



GOVERNMENT OF INDIA

**AERB SAFETY GUIDELINES**

**PREPARATION OF  
OFF-SITE EMERGENCY PREPAREDNESS  
PLANS FOR  
NUCLEAR INSTALLATIONS**



ATOMIC ENERGY REGULATORY BOARD

**AERB SAFETY GUIDELINES NO. AERB/SG/EP-2**

**PREPARATION OF  
OFF-SITE EMERGENCY PREPAREDNESS  
PLANS FOR  
NUCLEAR INSTALLATIONS**

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## FOREWORD

Safety of public, occupational workers and the protection of environment should be assured while activities for economic and social progress are pursued. These activities include the establishment and utilisation of nuclear facilities and use of radioactive sources. They have to be carried out in accordance with relevant provisions in the Atomic Energy Act 1962 (33 of 1962).

Assuring high safety standards has been of prime importance since the inception of the nuclear power programme in the country. Recognising this aspect, the Government of India constituted the Atomic Energy Regulatory Board (AERB) in November 1983 vide standing order No. 4772 notified in the Gazette of India dated 31.12.1983. The Board has been entrusted with the responsibility of laying down safety standards and to frame rules and regulations in respect of regulatory and safety functions envisaged under the Atomic Energy Act of 1962. Under its programme of developing safety codes and guides, AERB has issued four codes of practice covering the following topics:

Safety in Nuclear Power Plant Siting

Safety in Nuclear Power Plant Design

Safety in Nuclear Power Plant Operation

Quality Assurance for Safety in Nuclear Power Plants.

Safety Codes and Standards lay down the minimum basic requirements, which must be satisfied to ensure safety. Safety Guides and Safety Guidelines are issued to describe and make available methods of implementing specific parts of relevant Codes of Practice as acceptable to AERB. Safety Manuals give practical examples and detailed methods, which can be used for application of specific parts of Safety Codes and Standards. Methods and solutions other than those set out in the Safety Guides and Guidelines and Safety Manuals may be acceptable if they provide at least comparable assurance that the nuclear installations can be operated without undue risk to the health and safety of general public and plant personnel.

The emphasis in the Safety Codes, Guides, Guidelines and Manuals is on protection of site personnel and public from undue radiological hazard. However for other aspects not covered in these documents, applicable and acceptable national and international Codes and Standards should be followed. Industrial Safety shall be ensured through good engineering practices and through compliance of the Factories Act 1948, as amended in 1987 and the Atomic Energy (Factories) Rules 1996.

This document is issued as a lead document to facilitate preparation of specific site manuals by the Responsible Organisation for emergency response plans at each site to ensure their preparedness to meet any eventuality due to site emergency in order to mitigate its consequences on the health and safety of site personnel. It takes cognisance of an earlier AERB publication on the subject: "Safety Manual on Off-Site Emergency Plan for Nuclear Installations", AERB/SM/NISD-2, 1988 and also takes into consideration the urgent need for promoting public awareness and drawing up revised emergency response plans, which has come about in a significant manner after the accidents at Chernobyl (1986) and Bhopal (1984).

This document has been prepared by the staff of AERB and other professionals. In drafting it, they have used extensively relevant documents of the International Atomic Energy Agency (IAEA) and the experience gained at the nuclear power plant sites in the country. Further, it also takes into account the Indian statutory requirements as laid down in the Manufacture, Storage and Transport of Hazardous Chemicals Rules, 1989 as well as the amendments incorporated in it subsequently.

Experts have reviewed the Safety Guidelines and the Advisory Committee on Nuclear Safety (ACNS) has vetted it, before issue. AERB wishes to thank all individuals and organisations who reviewed the drafts and finalised the Guidelines. The list of persons who have participated in the Committee Meetings for this document, along with their affiliations, is included for information.

*P. Rama Rao*

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## DEFINITIONS

### **Countermeasure**

An action aimed at alleviating the consequences of an accident.

### **Critical Group**

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

### **Derived Intervention Level (DIL)**

Derived Intervention Levels are 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.

**Domain** (in the context of applications of countermeasure during a radiological emergency)

A region bound by time-space considerations, categorised on the basis of radiological characteristics. Domains 1, 2 and 3 are off-site areas/regions affected by the radioactive releases from a nuclear plant and within each domain, radiological characteristics/severity are nearly the same.

### **Emergency Alert**

Abnormal conditions with a possibility of aggravating to plant/site/off-site emergency.

### **Emergency Exercise**

An exercise is a test of an emergency plan with particular emphasis on the co-ordination of the many interphasing 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.

**Emergency Plan**

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

**Emergency Planning Zone (EPZ)**

The zone defined around the plant up to 16 km radius providing a basic geographic framework for decision-making on implementing measures as part of a graded response in the event of an emergency.

**Emergency Shelters**

Rooms/buildings where personnel could be sheltered during emergencies.

**Intervention Level**

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

**Nuclear Facility**

A facility and its associated land, buildings and equipment in which the radioactive material is produced, processed, used, handled, stored or disposed of (for example repository) on such a scale that consideration of safety is essential.

**Occupier**

Occupier of a facility means the person who has or who has been given ultimate control over the affairs of a facility.

**Off-Site**

Area beyond the site boundary (public domain).

**Off-Site Emergency**

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

**Off-Site Emergency Director**

A specifically designated officer (for example the Collector/District magistrate) who has adequate authority to control and co-ordinate all off-site emergency actions in the public domain.

**Prophylactics**

Materials that are administered to reduce the dose equivalent commitments incurred due to internal contaminants (example: administration of stable KI or  $\text{KIO}_3$  in cases when severe radioactive iodine uptakes are anticipated).

**Site**

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

**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/explosion, whose effects are confined to the site, with off-site consequences expected to be negligible.





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# 1. INTRODUCTION

## 1.1 General

1.1.1 Nuclear installations are sited, designed, constructed, commissioned and operated with utmost care, in order that the operating personnel, public in the vicinity and the environment are always protected from any risks of undue radiation exposure. Yet, as a measure of abundant precaution it is quite essential that a site emergency response plan is meticulously drawn up and the concerned personnel are trained and tested to ensure that the organisation is always prepared to meet the unlikely occurrence of abnormal or accident situations at the off-site of any nuclear installation in the country.

