

EXECUTIVE SUMMARY

During the year 2023, Atomic Energy Regulatory Board (AERB) continued to monitor safety aspects of all facilities and activities associated with nuclear energy and applications of ionising radiation under its purview. AERB carried out its functions with the support of various safety committees and specialist committees.

Important Decisions by the Board

During the year, the Board met six times. The Board was periodically apprised of the important activities conducted by AERB and the safety status of the regulated installations. The important decisions by the Board are as follows:

- a. Taking note of the measures being planned for strengthening the regulatory control over medical X-ray facilities, the Board accepted the proposal for closure of DRS model. To close the process of closure of DRS model in a systematic manner, the proposal has been forwarded to DAE for placing before AEC.
- b. The Board suggested to develop practice specific guidelines for Proton Therapy based on the operating and regulatory experience gained. AERB has developed draft guidelines on regulatory requirements for establishing Proton Therapy Facility, which is under review.
- c. The Board suggested wide dissemination of short awareness videos developed by AERB through social media to professional associations and all stakeholders. The video clips were uploaded on AERB website and on YouTube. Information circulars along with the links were sent to concerned parties.
- d. The Board approved the revised Safety Standard on "Civil Engineering Structures Important to Safety of Nuclear Facilities AERB/NF/SS/CSE (Rev.1)".



Board Meeting of AERB

Safety Surveillance of Nuclear Facilities

Thirteen NPP units with a capacity of 10,100 MWe are under construction / commissioning stage.

Presently, civil construction and erection of major equipment are in progress at Kudankulam Nuclear Power Plant (KKNPP-3&4). AERB had issued Consent for Erection of Major Equipment in April, 2022.

In KKNPP-5&6, civil construction work is in progress. AERB gave permission for erection of Core Catcher Vessel in July, 2023. The Vessel has been installed.

Prototype Fast Breeder Reactor (PFBR) project is in commissioning stage. AERB is closely monitoring and reviewing the commissioning activities and related issues. Based on review, permission for pre-heating of Main Vessel was issued in April, 2023. Subsequently, permission for sodium filling in Main Vessel and commissioning activities up to 200°C was issued in August, 2023. AERB has also issued permission for raising the temperature of Primary Sodium in Main Vessel, Secondary Sodium System and Safety Grade Decay Heat Removal (SGDHR) system up to 250°C in November, 2023.

Kakrapara Atomic Power Plant (KAPP)-3, the first 700 MWe PHWR unit, is under Phase-C commissioning. After validating the modifications implemented to address the high area temperatures in Reactor Building, permission was granted for the resumption of commissioning and operation at 60% FP in March, 2023. Subsequently, permissions for raising KAPP-3 reactor power in steps were issued progressively. Permission for raising reactor power up to 100% FP was issued in August, 2023.

For KAPP-4, AERB issued permissions for

PHT system Hot Conditioning & Light Water Commissioning and Initial Fuel Loading in June and October, 2023 respectively. On completion of Initial Fuel Loading and satisfactory safety review, permission was issued for Bulk Addition of Heavy Water to the moderator system and First Approach to Criticality and Low Power Physics Experiments in December, 2023. KAPP-4 achieved its first criticality on December 17, 2023.

For Rajasthan Atomic Power Plant (RAPP)-7, AERB issued permission for PHT system Hot Conditioning and Light Water Commissioning in November, 2023. Hot Conditioning of PHT system was completed and currently Light Water Commissioning related tests are in progress. At RAPP-8, Construction/ Pre-commissioning activities are in progress.

The permission for the commencement of raft construction for the Nuclear Building (NB-1) at Gorakhpur Haryana Anu Vidyut Pariyojna (GHAVP-1&2) was issued on March 16, 2023. AERB was subsequently notified of subsidence in some of the ground improved area near Station Auxiliary Building of GHAVP-2. NPCIL is conducting investigations to establish the cause and extent of the problem.

AERB continued regulatory oversight of 22 operational NPP units in India. The radioactivity releases from all the NPPs were less than the AERB specified limits. Effective dose to member of public in the vicinity of NPP sites was far less than the annual dose limit of 1 mSv.

AERB renewed the Licences for Operation under the Atomic Energy Act, 1962 (and rules framed thereunder), the Factories Act, 1948 (and rules framed thereunder) and issued Authorization for radioactive waste disposal / transfer under the Atomic Energy (Safe Disposal of Radioactive

Wastes) Rules, 1987 for KGS-3&4 and NAPS-1&2. RAPS-3 is under shutdown since October 27, 2022 for En-masse Coolant Channel Replacement (EMCCR) and En-masse Feeder Replacement (EMFR).

