mechanical or other failure or event due to breach of security provisions[5] at the site.

1.3.3 Long term remedial actions as part of existing exposure situation are excluded from the scope of this Code.

[5] Preparedness and response for a nuclear attack or explosion of radiation dispersal devices or explosion of improvised nuclear device is not within the scope of this Code.

2. GOAL OF EMERGENCY PREPAREDNESS AND RESPONSE

2.1. General

2.1.1 Emergency preparedness and response shall have a well-defined goal towards adequate infrastructure and capabilities to deal with any nuclear and radiological emergency situation *with emphasis on response actions that result in doing more good than harm*.

2.2. Goal of Emergency Preparedness

2.2.1 The goal of emergency preparedness is to ensure that adequate capability is in place with the licensee and response organisations at local, state and national levels and, where appropriate, at the international level, for an efficient management of nuclear or radiological emergency situation. This capability relates to an integrated set of infrastructural elements that include authority and responsibilities, organization and staffing, coordination, plans and procedures, tools, technologies, equipment and facilities, training, exercises and a management system. The above aspects shall be reflected in the emergency preparedness and response plan of the licensee and the relevant government authorities, as appropriate.

2.3. Goal of Emergency Response

2.3.1 The goal of emergency response in a nuclear and radiological emergency is to:

a) Save human lives;
b) Regain control of the situation and to mitigate consequences;
c) Avoid or minimize severe deterministic effects;
d) Render first aid and manage the treatment of radiation injuries;
e) Reduce the risk of stochastic effects;
f) Keep the public informed and to maintain public trust;
g) Mitigate, to the extent practicable, non-radiological consequences;
h) Protect, to the extent practicable, property and the environment;
i) Prepare, to the extent practicable, for the resumption of normal social and economic activity.

2.3.2 It is recognized that emergency response actions undertaken to mitigate the radiological consequences, may also have undesirable non-radiological consequences. The authority(ies) responsible for implementation of emergency response actions shall ensure that any actions in public domain shall do more good than harm considering

both radiological and non-radiological aspects. Therefore the response actions in public domain shall be justified and optimised, such that the overall benefit from these actions clearly outweighs the harmful effects of both radiological and non-radiological impacts.

3. NATIONAL FRAMEWORK FOR EMERGENCY MANAGEMENT

3.1. General

3.1.1 The Disaster Management Act, 2005 (DM Act, 2005) lays down institutional and coordination mechanism at the national, state and local levels for effective disaster management which also includes nuclear and radiological emergencies. Section 23, 31 and 37 of the said DM Act mandates that responsible Ministry, Department, State and local authorities must prepare response plans. Sections 35-41 of the said DM Act enable central and state governments and local authorities to make provisions for the implementation of the respective response plans, as necessary.

3.1.2 National Disaster Management Authority (NDMA) established in 2005 under the provisions of Disaster Management Act, 2005 is the apex body for laying down the policies, plans, and guidelines for disaster management for ensuring timely and effective response actions.

3.1.3 National Disaster Management Plan (NDMP) provides a framework and direction to the government agencies for emergency management. The relevant administrative authorities – central or state or local– will carry out response actions in different phases in the affected areas depending on the scale of the emergency. The administrative authorities are assisted by special response forces, armed forces, other uniformed services and government organizations / agencies as necessary during the response.

3.1.4 Department of Atomic Energy (DAE) is the nodal department for technical support during management of nuclear or radiological emergencies. DAE coordinates its actions through the Crisis Management Group-DAE (CMG-DAE) at the national level. At the local level, the Licensee/employer/plant management/CMG-DAE, as applicable provide required technical input to, and coordinate with local/state authorities designated for response actions. DAE is responsible for liaison with IAEA and other International organizations as applicable with respect to nuclear and radiological emergency.

3.2. Responsibilities

3.2.1 The licensee shall be responsible for the management of nuclear or radiological emergencies within the site of the facility. The licensee shall have emergency preparedness and response plan approved by the concerned regulatory body and shall establish mechanism for

management of these emergencies. The state / local authorities are responsible for the management of nuclear or radiological emergencies in public domain (Off-site). The state / local authorities shall have an approved emergency preparedness and response plan and establish the required infrastructure as per the plan.

3.2.2 In the case of transport of radioactive material, the consignor shall be responsible for providing appropriate emergency instructions to the carrier and for extending the necessary assistance to state/local authorities in the management of an emergency involving the radioactive consignment. In the case of an emergency involving the transport of an imported radioactive material at the time of or immediately after the receipt of the consignment (e.g. package received in a damaged condition), the consignee shall provide the relevant technical information and in coordination with the consignor, where applicable, extend the necessary support to the concerned response organizations.

3.2.3 The concerned regulatory body (ies) is/are responsible for stipulating the requirements, provide guidance on various protective actions for management of nuclear and radiological emergencies, based on the generic requirements and guidance, and as necessary, in addition to those prescribed by AERB. The concerned regulatory body reviews and approves the emergency preparedness and response plan of the licensee. The regulatory body will also review the emergency preparedness and response plan of local authorities prior to their approval by respective authority. During an emergency, regulatory body is responsible for keeping itself apprised of situation, review of response actions and inform public as and when necessary. Concerned regulatory bodies (other than AERB) may seek assistance/advice from AERB/DAE-CMG in discharge of above functions.

4. GENERAL REQUIREMENTS

This section spells out general requirements for emergency preparedness and response detailing organisational and their functional responsibilities to ensure adequate planning for nuclear and radiological emergencies.

4.1. Emergency Management System

4.1.1 An integrated and coordinated emergency management system under the legal framework provided by Disaster Management Act, 2005, Atomic Energy Act, 1962 and rules made thereunder shall be established and maintained to fulfil the purposes of emergency response in the event of a nuclear or radiological emergency.