1.1.2 The Regulatory Body has to ensure that before the commencement of operation of the nuclear installation, the organisation responsible for installation establishes in association with the state authorities a satisfactory off-site emergency preparedness plan (OSEPP) acceptable to the Regulatory Body.

1.1.3 Radiological emergencies at the nuclear installations are mainly categorised as under:

- (i) Plant emergency alert
- (ii) Plant emergency
- (iii) Site emergency
- (iv) Off-site emergency

The operating organisation is responsible for handling the first three categories of emergencies, while the off-site emergencies involving radiation fallout in the public domain is handled by the state public authorities with the technical input and guidance from the operating organisation and the Regulatory Body.

1.1.4 The purpose of this Safety Guidelines is to lay down the requirements of the Regulatory Body for the operating organisation and state public authorities in preparing an emergency response plan for off-site emergency for the nuclear installation.

1.1.5 The off-site emergency preparedness plan in its title page should clearly identify the name of the nuclear installation. In its introductory section it should give the objectives of the plan, definition of off-site emergency, basis on which the plan has been drawn up, the need for the plan, the agency which has approved the plan, the date of issue and the planned date of review and revision of the plan.

## 1.2 Objectives

1.2.1 The main objectives of this Safety Guidelines are as under:

- (i) To provide detailed guidelines for nuclear installations in the country on the essential components of off-site emergency preparedness and response plans at each installation taking into consideration any ongoing construction activities at the off-site.
- (ii) To elaborate various aspects of the response plan such as: Emergency Organisation, Emergency Equipment and Facilities needed outside the nuclear installation in order to protect the site personnel from risks of undue radiation exposure.
- (iii) To advise on other aspects such as: enforcement of off-site emergency plans, conduct of periodic off-site emergency drills to ensure readiness of the nuclear installation for handling off-site emergencies.
- (iv) To indicate guidelines on off-site related factors, which may influence management of off-site emergencies.
- (v) To highlight the need for the operating organisation/plant management to establish and maintain communication lines between the site, the headquarters of the operating organisation, Regulatory Body and the state public authorities for prompt and effective use in times of off-site emergency.

## 1.3 Scope

1.3.1 This Safety Guidelines covers all aspects of off-site emergency response plans, which the operating organisation and state public authorities shall prepare and maintain in full readiness for implementation in the event of off-site emergency at nuclear installations in the country.

1.3.2 In this context, "Nuclear Installations" are meant to include the following:

- (i) Nuclear fuel fabrication facilities including those utilising plutonium recycling;
- (ii) Research reactors with significant source terms;
- (iii) Nuclear power plants;
- (iv) Spent fuel storage facilities;
- (v) Nuclear fuel reprocessing plants;
- (vi) Radioactive waste management plants;
- (vii) Isotope production facilities; and
- (viii) Heavy water plants.

1.3.3 This Safety Guidelines does not include any technical guidance regarding controlling the nuclear processes in the plant to ensure achievement of safe shutdown of the nuclear installation or to stop further fallout of the radioactive materials which the operating organisation has, by necessity, to undertake following established procedures.

1.3.4 It also does not cover the emergency response plans for site emergency of nuclear installations nor site or off-site emergency plans for non-nuclear installations for which separate safety manuals are issued by AERB.

1.3.5 The following sections describe the essential contents of Site Emergency Plan Manual which should be drawn up specifically for each installation by the operating organisation and the state public authorities with the concurrence of the Regulatory Body.

## **2. DESCRIPTION OF NUCLEAR INSTALLATION AND SITE**

This section of OSEPP should describe in detail the installation and the site. The site description should include its geographical, meteorological and demographic characteristics. The essential details, which should be given in this Section, are listed below.

### **2.1 Description of Installation**

This sub-section should briefly describe the various major components of the facility, the nature of materials handled, the processes involved. It should be supplemented by a plan of the facility giving its layout, access roads, emergency control room(s) location, exit points and assembly points.

### **2.2 Site Location**

This sub-section shall indicate the state, district, and taluk level divisions. It shall specify the location with respect to the nearest natural and man-made features such as rivers, lakes, embankments, dams, railway line, roads, etc., including activities connected with land and water use, such as agricultural cattle farm, and details of nearby installations like factories, oil/gas pipelines, defence installations, airports and other vital installations. It should also include those installations, where, if an emergency were to occur, it would have a bearing on the functioning of the facility.

### **2.3 Site Area Maps**

All maps pertaining to OSEPP should be provided as a separate Annexure to the Plan and the list for the same shall be given in this sub section. All maps shall be drawn to scale and should include the following information:

- (i) Installation or plant boundary lines;
- (ii) Site boundary;
- (iii) Facility or plant exclusion area;
- (iv) Principal structures in the facility or plant;
- (v) Principal storage sites for materials, inflammable materials, toxic substances, radioactive material and conventional waste dump yards



- (vi) Industrial, commercial, institutional, recreational or residential structures within the Emergency Planning Zone;
- (vii) Topography of the area up to the Emergency Planning Zone;
- (viii) Highways (national, state, district) railways and waterways that traverse or are adjacent to the site;
- (ix) Routes of evacuation including alternate routes if the main routes are blocked due to adverse weather conditions, accidents, traffic jams or other causes;
- (x) Locations of police stations, schools, hospitals including primary health centres and dispensaries which could serve as assembly points; and
- (xi) Other assembly points identified by the facility for use in emergency.

#### **2.4 Exclusion Zone**

This sub-section should give the following details for the Exclusion Zone:

- (i) Ownership of land, if not already under the control of the "Occupier"
- (ii) Control of activities other than those of the Facility being described
- (iii) Arrangements for traffic control
- (iv) Control of roads or transport ways and/ statutory provisions if any for roads or transport ways abandoned or relocated
- (v) Access control details
- (vi) Numbers and location of assembly areas
- (vii) Time required to evacuate the plant personnel and the means thereof.

#### **2.5 Demographic Characteristics**

This sub-section should indicate the nature or details of the demographic data and the base year of census to which the data apply. The data given should include population distribution within the emergency planning zone (EPZ), transient population, population density, population centres and special groups if any. Village-wise census data, updated to the relevant year should be presented in a tabular form. The site and its environs up to 16 km are divided into sixteen 22½° sectors and concentric rings at distances up to 1.5, 5, 8, 10 and 16 km from site and population in each sector should be indicated in the form of a map. Population centres within 50 km having population in excess of 10,000 should also be indicated.

