

CHAPTER

5

EMERGENCY PREPAREDNESS



Nuclear Power Plants (NPP) in India are designed, constructed, commissioned and operated in conformity with relevant nuclear safety requirements. These requirements ensure an adequate margin of safety so that NPPs can be operated without undue radiological risks to the plant personnel, members of the public and the environment. State of the art safety measures are provided based on principles of defence-in-depth, redundancy (more numbers than required) and diversity (back-up systems operating on different principles). These include failsafe shutdown system to safely shutdown the reactor, combination of active and passive (systems working based on natural phenomena and not needing motive power or operator action) cooling systems to remove the heat from the core at all times and a robust containment system for confining any release of radioactivity. Notwithstanding these, it is mandatory to develop Emergency Preparedness and Response (EPR) plans as a measure of abundant caution. These plans are prepared in accordance with the national laws and regulations and deal with the effective management of any eventuality with a potential to pose an undue radiological risk to the plant personnel and public.

Similarly, EPR plans are ensured for non-nuclear facilities under the purview of AERB and handling hazardous chemicals viz. ammonia and hydrogen sulphide based Heavy Water Plants (HWP) and some of heavy water plants catering

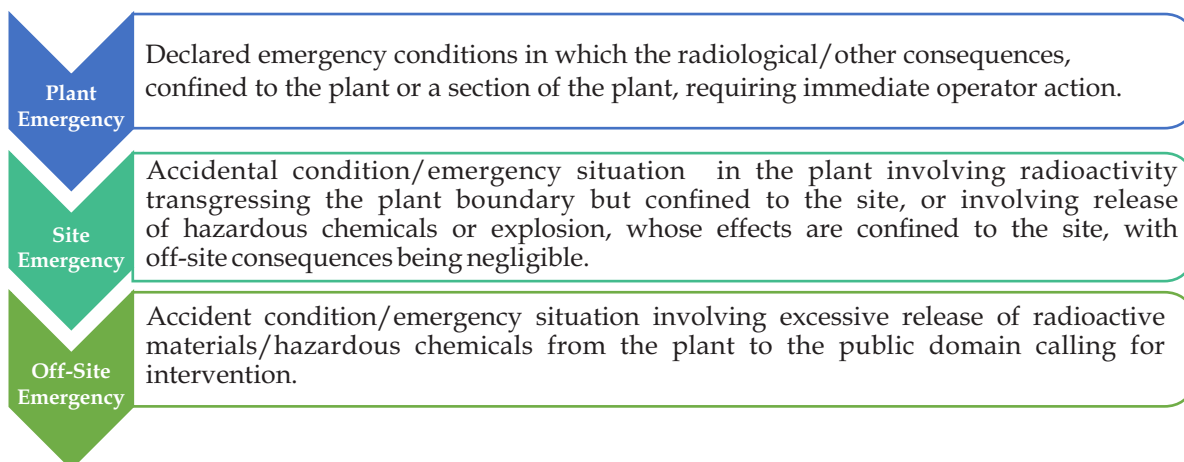
to the production of solvents. These plans are prepared as per AERB Safety Guidelines and the Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 for 'On-Site' and 'Off-Site' Emergency Preparedness for non-nuclear installations and deal with the effective management of any eventuality with a potential to pose an undue chemical risk to the plant personnel and public.

The establishment and submission of emergency preparedness plans and procedures is one of the pre-requisites for licensing of radiation facilities (RF) also.

5.1 ROLE OF AERB IN EMERGENCY PREPAREDNESS AND RESPONSE

AERB has established regulations and guidelines specifying the principles, requirements and associated guidance and criteria for emergency preparedness and response. It also ensures and verifies that arrangements for preparedness and response to a nuclear and radiological emergency for facilities and activities under purview of licensee are adequate. This is achieved by review and approving the EPR plan of the licensee. AERB oversees the arrangements and preparedness of the licensee through regulatory inspection and observation of emergency exercises. During an emergency, AERB's role is to keep itself apprised of situation, review of response actions and inform public as and when necessary.

