

**AERB SAFETY GUIDELINES NO. AERB/SG/EP-1**

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

**Issued in October 1999**

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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 Safety Guidelines 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 Site Emergency Plan for Nuclear Installations", AERB/SM/NISD-1, 1986 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)  
Chairman, AERB

## DEFINITIONS

### **Emergency Alert**

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

### **Emergency Plan**

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

### **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 radioactive material is produced, processed, used, handled, stored or disposed of (for example repository) on such a scale that consideration of safety is required.

### **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.

**Plant Emergency**

Declared conditions in which radiological/other consequences are confined to the plant or a section of the plant.

**Prophylactics**

Materials 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 the 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.

# CONTENTS

FOREWORD .....	i
DEFINITIONS .....	iii
1. INTRODUCTION .....	1
1.1 General .....	1
1.2 Objectives .....	2
1.3 Scope .....	2
2. DESCRIPTION OF NUCLEAR INSTALLATION AND SITE .....	4
2.1 Description of Installation .....	4
2.2 Site Location .....	4
2.3 Site Area Maps .....	4
2.4 Site Area .....	5
3. ORGANISATION AND RESPONSIBILITIES .....	6
3.1 Organisation Details .....	6
3.2 Contact Details .....	6
3.3 Responsibility .....	6
3.4 Emergency Response Groups .....	6
3.5 Mutual Aids .....	7
4. GUIDELINES FOR EVALUATION OF EMERGENCIES .....	8
4.1 Radiation Doses .....	8
4.2 Accident Scenarios .....	8
4.3 Emergency Classification .....	8
4.4 Countermeasures .....	8
5. COMMUNICATIONS .....	10
5.1 System Description .....	10
5.2 System Requirements .....	10
5.3 System Facilities .....	11
5.4 Testing of the Communication System .....	11
5.5 Redundancy in Communication Links .....	11
6. RESOURCES AND FACILITIES .....	12
7. DECLARATION AND TERMINATION OF SITE EMERGENCY .....	13

8. ACTION PLAN FOR RESPONDING TO A SITE EMERGENCY 14

9. MAINTENANCE AND UPDATING OF SITE  
EMERGENCY RESPONSE PLAN ..... 15

APPENDIX – A : Emergency Reference Levels for On-Site Emergency 16

BIBLIOGRAPHY ..... 17

LIST OF PARTICIPANTS ..... 18

COMMITTEE FOR REVISION OF SAFETY MANUALS ON  
ON-SITE AND OFF-SITE EMERGENCY PLANS FOR NUCLEAR  
INSTALLATIONS (CRÖOEN) ..... 18

ADVISORY COMMITTEE ON NUCLEAR SAFETY (ACNS)..... 19

PROVISIONAL LIST OF SAFETY DOCUMENTS ON EMERGENCY  
PREPAREDNESS ..... 20



# 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, the 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 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 a satisfactory site emergency preparedness plan (SEPP) acceptable to the Regulatory Body.

1.1.3 Radiological emergencies at 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 off-site emergencies involving radiation fallout in the public domain is handled by state public authorities with 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 of the nuclear installation in preparing an emergency response plan for site emergency.

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

## **1.3 Scope**

1.3.1 This Safety Guidelines covers all aspects of emergency response plans, which the Operating Organisation shall prepare and maintain in full readiness for implementation in the event of site emergency at the 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

In addition, any other facilities in which emergency reference levels given in Appendix-A are likely to be reached as per accident scenarios in the Safety Report of the facility also require establishment of SEPP.

- 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 as per its established procedures.
- 1.3.4 It also does not cover the emergency response plans for off-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 which should be got approved by the Regulatory Body.

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

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

### **2.2 Site Location**

This sub-section should indicate the state, district, and taluk level divisions. It should specify the location with respect to the nearest natural and man-made features such as rivers, lakes, embankments, dams, railway line, roads, etc.. It should include the details of usage of land and water resources for agriculture/cattle farming, 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 SEPP should be provided as a separate Annexure to the plan and the list for the same should be given in this subsection. All maps should be drawn to scale and should include the following information:

- (i) Installation or plant boundary lines;
- (ii) Site boundary;
- (iii) Principal structures in the installation or plant;
- (iv) Principal storage sites for materials, inflammable materials, toxic substances/ radioactive material, conventional waste dump yards etc.;

- (v) Location of personnel assembly areas;
- (vi) First aid centre, dispensary/hospital;
- (vii) Police headquarters/state transport headquarters; and
- (viii) Access/exit routes.