## 2.6 Site Meteorology

This sub-section should provide the meteorological data at various times of the year. This should include wind-rose diagrams, weather conditions and monsoon and fog conditions. Estimates (both conservative and realistic) of atmospheric dilution factor ( $\chi/Q$ ) at ground level due to ground as well as stack releases at the exclusion zone boundary and at EPZ for time periods up to 30 days after accident should be provided. Cumulative values of  $\chi/Q$  for:

- (i) 0 - 8 hours;
- (ii) 8 to 24 hours;
- (iii) 1 day to 4 days; and
- (iv) 4 to 30 days.

should be provided. In all the time periods listed above, the model used should project the most restrictive diffusion condition to ensure a conservative estimate of potential off-site exposures.

The effect of topography on the above estimates (including wake) should be assessed and indicated.

For each class of release, isodose curves should be provided for unit release of activity, of radioiodine and noble gases at ground level and through the stack. The curves should extend to distances up to EPZ boundary. The data should enable the preparation of accident specific isodose curves.

## 2.7 Nature of Land and Produce

This sub-section should describe agricultural farming and/or fishing activities in the site area and its neighbourhood up to EPZ including the area of grazing land, the population and an estimate of annual production of main products.

### **3. ORGANISATION AND RESPONSIBILITIES**

This section of OSEPP describes the overall organisation structure both during normal conditions as well as that, which will come into force during an off-site emergency situation. It shall include the following:

#### **3.1 Organisation Details**

Organisation structure, hierarchy of emergency response personnel, their designations and alternate officials.

#### **3.2 Contact Details**

Names and all contact details (address, telephone, fax, electronic mail) of all emergency response personnel.

#### **3.3 Responsibilities**

This subsection should list the responsibilities assigned to personnel engaged or likely to be engaged in emergency response activities. The listing should be as follows:

- (i) Responsibilities assigned to the occupier and the designated officials working under him, both during normal working hours and outside working hours, including the specific authority vested in them to ensure that the assigned responsibilities will be carried out.
- (ii) Responsibilities assigned to state and district level authorities considered having a role in emergency response and control.
- (iii) Responsibilities given to supporting organisations, if any, other than plant/state/district/local authorities

#### **3.4 Emergency Response Group**

The following components of the emergency response system should be covered:

- (i) Planning and co-ordination;
- (ii) Communication;
- (iii) Public information;

- (iv) Radiological monitoring;
- (v) Sheltering;
- (vi) Evacuation/transport of people and livestock;
- (vii) Medical care including administration of prophylactics;
- (viii) Security/maintenance of law and order;
- (ix) Control on food articles, usage of water, if needed;
- (x) Decontamination; and
- (xi) Over-exposure management.

## **4. GUIDELINES FOR EVALUATION OF EMERGENCIES**

### **4.1 Accident Scenarios**

This section of the plan describes the various accident scenarios, which have been considered while drawing up the off-site emergency response plan. It is recognised that it would not be possible to include all scenarios in this section. However, it is essential that a wide range of possibilities is postulated and planned for. In general, the objective of all the plans should be to ensure that exposure in the public domain should not exceed the intervention levels prescribed by the AERB.

Some typical situations would include:

- (i) The detection by the effluent monitors that the release has resulted in concentrations at the site boundary equivalent to doses in excess of the prescribed whole body and thyroid dose levels;
- (ii) Loss of one or more safety barriers with potential loss of the next barrier;
- (iii) Complete or partial loss of post accident mitigation measures; and
- (iv) Other plant conditions which, irrespective of the cause, would make it possible for release of large amounts of radioactivity during a very short time period.

### **4.2 Radiation Dose**

The guidelines based on which an off-site emergency will be declared are based on intervention levels and derived intervention levels. Intervention levels are projected values of dose or dose commitment to the whole body or tissues at risk to the critical groups to which appropriate countermeasures are applied. The derived intervention levels are derived values applicable to a specific mode of exposure or pathway through which the exposure is incurred, such as exposure rate from ground deposited activity, and activity concentrations in food or water. This sub-section should contain details of the following:

- 4.2.1 The countermeasures stipulated are sheltering, potassium iodate prophylaxis, evacuation and control of foodstuffs.

- 4.2.2 The intervention levels and derived intervention levels relevant to the countermeasures indicated above are given in Tables A-1 to A-8 of Annexure-A. (Ref. AERB Safety Guide on Intervention Levels and Derived Intervention Levels for Off-Site Radiation Emergencies, AERB/SG/HS-1, December, 1992). The criterion for introduction of a countermeasure is indicated in Annexure-B. In implementing the above countermeasures details of additional measures such as access control to the affected areas, traffic control etc. will also provided in this sub-section.
- 4.2.3 The domain concept referred to in Annexure-A is shown schematically in Fig. A-1.

## 5. COMMUNICATIONS

This section of OSEPP shall describe the normal communication system that would function at the facility as well as the communication system set up for handling emergencies. The communication system for off-site emergency response shall be exclusively used during emergencies only and shall not be used for routine day-to-day communications. The system shall be tested periodically and have the capability for round-the-clock communication with the local/state emergency response network and shall provide linkage to Department of Atomic Energy (DAE) and other governmental organisations including AERB and other services such as local emergency team and fixed/ mobile medical support facilities.

### 5.1 System Description

The description of each system at the plant and the emergency control centres should cover the following:

- (i) Organisation structure for communication: the designated official including alternate(s);
- (ii) Manpower: to maintain the communication systems including functional responsibilities;
- (iii) Equipment: including availability of alternate system(s); and
- (iv) Contact details including nature of contact for the emergency control centre(s).

### 5.2 System Requirements

There shall be two emergency control centres, one at the facility and the second outside the site boundary. There shall be a direct communication link between the emergency control centres, the fire station and the plant control room. The emergency control centres should be equipped with at least two external and two internal telephone lines of which one each shall be dedicated solely to outgoing calls.

### 5.3 System Features

The communication system for activating the off-site emergency control centre shall ensure the availability of the following:

- (i) List of plant personnel authorised to issue emergency messages or announcements.
- (ii) List of officials at the facility, to be contacted in the event of an off-site emergency.
- (iii) List of officials outside the facility, to be contacted in the event of an emergency.
- (iv) Responsibilities and authority of the communication system personnel.
- (v) Mechanism by which the contact details of all concerned officials are kept updated.
- (vi) Standardisation of various messages that would be transmitted to officials both inside and outside the facility.