AERB continued to review the safety aspects of operating Nuclear Fuel Cycle facilities under its purview. AERB issued the Licence for Operation of mines at Jaduguda, Narwapahar, Turamdih, Bhatin & Tummalapalle. AERB also issued the License for Operation of HWP-Hazira and extended the validity of license for operation of HWP-Tuticorin.

During the year, AERB also renewed the License for Operation of IGCAR facilities viz. FBTR, IFSB, CORAL, RML and RCL. Details of licenses / consent issued to Operating Nuclear Power Plants, Research Reactors, Nuclear Fuel Cycle Facilities and other related Industrial Facilities are given in section 1.6.

Safety Surveillance of Radiation Facilities (RF)

AERB issued 25,623 licences for operation of various Radiation Facilities (RFs) involved in use of ionising radiation in medical, industrial and research activities. AERB also issued 6,810 permissions for procurement of radioactive sources and granted 5,589 approvals for Radiation Safety Officer (RSOs) in various practices.

Enforcement actions in the form of suspension of license for operation was taken against Industrial Radiography facilities in Mathura, Trichy, Delhi and Ahmednagar due to non-adherence to Personnel Monitoring Service (PMS), engaging untrained personnel, use of enclosure without valid consent and higher radiation levels outside the radiography enclosure, and falsely declaring RSOs.

The details of Safety Surveillance of Radiation Facilities are given in Chapter-2.

Regulatory Inspection (RI) of Nuclear and Radiation Facilities

AERB conducted 129 RIs in various nuclear power projects, operating NPPs, and Industrial & fuel cycle facilities and 942 RIs in various medical, industrial and research facilities, to check compliance with the licensing conditions and relevant safety requirements. Site Observers Teams (SOT) are posted at four NPP sites (Rawatbhata, Kalpakkam, Kakrapar and Kudankulam) to observe activities at the operating as well as the under construction plants. There was no 'Red' category inspection findings observed in Nuclear and Radiation facilities during the year. Red category finding relates to a deviation of high safety significance and need urgent corrective action by the facility. The details of Regulatory Inspection of Nuclear and Radiation Facilities are given in Chapter-3.

Environmental Safety and Occupational Exposure (for the year 2022)

Radioactive effluent releases from all the licensed facilities remained within the authorized limit. Public dose to a hypothetical person considered to be present at the exclusion zone boundary of NPP was estimated to be between 0.002 μSv – 25.35 μSv , which is a small fraction of the public dose limit (1000 μSv). Occupational doses in the NPPs, nuclear fuel cycle facilities and radiation facilities were monitored at defined frequency. There was no case of individual exposure above regulatory dose limit for the regulated nuclear and radiation facilities.

Details of public doses, occupational doses and initiatives taken by AERB for dose reduction are presented in Chapter-4.

Emergency Preparedness

Plant/Site/Off-Site emergency exercises were conducted at NPP sites as per the defined frequencies. Off-Site Emergency Exercises (OSEE) were observed by AERB officials and monitored through Nuclear and Radiological Emergency Monitoring Centre (NREMC) of AERB. Site Emergency Exercises were conducted at seven NPP sites and Table-Top Off-Site Emergency Exercises (OSEE) were conducted at five NPPs.

The status of Emergency Preparedness are presented in Chapter 5.

Regulatory Safety Document Development

Fifty Two safety documents are under different stages of development / revision. During the year, a revised Safety standard on 'Civil Engineering Structures Important to Safety of Nuclear Facilities' was published. As part of India's contribution to the safety standards programme of IAEA, AERB reviewed and provided comments on number of draft Safety Standards of IAEA.

The status of Regulatory Safety Documents is presented in Chapter- 6.

Safety Analysis, Research and Development

To support the regulatory review functions of AERB, safety studies are performed in the area of reactor physics, thermal-hydraulics, structural mechanics, severe accidents, radiological impact assessment and environmental chemistry.

Safety assessment of low power reactor physics experiments during 7th fuel cycle operation of KKNPP-1 was carried out. Independent verification studies were conducted for safety review of proposal for loading of RU/SEU fuel bundles in PHWR-220.

Severe accident studies included estimation of critical heat flux and in-vessel retention capability of PHWRs, extended SBO event analysis for PHWR-700, effect of non-availability of one or more PDHRS loops and analysis of core disruptive accident scenario in a MOX fuelled reactor.