4.1.2 The emergency management system shall be integrated into all-hazards management system commensurate with the results of the hazard assessment, including very low probability events.

4.1.3 All response organizations including licensee shall have necessary resources commensurate with their roles and responsibilities to deal with both radiological and non-radiological consequences of nuclear and radiological emergencies.

4.1.4 The licensee as well as other response organizations shall demonstrate leadership in relation to preparedness and response for a nuclear or radiological emergency.

4.2. Organizational Arrangement for Emergency Management

4.2.1 The Ministry/Authority at national level, at the preparedness stage, shall make arrangements for enforcing compliance with the national plan for disaster management and requirements for emergency preparedness and response as established by legislation.

4.2.2 Department of Atomic Energy shall coordinate and provide technical support to Ministry/Authority at national level and authorities at state/local level to ensure,

(a) Roles and responsibilities are clearly specified and understood by the authorities responsible for emergency management, including the operating organisation, response organisation and the regulatory body.

(b) Local and State authorities understand the level of hazard, its consequences and periodically review the same.

(c) The emergency arrangements, including arrangements for response to relevant nuclear security events, of the local

administrations and licensees are consistent with each other and with the requirements of regulatory bodies.

4.2.3 The state/local authorities shall

(a) Ensure integration of emergency arrangements, security plans of licensee as specified by the regulatory body and the response plan of authorities in charge of nuclear security, as relevant;
(b) Coordinate communication with the public in preparedness for a nuclear or radiological emergency.

4.2.4 The regulatory body shall

(a) Ensure and verify that arrangements for preparedness and response to a nuclear and radiological emergency for facilities and activities under purview of licensee are adequate.
(b) Establish regulations and guidelines to specify the principles, requirements and associated guidance and criteria for emergency preparedness and response.
(c) Establish guidance on emergency management for radioactive material out of regulatory control or radioactive sources that have been abandoned, lost or stolen.
(d) Verify that appropriate arrangements for emergency response are in place before the commencement of operation of the facility or commencement of the activity.
(e) Establish arrangements to keep itself informed about the emergency situation and conducting independent assessment of the emergency situation.

4.2.5 The licensee shall

(a) Establish and maintain arrangements for on-site preparedness and response for a nuclear or radiological emergency for facilities or activities under its responsibility, in accordance with the applicable regulatory and legislative requirements.
(b) Maintain and periodically demonstrate that arrangements are in place for an effective response on the site to a nuclear or radiological emergency in relation to a facility or an activity under its responsibility.
(c) Ensure that arrangements and response actions for an emergency situation on the site are:
    1) Integrated with those of other response organizations, as appropriate, including changeover of responsibilities between response organizations at different stages of emergency;

2) Integrated with accident management plan or contingency plans and security plans.

(d) Ensure that in an actual emergency, the regulatory body is promptly updated with informations on the emergency conditions including the emergency classification, safety significance, radiological conditions and exposure to personnel and emergency workers.

4.2.6 The licensee and the consignor in the case of transport of radioactive material shall promptly take necessary protective actions on the site in response to a nuclear and radiological emergency arising during transport of radioactive material. In case of transport emergencies in the public domain, the licensee and the consignor shall coordinate with the nodal department (DAE) for providing technical support to local authorities for taking protective actions.

4.2.7 All the involved agencies shall ensure coordination of national emergency arrangements. Identified agency shall ensure consistency of national emergency arrangements with the relevant international emergency arrangements[6].

4.3. Hazard Assessment

4.3.1 The Licensee shall identify hazards of the facility and activities and assess the potential consequences to provide a basis for establishing arrangements for preparedness and response for a nuclear or radiological emergency. Established arrangements shall adopt a graded approach and be commensurate with the hazards and the potential consequences.

4.3.2 The hazard assessment carried out by the Licensee shall consider the following:

(a) Events that could affect the facility or activity, including events of very low probability and events not considered in the design;

(b) Events involving a combination of a nuclear or radiological emergency with a conventional emergency including natural calamity, and other events such as an aircraft crash, a chemical emergency, a pandemic situation, or civil disturbances that could affect wide areas and/or could impair capabilities to provide support in the emergency response;

(c) Events that could affect several facilities and activities at the site concurrently, as well as consideration of the interactions between the facilities and activities affected;

[6] for example, the Assistance Convention and the Early Notification Convention.

(d) Events at facilities in other countries or events involving activities in other countries;

(e) Results of threat assessments made for nuclear security purposes.

(f) An unforeseen medical or other emergency which has potential to affect a large number of plant personnel along with restrictions on movement of personnel and resources.

4.3.3 The outcome of the hazard assessment carried out following a realistic method shall include, but not limited to, understanding of the composition of the source, magnitude of the areas that are likely to be affected, requirements on the resources and means to reduce the consequence based on meteorological condition, topography of the area and demographic attributes.

4.3.4 The hazard assessment shall be reviewed periodically with the aim of taking into account any changes in the hazards or assessment of security threats, the experience and lessons from research, operation and emergency exercises, technological developments and changes in demographic pattern of public. This shall be used to revise the emergency arrangements as necessary.

4.3.5 The hazard assessment shall identify non-radiation-related hazards to people on the site and off-site that are associated with the facility or activity and that may impair the effectiveness of the response actions to be taken.

4.3.6 The nodal department shall identify those facilities and locations where there is a significant likelihood of encountering a dangerous source that is not under regulatory control[7].

4.4. Protection Strategy for a Nuclear or Radiological Emergency

4.4.1 The responsible organizations (licensee, nodal department, local authorities and consignor in the case of transport of radioactive material) shall ensure that on the basis of the hazards identified and the potential consequences of a nuclear or radiological emergency, protection strategies are developed. This shall consider all exposure pathways and all relevant protective actions in deciding on the optimum course of action.