#### **5.4 Testing of the Communication System**

This section of OSEPP should give details of the manner in which each mode of communication will be tested to ensure a high level of reliability. This should cover communication link within the facility as well as communication links to external agencies and resource groups. The communication testing procedures should specify the manner of testing, the links to be tested and the frequency with which they will be tested.

#### **5.5 Redundancy in Communication Links**

There shall be an in-built redundancy in the communication system by way of availability of at least two modes of communication at all levels connected with the off-site emergency response plan. The availability of infrastructure for ensuring back-up electric power supply should also be indicated.



## 6. RESOURCES AND FACILITIES

6.1 This section of the off-site emergency preparedness plan shall describe the resources and facilities that will be available during an off-site emergency at the installation. These should include the following:

- (i) Mechanism for announcement including public address systems and sirens, both fixed and mobile;
- (ii) Emergency shelters at the installation;
- (iii) First aid facilities;
- (iv) Decontamination facility;
- (v) Security points;
- (vi) Radiological monitoring and sampling (fixed and mobile);
- (vii) Off-site emergency management group, including public assistance
- (viii) Sheltering for people (rallying post);
- (ix) Sheltering for livestock;
- (x) Distribution mechanism for prophylactics ( $KI0_3$ );
- (xi) Transport, vehicles and fuel;
- (xii) Traffic diversion and control;
- (xiii) Hospital and primary health centres;
- (xiv) Civil supplies;
- (xv) Rescue teams;
- (xvi) Fire-fighting facilities/personnel;
- (xvii) Emergency control rooms;
- (xviii) Emergency equipment; and
- (xix) Information centre.

6.2 The duties and responsibilities of personnel entrusted with each of the above should be described.

6.3 Annexure-C provides a representative list of equipment, instruments, drawings, documents, furniture and supplies and protective equipment to

be kept in designated areas of an NPP, intended mainly for use during emergencies. Equipment for other facilities should be somewhat similar.

- 6.4 The facility should provide a list of numbers of the equipment and other supplies provided along with the name of the designated official responsible for their maintenance who will be authorised to draw up on these resources. The system for periodic testing maintenance and replacement of equipment (in case of obsolescence) should be clearly laid down and responsibility for its implementation should also be indicated.
- 6.5 The occupier should ensure that each of the organisation involved, mainly the occupier of the facility/state/district/local authorities have adequate and trained staff to be able to respond to an emergency and to stay on the job on a continuing basis. The occupier should also ensure that he has adequate staff to provide initial accident response at all times.

## **7. DECLARATION AND TERMINATION OF AN OFF-SITE EMERGENCY**

- 7.1 This section of OSEPP should list out the sequence of actions to be taken for the declaration of an off-site emergency. The declaration or notification should be made only by the designated authority namely the off-site emergency director (OED), or his/her authorised representative, who should also be the designated authority for terminating the same.
- 7.2 The steps or actions described in this section should be clear, unambiguous and coherent. These should include the specific conditions under which the off-site emergency would be declared and notified and the conditions under which it will be terminated. This should also include the mechanism for communicating the notification of the declaration and termination to all designated officials who are responsible for taking specific actions in response to such communications.
- 7.3 This section should also contain information on the following:
- (i) Identification of plant systems and effluent parameters through values characteristic of accident scenarios;
  - (ii) Sampling and analysis capability throughout emergency conditions with equipment such as radiation and effluent monitors, in-plant iodine monitors and containment radiation monitors;
  - (iii) Methods and techniques to estimate releases from the containment e.g. monitor readings and calculations of radioactive material likely to be released from the containment;
  - (iv) Relationship between monitor readings to exposure on-site and off-site and ground level contamination for various meteorological conditions;
  - (v) Alternate methods of evaluating doses if instruments used are off scale or inoperable;
  - (vi) Capability and resources for field monitoring within Emergency Planning Zone (EPZ);
  - (vii) Rapid methods of assessing potential or actual radiological status through liquid or gaseous release pathways;

- (viii) Capability to estimate releases of key radionuclides, and activity content in milk, potable water, fresh produce of vegetables, fruits etc. and an assessment of actions, such as whether interventions are needed or not; and
- (ix) All announcements should be made in English, Hindi and the regional language.

## **8. ACTION PLAN FOR RESPONDING TO AN OFF-SITE EMERGENCY**

- 8.1 This section of the plan is the most important point of the emergency response plan. It shall give clear directions to the officials listed in sections 3 and 5 especially those who have been designated to carry out the response action plans. In this regard, it shall be ensured that the control room of the facility has a display of names and the contact details of key designated officials, and that this display is updated.
- 8.2 This section should list out the sequence of actions to be taken by each resource group or person or agency on being notified about the off-site emergency. It should be comprehensive and should give all actions to be taken up to the stage of termination of off-site emergency. This should be supported by an "Action Flow Chart" for this purpose. There should be a mechanism to ensure that all persons involved in the control of off-site emergency have understood their duties and responsibilities.
- 8.3 This section should also include a specific sub-section which will address the mechanism set up or proposed to be set up to handle post-accident situations like decontamination and recovery of affected land and facilities.

## **9. MAINTENANCE AND UPDATING OF OFF-SITE EMERGENCY PREPAREDNESS PLANS**

9.1 This section shall describe the system of maintenance and updating of the off-site emergency response plan to ensure that it is kept at an acceptable level of readiness. It should address the following areas:

- (i) Updating contact details of emergency response personnel (including external agencies and resource groups);
- (ii) Testing of equipment at the off-site emergency control centre, environmental survey laboratory, decontamination facility and first aid area;
- (iii) Testing of equipment in emergency vehicles as well as testing of the vehicles themselves;
- (iv) Testing of emergency communication system;
- (v) Periodic replacement of prophylactics (KI<sub>3</sub>) and medicines;
- (vi) Appropriate training programmes for all personnel at the facility as well as district officials aimed at ensuring that agencies/individuals involved in emergency management understand the purpose and scope of the action plans;
- (vii) Conducting drills/exercises and their periodicity, obtaining feedback and taking corrective measures;
- (viii) Updating and revision of plans;
- (ix) Interaction with district authorities; and
- (x) Maintenance of relevant records.