The various types of Emergency conditions at nuclear facilities are elaborated below:



5.2 REVIEW OF PREPAREDNESS FOR EMERGENCY AT NPP SITES

AERB reviews the preparedness through review of EPR plans of the licensee, conduct of regulatory inspection and observation of emergency exercise following a graded approach. AERB conducts regulatory inspections to check the emergency preparedness at all NPPs. During the year 2020, AERB officials could not participate as observer in emergency exercises (since March, 2020 onwards) due to travel restrictions imposed consequent to COVID-19 pandemic preventive measures; however exercises were reviewed based on reports submitted by the facilities subsequent to completion of the exercises.

At the early phase of the lockdown, AERB advised the Operator and the NPP Stations to revisit their respective EPR Plans to identify the need of augmentation of any additional resources / change in the preparedness and response plans considering the COVID-19 situation as well as to

apprise the respective local administrators / governments of the same, so that there is complete preparedness for responding to any emergencies, should a need arises. NPPs continued to carry out the emergency exercises. Plant Emergency Exercise (PEE) and Site Emergency Exercise (SEE) were carried out as per schedule. Off-Site Emergency Exercise (OSEE) could not be conducted due to the restrictions imposed on movement and involvement of relevant Stakeholders from the public domain considering COVID-19 preventive measures. However, AERB advised NPPs to continue testing their preparedness for OSEEs through conduct of Table-Top (TT) exercises.

PEE and SEE are conducted by Stations with the frequencies once in every quarter and once in a year respectively. Currently, OSEEs are carried out with a frequency of once in two years. The number of SEE and OSEE conducted at various NPP Sites in 2020 are listed in Table 5.1.

The frequency for conduct of various emergency exercises in NPP is as follows:



Table 5.1: Site and Off-site Emergency Exercises at NPP (2020)

NPP Sites	SEE	OSEE (Table-Top)	OSEE (ICCR)
Tarapur	1	1	0
Rawatbhata	1	-	1
Kalpakkam	1	-	-
Narora	1	1	0
Kakrapar	1	1	1
Kaiga	1	-	1
Kudankulam	1	1	0
Total	7	4	3

The OSEE framework has been strengthened through conduct of different type of exercises, namely the Table-Top (TT) exercise and Integrated Command Control and Response (ICCR) OSEE.

In the TT exercises, the emphasis is on testing the decision-making capability of plant authorities on aspects such as classification, declaration, notification and evolving protection strategy based on plant conditions for recommending protective actions.

In the ICCR OSEE procedure, in addition to the decision-making process by plant authorities, the aspects of testing command control functions, early warning and field response along with resource mobilization in realistic environment, inter-agency co-ordination, communication, etc., are being tested. The ICCR procedure involves activation of the overall response framework covering Plant Authorities, District Authorities, CMG-DAE & RERD-BARC. As an important feature these exercises were conducted in a realistic environment where, the information on the event and possible consequence are not known to the response organizations participating in the exercise.

During the year 2020, the ICCR OSEE was conducted at three NPP sites viz. Kaiga,

Rawatbhata and Kakrapar. Earlier two ICCR exercises were conducted, first one at Rawatbhata-Rajasthan site in 2018 and another at Kalpakkam in 2019. The ICCR OSEE that were scheduled at other NPP sites (viz. Tarapur, Narora, Kudankulam) could not be conducted due to the COVID-19 pandemic situation and consequent preventive measures. However, Table Top OSEE was conducted at these sites to ensure preparedness of plant authorities for responding to any off-site emergency situations.

Following para gives brief description of ICCR at NPP sites:

(i) ICCR at Kaiga-Karnataka

Third ICCR OSEE conducted at Kaiga site in January, 2020, wherein all Stakeholders such as NPP Management, District Authority, NDMA, AERB, participated in the exercise at Site, while CMG-DAE, RERD-BARC participated remotely from their respective locations at Mumbai. At AERB HQ, Nuclear and Radiological Emergency Monitoring Centre (NREMC) was activated and progression of event and response actions were monitored and assessed. Major findings were noted by all the Stakeholders and these were discussed in the feedback meeting after the completion of the exercise for further improvements.