#### **2.4 Site Area**

This sub-section should give the following details for the site area:

- (i) Ownership of land, if not already under control of the "Occupier";
- (ii) Control of activities other than those of the facility being described;
- (iii) Arrangements for traffic control;
- (iv) Access control details;
- (v) Industrial, commercial, institutional, recreational or residential structures within the site area; and
- (vi) First aid centres, dispensary/ hospital within the site area.

### **3. ORGANIZATION AND RESPONSIBILITIES**

This section of the SEPP should describe the overall organisation structure, which will come into force during a site emergency. It should include the following:

#### **3.1 Organisation Details**

Organisation structure, hierarchy of emergency response personnel, 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 Responsibility**

Details of responsibilities assigned (during normal working hours and outside working hours) to the designated officials and the specific authority vested in them to ensure that the assigned responsibilities can be carried out.

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

Composition of service groups and their responsibilities should be outlined. The following components of service groups should be covered:

- (i) Communication;
- (ii) Announcements (within the facility);
- (iii) Radiological monitoring;
- (iv) Sheltering;
- (v) Evacuation/transport of personnel;
- (vi) Medical care including administration of prophylactics;
- (vii) Security/maintenance of order;
- (viii) Fire fighting; and
- (ix) Decontamination.

### **3.5 Mutual Aids**

The types of accidents where external organisations would be involved should be identified and the responsibilities to be shouldered by them clearly outlined. This would also include the responsibilities taken up by the facility for rendering such assistance to external organisations.

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

This section should include guidelines on radiation dose, accident scenarios, emergency classification and countermeasures.

### **4.1 Radiation Doses**

4.1.1 Emergencies in nuclear installations are likely to result in exposures, which may be controlled only by taking some remedial measures. Emergency reference levels are those values of dose, dose equivalent or dose commitment which, if reached, or exceeded would call for enforcement of remedial measures.

4.1.2 Radiological conditions for declaring plant/site emergency are given in Annexure-A.

### **4.2 Accident Scenarios**

A list of accident scenarios which are considered in the plant safety report of the facility as likely to cause a site emergency situation should be given.

### **4.3 Emergency Classification**

Depending upon the nature and severity of accident, the effect of the emergency may be restricted to either a small area of the plant, or a few individuals or it may pose danger to the plant itself. In more severe cases, release of radioactive materials from the plant may take place, contaminating the site within the site boundary. Taking these into consideration, emergency situations are classified as Emergency Alert, Plant/Local emergency and Site emergency. These terms have been defined in the beginning of the document under definitions.

### **4.4 Countermeasures**

4.4.1 The countermeasures envisaged hereunder are stay in-doors (sheltering) and evacuation from site.

4.4.2 In the case of evacuation from site, these guidelines are applicable only for those personnel who are not required for carrying out the operations necessary for controlling an emergency or for performing the assigned



emergency duties or functions. The radiation exposures for essential personnel likely to be involved in these tasks, will be governed by provisions applicable to radiation workers as contained in the AERB Safety Manual on Radiation Protection for Nuclear Facilities, (Rev.3), 1996. The same criteria will also apply for post-operation remedial measures.

## **5. COMMUNICATIONS**

This section should 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 site emergency response shall be exclusively used for emergency purposes only and shall not be used for routine day-to-day communications. It should be ensured that the systems concerned are kept functional at all times.

### **5.1 System Description**

The description of each system should cover the following:

- 5.1.1 Organisation structure for communication- the designated official including alternate(s)
- 5.1.2 Manpower- to maintain the communication systems including functional responsibilities
- 5.1.3 Equipment- including availability of alternate system(s)
- 5.1.4 Contact details including the nature of contact for emergency control centre(s).

### **5.2 System Requirements**

- 5.2.1 Emergency control centre at the facility: There shall be a direct communication link between the emergency control room, fire station and the control room. The emergency control room should be equipped with atleast two external and two internal telephone lines, of which, one each should be dedicated solely to outgoing calls.
- 5.2.2 Alarm systems: There should be an adequate number of points from which an emergency alarm can be raised. Details of the alarm systems should be furnished. The alarms are sounded only under emergency conditions. Separate signals should exist for declaration and termination of emergency. The alarm should be followed by emergency announcements on the PA system.

### **5.3 System Features**

With respect to the communication system for site emergency response, the system shall ensure the availability of the following:

- (i) List of officials authorised to issue emergency messages or announcements;
- (ii) List of officials at the facility to be contacted in the event of a 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) The mechanism by which contact details of all the concerned officials are kept updated; and
- (vi) A system of standardisation of various types of messages that should be transmitted to officials outside the facility.