9.2 For each of the items listed above, details regarding the designated official responsible for implementation, updating and revision actions, if and when required, powers delegated and procedures adopted should be listed.

## **10. PUBLIC AWARENESS PROGRAMME**

This section of OSEPP shall detail the public awareness programme. It is recognised that the facility will have an established public awareness programme by which information will be disseminated to public. In addition to general information about the installation, its safety features and safety aspects of the plant, it shall include the following:

- (i) The mechanism for involving the public in the off-site emergency exercises;
- (ii) The mechanism for dissemination information to the public in the actual event of an off-site emergency;
- (iii) The authorities designated to disseminate such information; and
- (iv) The nature and content of the information that will be disseminated.

## ANNEXURE-A

### INTERVENTION AND DERIVED INTERVENTION LEVELS

#### **Intervention levels for off-site emergency**

- (1) The intervention levels (IL) and derived intervention levels (DIL) for implementation of countermeasures in the case of off-site emergency are given in Tables A-1 to A-8.
- (2) The practical guidelines for implementation of countermeasures are given in Annexure-B.
- (3) Persons in domain I, whose estimated exposures are in excess of the upper levels of intervention, may need special attention including medical care. (See Fig. A-1)

#### **Declaration of off-site emergency**

Off-site emergency will be declared if any of the following conditions exist:

- (1) Gamma radiation levels at 1 m above the ground in off-site locations exceed stipulated DIL, (see Tables A-4 to A-8).
- (2) Levels of contamination in water and food materials in off-site locations exceed the stipulated DIL, (see Tables A-2 and A-3).

Note:- The announcements of off-site emergency declaration should be done in English, Hindi and the local language.



**Table A-1: INTERVENTION LEVELS**

Countermeasure	Intervention Level			
	Effective dose (mSv)		Thyroid (single organ) (mGy)	
	Lower	Upper	Lower	Upper
<b>Domain 1</b> (See Fig. A-1)				
Administration of stable iodine	—	—	500	2500
Sheltering	20	100	—	—
Evacuation	100	500	—	—
<b>Domain 2</b> (See Fig. A-1)				
Administration of stable iodine	—	—	50	500
Sheltering	5	20	—	—
Control on foodstuff	5	20	50	500
<b>Domain 3</b> (See Fig. A-1)				
Control on foodstuff	1	5	Not anticipated	

- Note:-
1. The doses to thyroid are expressed in mGy consistent with units used in ICRP Publication 63 of the International Commission on Radiological Protection (ICRP).
  2. Because of note 1, the millisievert to rem conversion is deleted.
  3. The ILs for domains 2 and 3 are Committed Dose (CD)/ Committed Effective Dose (CED) from intakes during the first year following the accident. (See Fig. A-1)

**Table A-2: DERIVED INTERVENTION LEVELS FOR CONTROL OF FOODSTUFF**

Domain 3 (See Fig. A-1)

Countermeasure : Control of foodstuff

IL of dose : 1 mSv - 5 mSv effective dose

Radiological parameter : Concentration of radionuclides in the food items considered for initiating the countermeasure

Sr. No.	Food Item	$^{131}\text{I}$	$^{89}\text{Sr}$	$^{90}\text{Sr}$	$^{134}\text{Cs}$	$^{137}\text{Cs}$
1.	MILK Conc. in milk (Bq/l)	1.3E03	4.0E03	3.0E02	3.0E03	4.0E03
	Conc. in grass (Bq/kg)	4.7E03	1.8E05	1.0E04	1.2E04	1.8E04
2.	MILK PRODUCTS (Bq/kg)	2.0E04	6.0E04	4.0E03	2.0E04	2.0E04
3.	FRUITS & VEGETABLES (Bq/kg)	1.0E04	3.0E04	3.0E03	8.0E03	1.0E04
4.	MEAT (Bq/kg)	6.7E03	1.6E03	1.0E03	1.4E03	2.0E03
5.	CEREALS (Bq/kg)	6.0E03	6.0E03	1.4E02	5.0E02	6.0E02
6.	WATER (Bq/l)	3.3E03	1.4E03	3.0E01	1.2E02	1.4E02

- Note:
- (1) DILs are based on the lower level of IL of dose
  - (2) DILs are exclusively for a particular food item and a radionuclide.
  - (3) When the level falls below the values indicated above, this countermeasure may be withdrawn.

**Table A-3: DERIVED INTERVENTION LEVELS FOR CONTROL OF FOODSTUFF**

Domain 2 (See Fig. A-1)

Countermeasure : Control of foodstuff

IL of dose : 5 mSv - 20 mSv to whole body  
50 mGy - 500 mGy to thyroid

Radiological parameter : Concentration of radionuclides in the foodstuff considered for initiating the countermeasure

Sr. No.	Food Item	<sup>131</sup> I	<sup>89</sup> Sr	<sup>90</sup> Sr	<sup>134</sup> Cs	<sup>137</sup> Cs
1.	MILK Conc. in milk (Bq/l)	2.0E03	2.0E04	1.5E03	1.5E04	2.0E04
	Conc. in grass (Bq/kg)	7.0E03	9.0E05	5.0E04	6.0E04	9.0E04
2.	MILK PRODUCTS (Bq/kg)	3.0E04	3.0E05	2.0E04	1.0E05	1.0E05
3.	FRUITS & VEGETABLES (Bq/kg)	1.5E04	1.5E05	1.5E04	4.0E04	5.0E04
4.	MEAT (Bq/kg)	1.0E04	8.0E04	5.0E03	7.0E03	1.0E03
5.	CEREALS (Bq/kg)	9.0E03	3.0E04	7.0E02	2.5E03	3.0E03
6.	WATER (Bq/l)	5.0E03	7.0E03	1.5E02	6.0E02	7.0E02

- Note : (1) For <sup>131</sup>I, DIL values are based on the committed absorbed dose to the thyroid.
- (2) DILs are based on the lower level of IL of dose.
- (3) DILs are exclusively for a particular food item and a radionuclide.
- (4) When the level falls below the above DILs, control will be still applicable as per Table A-2 (domain 3 conditions).