4.4.2 The protection strategy and each protective action shall need to be justified (i.e. to do more good than harm), with account taken not only

[7] Examples of such facilities and locations are: facilities where dangerous sources (legacy sources) might have been used in the past, scrap metal processing facilities, border crossing points, seaports, airports, and other locations.

of those detriments that are associated with radiation exposure but also of those detriments associated with impacts of the actions taken on public health (including psychological effects and health effects due to change in lifestyle), the economy, society and the environment.

4.4.3 Protection strategies developed based on hazards identified, shall include, but shall not be limited to, the following:

(a) Actions to be taken to avoid or to minimize severe deterministic effects and to reduce the risk of stochastic effects;

(b) Setting up of reference levels expressed in terms of residual dose to plan protective measure commensurate with the phase of emergency. This reference level shall be used in conjunction with the goals of emergency response and specific time frame in which the particular emergency response goals are to be achieved.

(c) Application of generic criteria and operational criteria to initiate a protective measure that is part of the protection strategy.

4.4.4 The protection strategy shall be implemented safely and effectively in an emergency response by executing the following inter alia:

(a) Promptly taking 'urgent protective actions' and other response actions to avoid or to minimize severe deterministic effects. This includes precautionary action taken before or shortly after any exposure occurs;

(b) Taking 'early protective actions' and other response actions to reduce the risk of stochastic effects;

(c) Taking actions to mitigate non-radiological consequences;

(d) Assessing the effectiveness of the actions taken and adjusting them as appropriate on the basis of prevailing conditions and available information as well as the reference level prescribed in terms of residual dose;

(e) Revising the protection strategy as necessary and its further implementation;

(f) Providing for health screening and long term medical follow-up, as appropriate;

(g) Taking actions to protect emergency workers and volunteers;

(h) Discontinuing protective actions and other response actions when they are no longer justified.

The basis and justification of the protection strategy shall be communicated to all interested parties as appropriate.

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5. FUNCTIONAL REQUIREMENTS

This section spells out the functional requirements necessary for response to nuclear and radiological emergencies.

5.1. Management of Operations during Emergency

5.1.1 All response organisations shall adhere to clearly specified and unified command and control system under the all-hazards approach as part of the emergency management system for execution and management of emergency response functions.

5.1.2 The system shall ensure transition from normal operation to operation under emergency without impairing the performance of the continuing operational safety and security functions both at the facility and at any other facilities on the same site.

5.1.3 All the emergency response arrangements shall be integrated with nuclear security measures so that application of one will not compromise the other.

5.1.4 Arrangements for response to a nuclear or radiological emergency shall be coordinated and integrated with arrangements at the local, state and national levels for response to a conventional emergency, and to a nuclear security event. These arrangements shall take into consideration the fact that the initiating cause of the nuclear or radiological emergency may not be known early in the response.

5.1.5 Arrangements shall be made for protection of response personnel in the facility and in the public domain even under challenging situations such as pandemics to ensure continued emergency response.

5.1.6 The licensee and the consignor (in the case of transport of radioactive material) shall provide technical assistance to the emergency response personnel.

5.1.7 Mechanism shall be established to collect information necessary for appropriate allocation of resources for all response organizations throughout the emergency.

5.1.8 Adequate arrangements shall be made for communication and coordination with the responders and interested parties.

5.2. Identification, Notification and Activation of Response

5.2.1 The licensee shall make arrangement to identify and classify emergency conditions through an emergency classification system. The

arrangement shall be based on hazard assessment and include pre-defined action levels and other observable conditions that allows for prompt classification.

5.2.2 The classification system shall identify various emergency classes in accordance to the requirement of the emergency conditions considering the impact on safety systems, potential for further degradation of safety and the consequence on people and environment.

5.2.3 Declaration of appropriate emergency class shall be made and coordinated response action shall be initiated (see clause 5.2.7).

5.2.4 A notification process shall be established to notify the emergency class including communication to alert necessary personnel for assembly and activation of emergency response organizations and facilities. The communication/notification shall also include information/set of conditions that may be necessary to initiate effective response.

5.2.5 Notification points to receive alerts and information on emergency conditions shall be established in line with the overall response framework involving various agencies at local, state and national levels. Such points shall be maintained in a state of availability for the purpose of receiving notification, request for support or to initiate prompt and coordinated response.

5.2.6 Managers of the facilities and locations where there is a significant likelihood of dangerous sources that are not under regulatory control, shall be aware of indicators of potential emergency and necessary notification (also refer Clause 4.3.6).

5.2.7 The overall process of emergency classification, declaration, notification and activation shall be conducted by the pre-identified response agencies in accordance with the identified response time objectives.

5.2.8 Appropriate emergency response actions shall be initiated in a timely manner upon the receipt of a notification from neighbouring countries or of information from the IAEA on a notification relating to an actual or potential radioactive fallout from nuclear accident in neighbouring countries that could have impacts in our country.

5.3. Mitigatory Actions

5.3.1 The licensee of a facility or activity shall have arrangements to promptly decide and take on-site actions that are necessary to mitigate the consequences of a nuclear or radiological emergency. These arrangements shall include emergency operating procedures and technical guidance for operating personnel on mitigatory actions. This

shall also include, availability of on-site teams at the facility for mitigating the consequences of an emergency (e.g. damage control, firefighting).

5.3.2 The licensee shall make arrangements for mitigatory actions to be taken by the operating personnel, in particular:

(a) To prevent escalation of an emergency;
(b) To return the facility to a safe and stable state;
(c) To reduce the potential for, and to mitigate the consequences of, radioactive releases or exposures.