Environmental monitoring activities during ICCR Off-Site Emergency Exercise at KGS site



Feedback meeting of all stakeholders after conduct of ICCR Off-Site Emergency Exercise at KGS site

(ii) ICCR at Rawatbhata, Rajasthan

Fourth ICCR Off-site Emergency Exercise was conducted at Rawatbhata on December 16, 2020. All the stakeholders viz. Plant and Site Officials, District Officials, Technical Support Centre NPCIL-HQ, CMG-DAE, RERD-BARC, SOT of AERB participated in the exercise. The



SECC during Off-site Emergency Exercise at Rawatbhata site

focus of the exercise was on identification & declaration of emergency class, early & intermediate phase decision making, activation of different emergency control centres, initial response, recommendation of protective action & to check response of district officials in the process of implementation, interface and coordination between plant / site & district authorities without involvement of public.



Field Survey by ESL Team during Off-site Emergency Exercise at Rawatbhata site

(iii) ICCR at Kakrapar, Gujarat

Fifth ICCR was conducted at Kakrapar Site on December 18, 2020. Various DAE and other Government organisations actively participated in the exercise viz. Kakrapar Site, District Administrations of Surat and Tapi-Vyra, DAE-CMG & DAE-RERD, Environmental Survey Laboratories (ESL) as part of ERC, NPCIL HQ, and AERB. The exercise was designed to challenge all organizations having a role in responding to a nuclear emergency in the early and intermediate phase. AERB SOT members participated in exercise at Site, where as AERB Observers Team (AOT) participated remotely from NREMC, Mumbai.

5.3 HARMONIZATION OF EMERGENCY PREPAREDNESS PLANS OF NPP

Successful demonstration of EPR plans is a mandatory requirement for issuing licence for operation of NPP. AERB ensures that necessary EPR plans are in place and they are successfully demonstrated before issuing regulatory consent for First Approach to Criticality (FAC). AERB evaluates all the elements of the EPR plans such as identification of emergency, classification, decision-making, notification, communication and projected dose assessment, and ensures the periodic revision of these plans.

During review and revision of Plant EPR of few of NPPs, AERB felt the need of harmonization of Plant, Site and Off-Site EPR plans of NPPs. Keeping this in view, standard Templates on Plant and Site EPR plans were prepared by NPCIL in line with regulatory requirements (AERB Safety Codes and Guides on the subject), latest published IAEA Safety Standards on EPR (GSR Part-7, GS-G-2.1, GSG-2 and GSR Part-3) and all NPPs were asked to revise their Plant and Site Emergency Preparedness Plans accordingly.

The Off-Site Emergency Preparedness Plan (OSEPP) is covered in two parts.

Part-I:

The NPPs to have their own Plan covering the arrangement required for prompt classification, declaration, communication, mitigatory actions, and recommendation on necessary protective actions in the public domain.

Part-II:

District Authorities to maintain their own Plan covering response actions in the public domain as part of the integrated District Disaster Management Plan (DDMP).

Earlier, the Template for OSEPP for NPP (Part-I) was approved by AERB, and currently NPPs are revising the same plan based on the approved Template. The OSEPP by District

Authorities (Part-II) is being revised by the respective District Authorities following the Document Preparation Profile (DPP) issued by National Disaster Management Authority (NDMA).