**Table A-4 : DERIVED INTERVENTION LEVEL FOR KIO<sub>3</sub> ADMINISTRATION**

Domain 2 (See Fig. A-1)

Countermeasure : Administration of stable iodine

IL of Dose : 50 mGy - 500 mGy to thyroid

Radiological parameters : External gamma dose rate at 1m above ground. considered for initiating the countermeasure

Gamma Dose Rate (mSv/h)	Period for Distribution of KIO <sub>3</sub> to All Persons in the Affected Areas
Above 0.01	At the earliest

- (i) Method of administration of KIO<sub>3</sub>
  - (a) All individuals above 12 years of age:
    - 170 mg - as soon as possible
    - 85 mg - 2nd and 3rd day
    - 170 mg - repeat after two weeks if required
  - (b) Pregnant women and children of age 3-12 years:
    - 50% of quantities given in (a)
  - (c) Children under the age 3 years:
    - 25% of the quantities given in (a)
- (ii) Time of administration of stable iodine is important for thyroid dose reduction. The reduction factors are given below:

Time of Stable Iodine Administration	Dose Reduction %
Before exposure (empty stomach)	100
1 hour after exposure	80
6 hours after exposure	50
1 day after exposure	Negligible

**TableA-5: DERIVED INTERVENTION LEVELS FOR SHELTERING**

Domain 2 (See Fig. A-1)

Countermeasure : Sheltering

IL of dose : 5 mSv - 20 mSv effective dose

Radiological parameter : External gamma dose rate at 1m above the ground considered for initiating the countermeasure

Period of persistence : 10 hours

Gamma Dose Rate Range (mSv/h)	Calculated Period of Reaching IL (hours)	Period for Completion of countermeasure (hours)
0.01- 0.05	110	24
0.05 - 0.10	50	

- Note: (1) Population group falling in this countermeasure should also be administered  $KIO_3$ .
- (2) For gamma dose rates below 0.01 mSv/h, stay in-doors (sheltering) is considered adequate.

**Table- A-6: DERIVED INTERVENTION LEVELS FOR KIO<sub>3</sub> ADMINISTRATION**

Domain 1 (See Fig. A-1)

Countermeasure : Administration of stable iodine

IL of dose of dose : 500 mGy-2500 mGy to thyroid

Radiological parameter : External gamma dose rate at 1 m above the ground considered for initiating the countermeasure

Gamma Dose Rate (mSv/h)	Period for Distribution of KIO <sub>3</sub> to All Persons in Affected Area
Above 0.1	At the earliest

- Note: (1) KIO<sub>3</sub> shall be administered as soon as dose rate from ground deposition is found to be more than 0.1 mSv/h.
- (2) Population group falling in sheltering and/or evacuation countermeasure should also be covered by this action.

**Table A-7 : DERIVED INTERVENTION LEVELS FOR SHELTERING**

Domain 1 (See Fig. A-1)

Countermeasure : Sheltering

IL of dose : 20 mSv - 100 mSv effective dose

Radiological parameter : External gamma dose rate at 1m above the ground considered for initiating the countermeasure

Period of persistence : 4 hours

Gamma Dose Rate Range (mSv/h)	Calculated Period of Reaching IL (hours)	Period for Completion of Countermeasure (hours)
0.1 - 0.5	56	12
0.5 - 1.0	26	
1.0 - 1.5	16	
1.5 - 2.0 and above	11	

Note: (1) Population group falling in this countermeasure should also be administered  $KIO_3$ .

(2) After sheltering, evacuation is to be considered if IL of effective dose 100 mSv is likely to be exceeded.

**Table A-8: DERIVED INTERVENTION LEVELS FOR EVACUATION**

Domain 1 (See Fig. A-1)

Countermeasure : Evacuation

IL of dose : 100 mSv - 500 mSv effective dose

Radiological parameter : External gamma dose rate at 1 m above the ground considered for initiating the countermeasure

Period of persistence : 10 hours

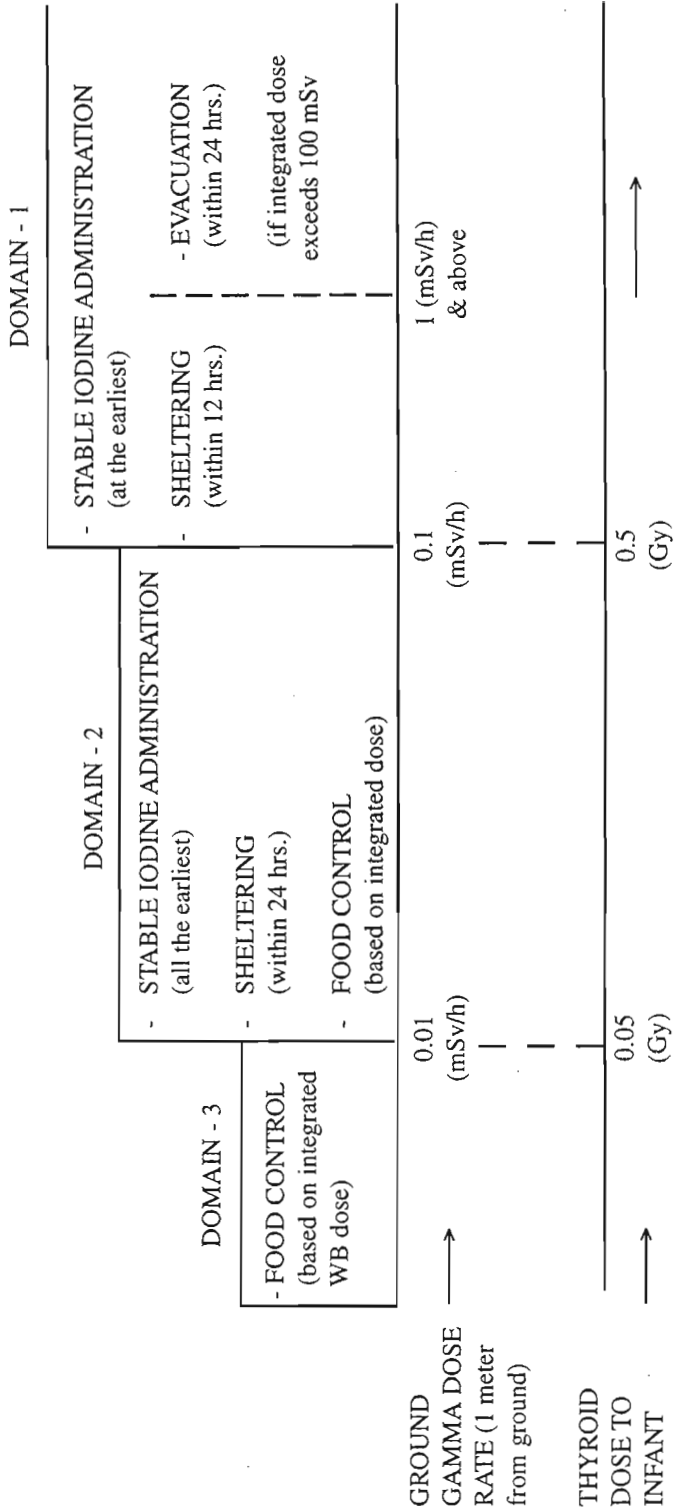
Gamma Dose Rate Range (mSv/h)	Calculated Period of Reaching IL (hours)	Period for Completion of Countermeasure (hours)
1.0 – 1.5	90	24
1.5 – 2.0	65	
2.0 – 2.5	50	
2.5 – 3.0 and above	40	