5.3.3 The licensee shall assess and determine, at the preparedness stage, when and under what conditions assistance from off-site emergency services may need to be provided on the site, consistent with the hazard assessment and the protection strategy.

5.3.4 Licensee, if warranted, shall make the provisions for availability of outside services for augmentation of emergency response on the site. In such a case, off-site emergency services shall be informed of on-site conditions and provided with instructions and means for protecting themselves as emergency workers.

5.3.5 The nodal department shall ensure that necessary technical expertise and services in radiation protection are provided to local authorities and first responders for responding to emergencies at an unforeseen location or at locations where there is a significant likelihood of dangerous sources that are not under regulatory control. First responders and those personnel at such locations shall be provided with basic instructions and training in the means of mitigating the potential consequences of a nuclear or radiological emergency (also refer Clause 4.3.6 and 5.2.6).

5.3.6 Arrangements shall be made by the local authorities (including necessary co-ordination with DAE) to initiate a prompt search along with containment measures in the event that a dangerous source could possibly be in the public domain as a result of its loss or unauthorised removal.

5.4. Protective Actions and other Response Actions

5.4.1 The response organisations shall ensure that arrangements are in place to assess and anticipate emergency conditions and to take protective actions and other response actions effectively in a nuclear or radiological emergency. The situations that need to be assessed for taking protective actions include,

(a) Set of abnormal conditions at the facility;

(b) Radioactive releases and releases of other hazardous material;
(c) Radiological conditions on the site and, as appropriate, off the site;
(d) Meteorological conditions during and after release;
(e) Any exposures or potential exposures to members of the public, personnel other than radiation workers, volunteers, radiation workers and emergency workers.

5.4.2 The arrangements for assessment and anticipation of conditions shall include, but not limited to,

(a) Utilization of pre-established operational criteria ('triggers') in accordance with the protection strategy;
(b) Access to instruments displaying or measuring those parameters that can readily be measured or observed in a nuclear or radiological emergency, and the expected response of instrumentation and of structures, systems and components at the facility under emergency conditions shall be taken into account;
(c) Utilization, as appropriate, of inference from detailed hazard analysis of the different types of event sequence carried out in preparing for the emergency response;
(d) Provisions for real-time time data collection through field installed radiation detectors and monitoring through mobile survey teams;
(e) Utilization of models for prediction and assessment of dose based on, source term estimate, plume dispersion and field monitoring.

5.4.3 The concerned response agencies shall ensure that after assessment of the situation, arrangements for taking protective actions are made with account taken of the uncertainties in and limitations of the available information. These arrangements shall include the following:

(a) The specification of planning zones and distances for which arrangements shall be made at the preparedness stage for taking protective actions and other response actions effectively;
(b) Criteria, based on the emergency classification and on conditions at the facility and off the site, for initiating and for adjusting protective actions and other response actions, in accordance with the protection strategy;
(c) Warning the permanent population, transient population groups and special population groups or those responsible for them and warning special facilities;
(d) Taking protective actions such as sheltering, iodine thyroid blocking (ITB), restrictions on the food chain and on water supply, prevention of inadvertent ingestion, restrictions on the consumption of food,

milk and drinking water and on the use of commodities, evacuation as and when necessary, monitoring and decontamination of evacuees, and control of access and traffic restrictions and other response actions;

(e) Timely monitoring and assessment of contamination[8], radioactive releases and exposures for the purpose of deciding on or adjusting the protective actions and other response actions that have to be taken or that are being taken.

(f) Protection of emergency workers and volunteers in an emergency.

(g) Ensuring that services necessary for public safety (rescue services, and health care services for critically ill patients) are provided continuously throughout the emergency.

5.4.4 The licensee shall make arrangements to ensure protection and safety for all persons on the site in a nuclear or radiological emergency. These arrangements shall include provisions,

(a) To notify all persons on the site of an emergency with suitable means for warning and instructing all persons present under the full range of emergency conditions;
(b) For all persons on the site to take appropriate actions immediately upon notification of an emergency;
(c) To account for those persons on the site and to locate and rescue those persons unaccounted for;
(d) To provide immediate first aid;

(e) To provide for transportation of persons on the site to location off the site.

5.4.5 The licensee shall ensure that appropriate reliable and diverse means of communication are available at all times, under the full range of emergency conditions, for use in taking protective actions and other response actions on the site and for communication with off-site officials responsible for taking protective actions and other response actions off the site.

5.4.6 The concerned response agencies, including the licensee and the consignor of radioactive material, as appropriate, shall provide guidance

[8] Monitoring of contamination include, measurements of dose rate from above the ground due to air borne activity and ground contamination, measurement of dose rate and beta count rates from the skin, measurement of concentrations of marker radionuclides in food, milk and drinking water samples, dose rate measurements from the thyroid, etc.

and training on taking protective actions and other response actions for operating personnel and first responders to activities and acts that can lead to an emergency at an unforeseen location (e.g. transport of radioactive material, mobile radiography devices) and those personnel at locations where there is a significant likelihood of encountering a dangerous source that is not under regulatory control. This shall include guidance and training on the demarcation of the approximate radius of the inner cordoned off area in which protective actions and other response actions need to be taken and adjustment of this area on the basis of observed or assessed conditions on the site.

5.5. Instructions, Warnings and Relevant Information to the Public for Emergency Preparedness and Response

5.5.1 The local authorities shall have the arrangements for imparting information to the general public about the nature of hazards, consequences of the emergency, modes of notification and protective actions required during an emergency in the local language. The licensee or nodal department shall provide necessary technical information to the local authorities.

5.5.2 These arrangements shall include issuing prompt warning and instructions that are to be followed after declaration of emergency.

5.5.3 These arrangements shall also include issuing a warning to the public and providing information in the event that a dangerous source could be present in the public domain as a consequence of its loss or unauthorized removal.