5.4 CREATION OF ON-SITE EMERGENCY SUPPORT CENTRE AT NPP

Based on the reviews undertaken during safety assessments of Indian NPPs, in light of the accident at Fukushima NPPs, AERB mandated the requirement for establishing the On-Site Emergency Support Centre (OESC) at all NPP sites. AERB constituted an Advisory Committee to develop the guidelines for establishing OESC at all NPP Sites. This facility will have capability to withstand earthquake and flood of magnitudes larger than their respective design basis for the NPP. The building will be designed with requisite shielding for protected stay of response personnel for extended duration. AERB, after a detailed review, accepted the generic guidelines prepared by the Advisory Committee for establishing OESC and had asked NPCIL to submit design basis report for the site specific OESC for all NPP sites in accordance with these guidelines. The design of OESC has been finalized by the utilities and the implementation is in progress.

5.5 DECISION SUPPORT SYSTEM

Decision Support System (DSS) for handling nuclear emergencies is intended to provide comprehensive and timely information to emergency managers on an emergency situation arising from a nuclear accident. Based on the radiological monitoring readings of installed radiation monitors at NPPs and meteorological conditions, the DSS estimates the projected public dose. These estimates are used to decide appropriate protective actions in the public domain. DSS is being implemented progressively at all the NPP Sites.

5.6 NUCLEAR AND RADIOLOGICAL EMERGENCY MONITORING CENTRE

During nuclear and radiological emergency, AERB monitors and keeps itself informed about the emergency situation. It reviews & assesses the emergency situation, and if required, provides appropriate regulatory support and advice to the relevant response agencies. AERB also informs the public and the Government on the safety significance of events and actions being taken. To facilitate this, AERB has instituted an Emergency Response Monitoring Organization (AERB-ERMO) which gets activated during an emergency. The activities of AERB-ERMO is



Shri K. N. Vyas, Chairman, AEC visits NREMC at AERB

carried out and coordinated by the Nuclear and Radiological Emergency Monitoring Center (NREMC) established at AERB. The Centre is equipped with various cells (Communication, Assessment, Analysis & Legal) along with necessary software and hardware infrastructure.

The capabilities of NREMC include, emergency analysis, assessment of emergency response actions & protective actions and communication with all Stakeholders. The software systems with on-line Decision Support System (DSS), source term and radioactivity release assessment, environmental monitoring data inputs, video conferencing with other emergency response agencies and trained & experienced personnel has been established. NREMC is kept on alert mode during any abnormal natural phenomena occurring in any of the Districts containing NPPs and subsequently activated as required. Further during plant and site emergency exercise conducted by NPP sites, NREMC is poised to receive information about the on-going exercises. In case of OSEE at NPP Site, NREMC is activated and its various responsibilities are tested including independent assessment. In case of real emergencies, NREMC is activated as per the established procedures.

5.7 DEVELOPMENT OF REGULATORY DOCUMENTS RELATED TO EMERGENCY MANAGEMENT

AERB is in the process of consolidating & revising its requirements and guidance for EPR, which presently are addressed in different regulatory safety documents (REGDOC) which were developed in different timelines over many years. As a step towards holistic revision, the existing requirements are being consolidated/

updated through a dedicated Safety Code and three Safety Guides for management of nuclear and radiological emergency. 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 the role entrusted to AERB by National Disaster Management Authority through its National Disaster Management Plan (NDMP, 2019).

Safety Code and Guides for EPR are being developed taking into account existing EPR requirements, developments including the change in approach to public protection during emergency conditions as elaborated in ICRP publications, IAEA General Safety Requirements (IAEA GSR Part-7), lessons learned from the Fukushima Daiichi accident and subsequent safety reviews of Indian NPPs and guidance available nationally and internationally.

These new regulatory documents (Code and Guides) are being prepared following a bottom to top-approach. Necessary supporting documents on areas including development of Emergency Actions Levels (EAL), development of protection strategy, conduct of emergency exercise and the template for EPR plans of NPPs have been developed. These documents are being developed in AERB by Expert Groups consisting members from AERB, NPCIL, BARC and CMG-DAE. The understanding established in these basis/supporting documents are used in a graded manner in the Safety Code and the Safety Guides. Currently, the AERB Safety Code is in advanced stage of review.