- Note: (1) Population group falling in this countermeasure should also be administered  $KIO_3$ .
- (2) Prior to evacuation sheltering should be done.



Fig. A-1

COUNTERMEASURES TO BE IMPLEMENTED AT DIFFERENT  
GROUND GAMMA DOSE-RATES IN THE OFF-SITE AREAS



## ANNEXURE-B

### GUIDELINES FOR IMPLEMENTATION OF COUNTERMEASURES

#### **B.1 Actions during Early and Intermediate Phases of the Accident (up to say one week)**

[In these early/intermediate phases of the accident the intervention levels of doses will be as given in Table A-1]

In the case of an emergency situation, in which the radiation fields in the off-site areas, resulting from the passage of plume containing radioactive materials or due to ground contamination are detected and are showing rising/changing trend, the steps to be followed are given below:

- (i) Measure gamma radiation field at one metre from the ground in the off-site locations.
- (ii) If the fields are significantly higher than the normal background levels, but below 0.01 mSv/h and then the measurement of activity content and identification of contaminating radionuclides in water and foodstuffs produced in the area should be carried out by the Environmental Survey Laboratory. All off-site emergency agencies should be alerted.
- (iii) If the levels of contamination in the water and food materials are above those indicated in Table A-2, then only emergency alert would continue, but the sampling and analyses should be done more frequently.
- (iv) If the activity in samples of water and food materials exceeds that indicated in Table A-3, then off-site emergency (control of foodstuffs) should be declared. All the on-site and off-site emergency agencies should be activated. The consumption of water and food materials produced in all such areas should be restricted. These restrictions should be implemented within 24-48 hours. All the members of public should be asked to use water and food materials brought from outside such areas.
- (v) If the gamma radiation field at 1 metre from the ground at any off-site locations exceeds 0.01 mSv/h then off-site emergency (stable iodine incorporation) should be declared in this area. The following actions in public domain should be taken.

- (a) All members of public should be advised to take stable iodine (potassium iodate) tablets at the earliest (vide Table A-4 for iodine administration and doses).
  - (b) The members of public should be advised to be prepared to move to emergency shelters.
- (vi) If the external gamma radiation field level is more than 0.01 mSv/h but less than 0.1 mSv/h, then the members of public should be advised to take stable iodine tablets (if not already taken). If the period of persistence of radiation field is >10 hours then the members of public should be advised to move to emergency shelters (sheltering countermeasure). The implementation periods for this countermeasure are given in Table A-5. It is however advised that this countermeasure should be implemented as early as realistically possible but certainly within 24 hours.
- (vii) If the radiation field at 1 m above ground is above 0.1 mSv/h but less than 1 mSv/h, then the following steps should be taken:
- (a) Advise stable iodine incorporation (if not already done) (Ref. Table A-6)
  - (b) If the period of persistence is > 4 hours, then advise the members of public to move to emergency shelters (sheltering countermeasure). The periods of implementation are given in Table A-7. It is however advised that this countermeasure should be completed as early as realistically possible and certainly within 12 hours.
- (viii) In case the radiation fields are still higher, besides the countermeasures of stable iodine incorporation and sheltering, the more drastic countermeasure of evacuation would have to be implemented.
- (a) For implementation of this countermeasure the members of public should be alerted to be ready for evacuation when the radiation field reaches close to 1 mSv/h.
  - (b) At fields reaching or >1 mSv/h the countermeasure of evacuation should be implemented, if the period of persistence of the radiation field exceeds 10 hours or more. The periods of implementation of this countermeasure are given in Table A-8. However it is advised that this countermeasure should be implemented as early as realistically possible and certainly within 24 hours.

**B.2 Action during Later Phases of Accident** (more than say one week)

During the later phases of emergency, based on the advice of health physics agency, the emergency authorities may recast the boundaries of the domains in the off-site areas.

## ANNEXURE-C

### LIST OF DOCUMENTS, DRAWINGS, FURNITURES, EQUIPMENT, INSTRUMENTS AND PROTECTIVE EQUIPMENT TO BE KEPT IN VARIOUS AREAS.

#### Area Numbers and Area Description:

- |                                     |                               |
|-------------------------------------|-------------------------------|
| 1. Control room                     | 6. Emergency survey vehicle   |
| 2. Emergency equipment Centre       | 7. Contamination casualty kit |
| 3. Guard house                      | 8. First-aid post             |
| 4. Emergency decontamination centre | 9. Ambulance                  |
| 5. Emergency shelters               |                               |

Details	Area No. (Area Description)								
	1	2	3	4	5	6	7	8	9
<b>Documents</b>									
Station safety report	*								
Station emergency plan	*	*							
Station emergency procedures		*							
System description	*								
Personnel rosters	*								
Photographs of plant surroundings	*	*							
<b>Drawings</b>									
Site lay-out	*								
Plant equipment layout	*								
Site plan		*							
Logic diagrams	*								
Checklists	*								
System flowsheet	*								
Isodose curves	*								
Maps: Areas	*								
District		*							

\* indicates the area where the item is available.