5.6. Protection of Emergency Workers and Volunteers in an Emergency

5.6.1 The licensee and the local authorities shall designate the emergency workers during the preparedness stage with the provisions to augment the same during response phase in accordance with hazard assessment and protection strategy and shall provide appropriate training to the designated emergency workers. Female workers, on becoming aware that they are pregnant or those who are lactating, shall inform the licensee/concerned response agency thereof and they shall not be deployed for emergency response operations. For emergency workers not designated as such in advance, and volunteers in an emergency, arrangements shall be made for just in time training on how to perform the duties under emergency conditions.

5.6.2 Arrangements shall be made for dose management, control of exposure and contamination of emergency workers and volunteers by providing appropriate specialised protective equipment and monitoring equipment.

5.6.3 The exposure of the emergency workers and volunteers shall be controlled and optimized in accordance with guidelines laid by regulatory body. If the exposure is likely to exceed the guidance values laid by regulatory body, then informed consent of the worker shall be taken before deployment.

5.6.4 Emergency workers and volunteers in an emergency shall be given appropriate medical attention for doses received in response to a nuclear or radiological emergency or at their request.

5.7. Management of Medical Response

5.7.1 Provisions for medical management including first aid, treatment of radiation injuries, medical screening and triage, life stabilization, long term health monitoring through registration and psychological counselling for plant personnel within site and affected public at off-site shall be made by the licensee and local authority, respectively. Special attention should be given to infants, children, pregnant women, persons with disability and old and sick persons.

5.7.2 The local authorities shall make arrangements for providing necessary medical attention to individuals with possible contamination which includes appropriate transport services. Medical personnel should be knowledgeable and trained on the emergency response actions and precautions to be taken while handling such individuals.

5.7.3 The concerned emergency response agency shall ensure that identified medical institutions establish facilities for evaluation of radiation exposure with technical support from nodal department. Individuals who might have received high radiation doses and indicating radiation induced symptoms shall be provided with appropriate medical attention, including long term medical follow-up.

5.8. Communication with the Public throughout an Emergency

5.8.1 The licensee and local authority shall establish communication strategy involving multiple communication channels (radio, television, electronic media etc.) for dissemination of timely information to the public in simple and understandable language with due account taken of the possibility of disturbance or overburdening of identified communication channels during emergency. The strategy adopted shall

also take into account, how to communicate to differently abled persons, including mentally and visually challenged persons.

5.8.2 The information provided to the public by response organizations, nodal department, licensee, and regulatory body in a nuclear or radiological emergency shall be coordinated and consistent, with due recognition of the evolutionary nature of an emergency.

5.8.3 Sensitive information that could compromise the security arrangements for an ongoing or a foreseen event shall be protected in circumstances where a nuclear or radiological emergency is initiated by a nuclear security event.

5.8.4 Communication with the public in a nuclear or radiological emergency shall be carried out by the concerned response agency on the basis of a strategy developed at the preparedness stage as part of the protection strategy.

5.9. Management of Radioactive Waste

5.9.1 The licensee shall make plan for management of radioactive waste (both solid and liquid) generated in a nuclear or radiological emergency, or that might arise from protective actions and other response actions in the site.

5.9.2 The local authorities, with technical support from nodal department, shall make plan for management of radioactive waste (both solid and liquid) that might arise from protective actions and other response actions taken off the site.

5.9.3 The plan shall indicate methodology to classify, categorize and segregate the radioactive waste. The plan shall also include the provisions for temporary on-site storage, clearance, disposal and long term storage including identification of land area.

5.9.4 The treatment, conditioning and storage of radioactive waste shall be carried out in accordance with type and nature of the waste taking into consideration safety, non-radiological aspects of waste[9], secondary waste generation and economic aspects.

5.9.5 The clearance for reuse or recycle of residual materials shall be carried out in accordance with the criteria given by the regulatory body.

5.9.6 The waste shall be disposed off in an appropriate disposal facility with a level of safety acceptable to regulatory body.

[9] e.g. chemical properties such as toxicity, and biological properties

5.9.7 The local authorities shall establish communication channels with the public and other interested parties to assure about the safety and security involved in all stages of radioactive waste management.

5.10. Mitigation of Non-radiological Consequences of a Nuclear or Radiological Emergency and of an Emergency Response

5.10.1 The concerned response agencies shall ensure that the protection strategy takes into consideration the non-radiological consequences and associated risks in consultation with all involved interested parties.

5.10.2 Since the non-radiological consequences could be more for vulnerable sections (patients, persons with disabilities, pregnant women, children) of the public, the special needs and concerns of these groups including their psychological and physical health shall be adequately addressed.

5.10.3 Suitable communication strategy shall be developed to communicate the risk to public in the preparedness stage itself. This shall include dissemination of timely and correct information to the public through reliable and easily accessible sources.

5.10.4 Measures shall be implemented for control of trade of commodities, including food, within the country and outside[10]. The information on such control measures shall be shared with all concerned parties in a clear and consistent manner.

5.11. Requesting, Providing and Receiving International Assistance for Emergency Preparedness and Response

5.11.1 The nodal department shall establish mechanisms for obtaining/ providing assistance as necessary from/ to international organizations or other countries, in accordance with the provisions laid down by the Government of India.

5.11.2 Participation in emergency exercises carried out by international organizations or other countries shall be used for testing of these mechanisms.

5.12. Terminating a Nuclear or Radiological Emergency

5.12.1 The state/ local authorities shall have arrangements for notifying the termination of emergency in public domain. The decision for termination shall be taken in consonance with all response organizations and nodal

[10] For control of international trade of commodities, the 'Codex General Standard for Contaminants and Toxins in Food and Feed, Schedule-1'[22] guidelines can be followed

department after ensuring conformance to the conditions specified by regulatory body and implemented in consultation with the affected public and other interested parties.