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

SEPP 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 links within the facility as well as communication links to external agencies. 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 should be an in-built redundancy in the communication system by way of availability of atleast two modes of communication at all levels connected with the 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 SEPP shall describe the resources that should be available to the site emergency director during a site emergency at the facility. These should cover the following:

- (i) Mechanism for announcement;
- (ii) Emergency shelters at the facility;
- (iii) First aid facilities;
- (iv) Decontamination facility;
- (v) Security points;
- (vi) Radiological monitoring and sampling;
- (vii) Emergency groups;
- (viii) Distribution mechanism for prophylactics ( $KI0_3$ );
- (ix) Transport, vehicles and fuel;
- (x) Hospital facilities;
- (xi) Rescue teams;
- (xii) Fire fighting facilities/personnel;
- (xiii) Mutual aid;
- (xiv) Emergency control room; and
- (xv) Emergency equipment.

6.2 The system for periodic testing maintenance and replacement of equipment (in case of obsolescence) should be clearly laid down and the responsibility for its implementation indicated.

## **7. DECLARATION AND TERMINATION OF SITE EMERGENCY**

- 7.1** This section of the SEPP should list out the sequence of actions to be taken for the declaration of a site emergency. The declaration and notification should be made only by the designated authority who is the site emergency director (SED), or his/her authorised representative who should also be the designated authority for terminating the same. It would also specifically indicate how the audible signals would have to be interpreted for the declaration and termination of an emergency. All announcements should be in English, Hindi and the regional language.
- 7.2** The steps or actions described in this section should be clear, unambiguous and coherent. It should include the specific conditions under which site emergency would be declared or notified and the conditions under which it will be terminated. This should also include the mechanism or communicating the notification of declaration and termination to all designated officials who are responsible for taking specific actions in response to such communications.

## **8. ACTION PLAN FOR RESPONDING TO A SITE EMERGENCY**

- 8.1** This section of the plan is the most important part of the emergency response plan. It should outline the duties and responsibilities of officials listed in sections 2 and 5 and who have been detailed to carry out specific response action plans. In this regard it should be ensured that the control room of the facility has a display of names and contact details of key designated officials on duty, 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 site emergency. It should also include actions necessary for an orderly and phased shutdown of the facility or part of it, where required. It should be comprehensive and should give all the actions to be taken up to the stage till the site emergency has been terminated. This would also include the specific actions to be taken in the event that a site emergency situation deteriorates into an off-site emergency.
- 8.3** This section should also include a specific sub-section which will address the mechanism set up to handle post-accident situations like decontamination and recovery and recommissioning of the affected facilities.

## **9. MAINTENANCE AND UPDATING OF SITE EMERGENCY PREPAREDNESS PLAN**

- 9.1 This section should describe the system of maintenance and updating of the site emergency response plan to ensure that it is kept at an acceptable level of readiness. It shall address the following areas:
- (i) Updating contact details of emergency response personnel (including external agencies and service groups);
  - (ii) Testing schedule of equipment at the emergency control centre, environmental survey laboratory, decontamination facility and first-aid area;
  - (iii) Periodic 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 joint training programmes covered by mutual aids;
  - (vi) Conducting drills/exercises, obtaining feedback and taking corrective measures;
  - (vii) Maintenance of records; and
  - (viii) Updating and revision of plans.
- 9.2 For each of the items listed above, details regarding the designated official responsible for implementation, updating and revision action, if and when required, powers delegated and procedures adopted should be listed.

## APPENDIX-A

### Emergency Reference Levels for On-Site Emergency

- A. The emergency reference levels of dose:
- Effective dose : 5 mSv  
Thyroid dose : 50 mGy  
Any other organ dose : 50 mGy
- B. Ambient radiation levels : 0.25 mSv/h  
(at 100 m from the facility  
giving rise to site emergency)
- C. Ambient air activity levels : 5000 Bq/m<sup>3</sup> for <sup>131</sup>I  
(at 100 m from the facility)  
(to deliver effective dose of  
2.5 mSv, making an allowance  
of 50% for other iodines).  
or  
an equivalent airborne con-  
centration of other nuclides  
likely to be released from the  
plant as per accident analysis  
considered in the safety report

Note:- The above values are derived using levels A as the basis with a persistence time of 10 hours and an internal dose component of 50%. In case of a different scenario, the applicable emergency reference levels can be similarly derived.

### Reference Levels for control of contamination during site emergency monitoring at exit point

Sr. No.	Nature of Contamination	Alpha, (Bq/cm <sup>2</sup> )	Beta, gamma (Bq/cm <sup>2</sup> )
1.	Contamination on body	2.0	10.0
2.	Contamination on personal clothing	4.0	20.0



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**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.