Details	Area No. (Area Description)								
	1	2	3	4	5	6	7	8	9
Roads		*							
Sampling points	*	*							
<b>Furniture &amp; Stationary supplies</b>									
Black board		*							
Desk/ chairs		*							
Bed								*	*
Bed linen					*			*	*
Telephone	*	*	*	*	*	*	*	*	
Stationary		*							
Wheel chair folding									*
Stretchers								*	*
Leg rest								*	*
Basket stretcher								*	*
Blankets								*	*
First-aid kits								*	*
<b>Equipment</b>									
Two-way wireless	*	*				*			
Flash lights	*					*			
Lanterns	*								
Batteries for above	*					*			
<b>Instruments</b>									
Gamma meters		*			*	*			
High range gamma meters		*							
Very high range gamma meters		*							
GM survey meters		*							
Contamination monitors		*			*	*			

Details	Area No. (Area Description)								
	1	2	3	4	5	6	7	8	9
<b>Air samplers: Normal</b>		*							
High volume		*							
Battery operated		*							
Iodine-in-air monitor		*							
Tritium-in-air monitor		*							
Dosimeters: low range		*							
High range		*							
Dosimeter charger		*							
Vehicle gamma monitor						*			
Gamma spectrometer						*			
Filter paper discs:						*			
HEPA						*			
Charcoal						*			
Multipurpose survey meter		*				*			
Sampling accessories (bags, carbuoys, scoop, scissors, measuring bottles etc.)						*			
<b>Protective Equipment</b>									
Air packs – SCBA		*							
Spare cylinders		*							
Respirators: Ordinary		*							
Supplied air		*							
Air hoses 25 feet with quick fit		*							
Connectors for air hose		*							
Ventilation harness		*							
Plastic suits		*							
Plastic hoods		*							

Details	Area No. (Area Description)								
	1	2	3	4	5	6	7	8	9
Coveralls		*	*						
Caps		*							
Under pants		*							
Vests		*							
Socks		*							
Shoes: Orange rubber		*							
Red rubber		*							
Canvas			*						
Gloves: Cotton	*		*						
Latex			*			*	*	*	
Gauntlets		*		*			*	*	*
Lineman		*							
Post-mortem				*			*	*	*
Towels		*							
Mop-heads		*							
Mop-handles		*							
Pails with squeezers		*							
Disposal bags		*							
Radiation signs polythene sheets		*							
Detergent powder		*	*						
Water-proof paper		*							
Bath soap				*					
Hand brushes				*					
Barrier rope: yellow				*					
Masking tapes (2")			*						
Steel posts	*			*					



Details	Area No. (Area Description)								
	1	2	3	4	5	6	7	8	9
Smear paper discs	*								
First-aid kits									*
Loud hailers		*							
Extension board						*			
Axes						*			
Scissors						*			
Coveralls			*						
Lab. Coats			*						
Shoe covers; Plastics			*						
Cotton			*						
Emergency Light			*						
Sticker signs			*						
Tissue papers			*						
Brushes-soft bristle					*				
Tablets KIO <sub>3</sub>					*				
Oxygen apparatus								*	*
Cotton applicators								*	
Elastic rubber bands								*	
Tourniquets								*	
Analgesics								*	
Splints								*	
Skin cream								*	
Gauges assorted								*	
Eye pads								*	
Hand cleaner								*	

\* indicates area where the item is available

## BIBLIOGRAPHY

1. Safety Guide for Intervention Levels and Derived Intervention Levels for Off-site Radiation Emergencies . AERB/SG/HS-1 (1993)
2. Safety Guide on Medical Management of Persons Exposed in Radiation Accidents. AERB/SG/MED-1 (1990).
3. Safety Manual: Hand Book for Medical Management of Persons Exposed in Radiation Accidents. AERB/SG/MED-2 (1989)
4. Preparedness of the Operating Organisation for Emergencies at NPPs- Safety Guide IAEA-50-SG-46 (1982) and also AERB: AERB/SG/O-6 (1999)
5. Emergency Preparedness Exercises for Nuclear Facilities: Preparation, Conduct and Evaluation- Safety Series No. 73, IAEA (1985)
6. Role of Regulatory Body Concerning Emergency Response at Nuclear and Radiation Facilities- AERB Safety Guide AERB/SG/G-5 (1998)
7. Emergency Preparedness Manual for TAPS- NPC Vol. I Part 1-3 (1988)
8. Emergency Preparedness Manual for RAPS Vol. 1 & 2 - NPC (1988)
9. Emergency Preparedness Manual for MAPS Vol. 1 & 2- NPC (1988)
10. Emergency Preparedness Manual for NAPS- NPC Vol. 1 & 2- NPC (1989)
11. Emergency Preparedness Manual for KAPS- NPC Vol. 1 & 2-NPC (1989)

## LIST OF PARTICIPANTS

### COMMITTEE FOR REVISION OF SAFETY MANUALS ON ON-SITE AND OFF-SITE EMERGENCY PLANS FOR NUCLEAR INSTALLATIONS (CROOEN)

Dates of Meeting : June 22 & 23, 1995,  
July 20 & 21, 1995,  
October 27, 1995,  
December 19, 1995  
February 26, 1996,  
May 6, 1996,  
June 26 & 27, 1997

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Shri H.N. Mirashi : Director, Industrial Safety & Health,  
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Shri George Thomas : AERB

## ADVISORY COMMITTEE ON NUCLEAR SAFETY (ACNS)

Date of Meeting : September 26, 1998

### Members and alternates participating in the meeting:

Shri S.K. Mehta(Chairman)	:	Formerly Director, Rector Group, BARC
Shri S.M.C. Pillai	:	Nagarjuna Power Corporation
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Shri S.K. Goyal	:	BHEL
Shri Ch. Surendar	:	NPC
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Dr. V. Venkatraj	:	BARC
Dr. U.C. Mishra	:	BARC
Shri S.P. Singh	:	Formerly Head, NSD, AERB
Shri G.K. De	:	AERB
Smt. Usha Menon (Member-Secretary)	:	AERB
Shri Y.K. Shah (Invitee)	:	AERB

**PROVISIONAL LIST OF SAFETY DOCUMENTS ON  
EMERGENCY RESPONSE PREPAREDNESS**

Safety Series No.	Provisional Title
AERB/SG/EP-1	Preparation of Site Emergency Preparedness Plans for Nuclear Installations
AERB/SG/EP-2	Preparation of Off-Site Emergency Preparedness Plans for Nuclear Installations
—	Preparation of Site Emergency Preparedness Plan for Non-Nuclear Facilities of the Department of Atomic Energy.
—	Preparation of Off-site Emergency Preparedness Plan for Non-Nuclear Facilities of the Department of Atomic Energy.

## NOTES