5.12.2 Any protective actions or restrictions, if needs to be continued even after termination of emergency shall be justified, optimized, limited in scope and communicated to affected public and other interested parties.

5.12.3 Suitable monitoring programme shall be established after termination of emergency for ascertaining radiological and non-radiological consequences along with consideration of social concerns and financial implications.

5.12.4 Once the emergency is terminated, all workers who took part in the implementation of response actions shall be subjected to the relevant requirements for occupational exposure in planned exposure situations. Individual monitoring, dose assessment and health surveillance shall be conducted subject to the requirements for planned exposure situations or existing exposure situations, as appropriate.

5.12.5 After the termination of an emergency, necessary remedial actions shall be carried out, to reduce exposure due to contamination of areas by residual radioactive material from a nuclear or radiological emergency, as per the requirements and guidance established by the regulatory body.

5.13. Analysing the Nuclear or Radiological Emergency and the Emergency Response

5.13.1 All the responsible agencies involved in emergency response and implementation of protection strategy shall collect, document, preserve and analyse relevant information to draw the necessary learnings for identifying the areas of improvements in emergency response, safety and security of facilities including regulatory oversight. The same shall be shared with all interested parties.

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6. REQUIREMENTS FOR INFRASTRUCTURE

This section establishes the requirements for infrastructural elements that are essential to providing the capability for fulfilling the requirements established in Section 5 in accordance with the hazard assessment and the protection strategy.

6.1. Authorities for Emergency Preparedness and Response

6.1.1 The organisations responsible for developing, maintaining and regulating arrangements, both on the site and off the site, for preparedness and response for a nuclear or radiological emergency shall have appropriate authorities/power by legal or administrative arrangements.

6.1.2 Conflicting or potentially conflicting and overlapping powers, roles and functional responsibilities shall be resolved at the preparedness stage through consultations, exercises and feedback.

6.1.3 The authority and responsibility for making decisions on response actions to be taken and communication to be made with the public and interested parties, as applicable lies with licensee for on-site activities and with the local authorities for off-site activities.

6.1.4 Licensee shall assign an on-site position with the authority and responsibility for taking immediate actions within its premises, for classification and declaration off-site emergency, for its notification to public by local authorities.

6.1.5 Personnel with authority and responsibility to perform critical response functions[11] in an emergency response shall not be assigned any other responsibilities in an emergency that would interfere with the prompt execution of the specified functions. The arrangements for delegation and/or transfer of authority shall be specified in the respective emergency plans, any changes need to be notified to all appropriate organisations.

6.2. Organization and Staffing

6.2.1 The organizational relationships for preparedness and response to a nuclear or radiological emergency and interfaces between all those

[11] Critical response functions are functions that must be performed promptly and correctly in order to classify, declare and notify an emergency, to activate an emergency response, to manage the response, to take mitigatory actions, to protect emergency workers and to take urgent protective actions on and off the site.

organizations shall be established through emergency plans and procedures.

6.2.2 All the response organisations shall staff themselves with sufficient personnel who are qualified for their intended duties.

6.2.3 Appropriate numbers of suitably qualified personnel shall be available at all times so that appropriate positions can be promptly staffed as necessary following the declaration and notification of a nuclear or radiological emergency.

6.2.4 For a site where multiple facilities are co-located, an appropriate number of suitably qualified personnel shall be available to manage an emergency response if multiple facilities are under emergency conditions simultaneously. The licensee shall be prepared to dispatch these personnel, if need arises, to attend to an off-site emergency, involving transport of radioactive material.

6.2.5 Adequate qualified/trained manpower shall be developed and arrangements shall be in place taking into consideration the planned and unplanned absence of persons who are qualified/trained in emergency response.

6.3. Coordination for Emergency Preparedness and Response

6.3.1 National plan for nuclear and radiological emergency, shall establish protocols for operational interfaces between licensee and authorities at the local, state and national levels, including those organizations and authorities responsible for the response to conventional emergencies and to nuclear security events.

6.3.2 The administrative bodies and the licensee shall have proper coordination to improve the consistency of the assessments of the situation, including assessments of contamination, doses and radiation induced health effects and any other relevant assessments made in a nuclear or radiological emergency, so as not to give rise to ambiguity.

6.4. Plans and Procedures for Emergency Response

6.4.1 The plans and procedures necessary for effective response to a nuclear or radiological emergency shall be established at national, state and local levels as well as by the licensee and the consignor in the case of transport of radioactive material. These emergency plans and procedures shall be periodically reviewed and updated.

6.4.2 The emergency plans for a nuclear or radiological emergency shall ensure that the simultaneous implementation of the plans with other standard plans[12] shall not reduce their effectiveness or cause conflicts.

6.4.3 The plans and procedures at district levels shall be approved by appropriate higher authority at state or national level and the emergency plan established by licensee shall have the approval of regulatory body. Necessary co-ordination shall be ensured between the local authorities and the licensee in preparation of their respective plans and procedures.

6.4.4 The licensee and response organizations shall develop the necessary procedures and analytical tools including pre calculated results (charts, look-up tables, flow-sheets etc.) to effectively perform the response functions specified in this Safety Code.

6.4.5 Procedures and analytical tools shall be tested and validated prior to initial use. The decision makers within response organisations shall give due recognition to the limitations of such analytical tools in a way that would not reduce the effectiveness of response actions.

6.5. Logistical Support and Facilities for Emergency Response

6.5.1 The response organisations shall ensure that adequate logistical support and facilities are available to enable emergency response functions to be performed effectively in a nuclear or radiological emergency.

6.5.2 Adequate tools, instruments, supplies, equipment, communication systems, facilities and documentation (such as documentation of procedures, checklists, manuals, telephone numbers and email addresses) shall be provided for performing the functions specified in this Safety Code.

6.5.3 For facilities having off-site consequences, arrangements for accident management measures like alternative supply of water and an alternative electrical power supply, including any necessary equipment, shall be

[12] The example of other plans and procedures include:
(a) Emergency plans for facilities having off-site consequences;
(b) Security plans, contingency plans, accident management plans;
(c) Procedures for the investigation of a nuclear security event, including identification, collection, packaging and transport of evidence contaminated with radionuclides, nuclear forensics and related activities;
(d) Plans for executing protective actions in a conventional emergency (earthquake, flood, cyclone, tsunami, etc.) and other emergency situations(chemical, pandemic, etc.) such as sheltering, food control, prophylaxis distribution, evacuation, restrictions on movements, etc.;
(e) Plans for firefighting.

ensured. These equipment shall be located and maintained so that they are readily accessible and functional when needed.

6.5.4 At NPP sites, an on-site emergency facility, separate from the control room and supplementary control room shall be established. The separate facility shall remain functional under all conditions including extreme external events so that:

(a) Technical, operational and other logistic support can be provided to the operating personnel involved in accident management.
(b) The on-site emergency response is managed.
(c) Information on on-site conditions as well as expected off-site radiological consequences are provided to local authorities for necessary response actions.
(d) Information on evolving emergency situation can be provided to nodal department and regulatory body.

6.5.5 The nodal department or licensee (as applicable) shall establish emergency support facility to support local authorities for emergency response. Such facilities shall be assigned with the following minimum functions.

(a) Coordination with on-site response team;
(b) Coordination of monitoring, sampling and analysis;
(c) Recommending response actions;
(d) Providing input for decision making with respect to protective actions in the public domain;
(e) Providing information to nodal department and regulatory body on evolving emergency situation.

6.5.6 The Local authorities shall establish an emergency response centre for carrying out the following functions in the public domain, as appropriate:

(a) Receiving input from licensee or nodal department, as applicable, for carrying out response actions including information on radiological status;
(b) Taking response actions (initiate and direct) in public domain and providing operational support to the response personnel;
(c) Providing necessary public information.

6.5.7 These emergency response facilities shall operate as an integrated system in support of the emergency response, without conflicting with one another's functions, and shall provide reasonable assurance of being operable and habitable under a range of conditions expected during an emergency.

6.6. Training and Exercise

6.6.1 The licensee and local authorities shall conduct training to the personnel involved in response actions. This shall include arrangements for specialized training for workers identified for taking mitigation measures during emergency scenarios. Periodic refresher training shall be conducted so as to maintain the level of awareness and readiness at the requisite level.

6.6.2 Awareness programs shall be organized for general public for necessary actions to be taken during an emergency by the local authorities. The licensee or nodal department shall extend necessary technical support to the local authorities in this regard.

6.6.3 The licensee and emergency response organizations shall test preparedness and response plans in exercises that simulate a nuclear or radiological emergency, as appropriate. Exercises shall identify critical strengths and weaknesses in response capabilities. Exercises shall allow the personnel of various organisations to become familiar with their roles and with that of others and learn to coordinate and operate together.

6.6.4 Various types of exercise shall be conducted periodically as applicable, with emphasis on decision making, command & control functions and field actions.

6.6.5 The exercises shall be systematically evaluated and some exercises shall be evaluated by the regulatory body. Evaluation of exercises shall be done against pre-established objectives to demonstrate their effectiveness to achieve the goals of emergency response and to continually improve the response capability.

6.7. Management System of Response Organizations

6.7.1 The management system established by the response organisations shall ensure the appropriate structure and authority, adequate infrastructure and necessary process and procedures for effective implementation of response in a nuclear or radiological emergency.

6.7.2 The management system of response organizations shall include mechanism to maintain inventory, replenishment, tests and calibrations of all supplies, equipment and systems, to ensure that these are continuously available and are functional for use in a nuclear or radiological emergency.

6.7.3 Emergency preparedness and response plans, procedures and other arrangements shall be periodically reviewed and updated to incorporate lessons from research, operating experience (response to emergencies)

and emergency exercises, including the guidelines issued time to time by central and state agencies on emergency management.

6.7.4 The management system of the response organizations shall ensure that adequate records to include dose assessments, results of monitoring, inventory of radioactive waste managed, etc. are maintained in order to allow for their review and evaluation. The areas in which improvements are necessary may be recorded and the necessary improvements may be made.

BIBLIOGRAPHY

[1] GOVERNMENT OF INDIA, "Atomic Energy Act, 1962".

[2] GOVERNMENT OF INDIA, "Radiation Protection Rules, 2004".

[3] GOVERNMENT OF INDIA, "The Disaster Management Act, 2005".

[4] GOVERNMENT OF INDIA, "The Civil Liability for Nuclear Damage Act, 2010".

[5] GOVERNMENT OF INDIA, "National Policy on Disaster Management", National Disaster Management Authority, (2009).

[6] GOVERNMENT OF INDIA, National Disaster Management Guidelines on Management of Nuclear and Radiological Emergencies, National Disaster Management Authority, (2009).

[7] GOVERNMENT OF INDIA, "National Disaster Management Plan (NDMP), 2019", National Disaster Management Authority, (2019).

[8] GOVERNMENT OF INDIA, "National Disaster Management Manual on Medical Management of Nuclear and Radiological", National Disaster Management Authority, (2019).

[9] INTERNATIONAL ATOMIC ENERGY AGENCY, Preparedness and Response for a Nuclear or Radiological Emergency, IAEA Safety Standards for protecting people and the environment, General Safety Requirements (GSR Part 7), IAEA, (2015).

[10] INTERNATIONAL ATOMIC ENERGY AGENCY, Radiation Protection and Safety of Radiation Sources, Safety Standards for protecting people and the environment, General Safety Requirements (GSR Part 3), IAEA, (2015).

[11] ATOMIC ENERGY REGULATORY BOARD, "Site Evaluation of Nuclear Facilities" Safety Code No. AERB/NF/SC/S (Rev-1), Mumbai, (2014).

[12] ATOMIC ENERGY REGULATORY BOARD, "Design of Pressurised Heavy Water Reactor Based Nuclear Power Plants" Safety Code No. AERB/NPP-PHWR/SC/D (Rev-1), Mumbai, (2009).

[13] ATOMIC ENERGY REGULATORY BOARD, "Design of Light Water Reactor based Nuclear Power Plants" Safety Code No. AERB/NPP-LWR/SC/D, Mumbai, (2015).

[14] ATOMIC ENERGY REGULATORY BOARD, "Exclusion, exemption and clearance of radionuclides in solid materials," Directive No. 01/2010, Mumbai, (2010).

[15] ATOMIC ENERGY REGULATORY BOARD, "Nuclear Power Plant

Operation" Safety Code No. AERB/NPP/SC/O (Rev-1), Mumbai, (2008).

[16] ATOMIC ENERGY REGULATORY BOARD, "Management of Radioactive Waste" Safety Code No. AERB/NRF/SC/RW, Mumbai, (2007).

[17] ATOMIC ENERGY REGULATORY BOARD, "Quality Assurance in Nuclear Power Plants" Safety Code No. AERB/NPP/SC/QA (Rev-1), Mumbai, (2009).

[18] ATOMIC ENERGY REGULATORY BOARD, "Radiation Protection for Nuclear Fuel Cycle Facilities" Safety Code No. AERB/NF/SC/RP, Mumbai, (2012).

[19] ATOMIC ENERGY REGULATORY BOARD, Report of AERB Committee to Review Safety of Indian Nuclear Power Plants against External Events of Natural Origin, Mumbai (2011).

[20] INTERNATIONAL ATOMIC ENERGY AGENCY, Arrangements for Preparedness for a Nuclear or Radiological Emergency, IAEA Safety Standards for protecting people and the environment, Safety Guide (GSG 2.1), IAEA, (2007).

[21] INTERNATIONAL ATOMIC ENERGY AGENCY, Arrangements for the Termination of a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSG-11, 2018.

[22] INTERNATIONAL COMMISSION FOR RADIOLOGICAL PROTECTION, The 2007 Recommendations of the International Commission on Radiological Protection, ICRP publication 103, (2007).

[23] INTERNATIONAL COMMISSION FOR RADIOLOGICAL PROTECTION, Application of the Commission's Recommendations for the Protection of People in Emergency Exposure Situations, ICRP Publication 109, (2009).

[24] INTERNATIONAL COMMISSION FOR RADIOLOGICAL PROTECTION, Application of the Commission's Recommendations to the Protection of People Living in Long-term Contaminated Areas after a Nuclear Accident or a Radiation Emergency, ICRP Publication 111, (2009).

[25] CODEX ALIMENTARIUS COMMISSION, Codex General Standard for Contaminants and Toxins in Food and Feed, Schedule 1 — Radionuclides, CODEX STAN 193-1995, Codex Alimentarius Commission, Rome (2006).

Working Group for preparation of draft

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Dr. P. Vijayan, DRP&E, AERB	Member
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Shri Nishikant Tyagi, DRP&E, AERB	Member Secretary
Shri N Khandelwal, DRP&E, AERB	Co-opted Member
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Task Force for review of R0 draft

Dates of Meetings : 16th November, 2018
: 26th November, 2018
: 1st December, 2018
: 24th December, 2018
: 16th April, 2019
: 21st August, 2019
: 11th March, 2021

Dr. A. N. Nandakumar, Former Head, RSD, AERB	Convener
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Shri K. K. Narayanan, Rtd. HPD, BARC	Member
Dr. M. T. Jose, RSD, IGCAR	Member
Shri Piyush Srivastava, BRIT	Member
Shri Rajvir Singh, BSC, BARC	Member
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Shri Rajoo Kumar, RDS, AERB	Member
Dr. S. P. Lakshmanan, DRP&E, AERB	Member-Secretary
Shri Nishikant Tyagi, DRP&E, AERB	Invitee
Shri Ritu Raj, DRP&E, AERB	Invitee

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Advisory Committee on Nuclear and Radiation Safety (ACNRS)

Dates of meeting : 1st April, 2019

: 18th January, 2020

: 29th January, 2021

Members and Invitees of the committee:

Shri S. S. Bajaj	Chairman	Former Chairman, AERB
Shri D. K. Shukla	Member	Chairman, SARCOP & ED, AERB
Dr. N. Ramamoorthy	Member	Chairman, SARCAR, AERB
Dr. M. R. Iyer	Member	Former Head, RSSD, BARC
Shri U. C. Muktibodh	Member	Director (T), NPCIL
Shri V. Rajan Babu	Member	Director (T), BHAVINI
Prof. C.V. R. Murthy	Member	Director, IIT, Jodhpur
Shri H. S. Kushwaha	Member	Former Director, HS&E Group, BARC
Shri K. K. Vaze	Member	Former Director, RD&D Group, BARC
Shri S. K. Ghosh	Member	Former Director, CE Group, BARC
Dr. S. C. Chetal	Member	Former Director, IGCAR
Shri A. R. Sundararajan	Member	Former Director, RSD, AERB
Dr. A. N. Nandakumar	Member	Former Head, RSD, AERB
Shri S. Harikumar	Member-Secretary	Head, NPSD, AERB