Experimental studies were conducted in the Compartment Fire Test Facility (CFTF) at SRI to determine the fire hazard potential of turbine lube oil. The behaviour of Iodine in reactor containment during postulated accidental conditions was investigated in an in-house experimental facility. Studies on sorption of Iodine species using silver-doped alumina were also undertaken and completed.

Structural mechanics studies included deterministic analysis of BWR reactor pressure vessel using FAVOR Code, high temperature creep and rupture behaviour of calandria material SS 304L, assessment of PHWR-700 primary containment integrity for internal pressure, participation in Standard Problem Exercise (SPE) related to seismic soil-structure interaction in collaboration with the USNRC to evaluate the effectiveness of frequency domain method for analysing deeply embedded structures.

AERB renewed funded research projects on nuclear, radiation and industrial safety at academic institutions under the AERB-Safety Research Programme. Seven on-going projects were renewed / extended this year.

The details on various activities of Safety Analysis and Research are presented in Chapter-7.

Stakeholders Engagement & Public Outreach Activities

AERB conducted various programs to keep its stakeholders and public informed. Toward

this, AERB organised National Conference on Regulatory Interface (NCRI-2023) on "Safety Regulations in Mining, Milling and Fuel Fabrication Facilities", 39th DAE Safety and Occupational Health Professional Meet and organised number of awareness programs for stakeholders. AERB also conducted public awareness programs in the vicinity of NPPs viz. Kakrapara, Gorakhpur and Rajasthan sites for school children, college students and teachers.

AERB also conducted various awareness programs for stakeholders of radiation facilities.

AERB provided information to stakeholders through its annual report, quarterly e-newsletters, press releases / briefings, etc., which are available on the website of AERB, www.aerb.gov.in.

The details on Stakeholders Engagement & Public Outreach Activities are presented in Chapter-8.

Accountability

AERB provided timely responses to the queries posted by the members of public under Right to Information (RTI) Act, 2005 and Public grievances. It also submits responses to parliamentary questions related to regulation of NRFs. The details on Public Accountability Activities are presented in Chapter-9.

International Co-operation

Chairman AERB, led Indian delegation consisting of experts from AERB, Bhabha Atomic Research Centre, Nuclear Power Corporation of India Limited and the India's Permanent Mission in Vienna, to participate in Joint 8th and 9th Review Meeting (RM) of the Convention on Nuclear Safety (CNS) at Vienna, Austria held during March 20-31, 2023. The National Report of India for

peer review was presented on March 21, 2023. The presentation of India highlighted noteworthy practices in India's nuclear programme, response to challenges and suggestions identified in the previous RMs and areas of good performance in India's safety & regulatory framework. India was commended for seven Areas of Good Performance. Shri S B Chafle, Executive Director, AERB, chaired the Country Group-5 review meetings in CNS.

Chairman, AERB, as part of Indian delegation, attended the 67th IAEA General Conference held during September 25 - 29, 2023 at Vienna, Austria. He also attended the Senior Safety and Security Regulator's meet and side-line meetings with delegation from regulatory bodies of Slovak Republic, Vietnam and Argentina arranged during the General Conference.

AERB signed a MoU with Nuclear Regulatory Authority of the Slovak Republic (UJDSR) on September 25, 2023 for the exchange of technical information and co-operation in the field of regulation of the safe use of nuclear energy for peaceful purposes.

A bilateral meeting with United States Nuclear Regulatory Commission (USNRC) was held at AERB Headquarter, Mumbai during February 13-15, 2023.

AERB actively participates and contributes in the multi-lateral international activities organized by International Atomic Energy Agency (IAEA) and Nuclear Energy Agency (NEA).

The details on AERB's contributions in the areas of International Co-operation are provided in Chapter-10.

Human Resource Development and Infrastructure

AERB continued to augment its human resources with recruitment of personnel at various levels considering the safety regulation needs of expanding nuclear power programme of India and increasing number of radiation facilities in the country. This is being carried out through induction of Graduate Trainees from Orientation Course for Engineering Graduates and Science Post Graduates (OCES) of DAE units and direct recruitment mode.

As striving towards workplace excellence, AERB conducted two opinion surveys of its staff pertaining to assessment of organisational climate and participation of staff in policy making. The first survey was an attempt to elicit views/opinion of employees of AERB on eligibility cum selection criteria for choosing the 'right person' for heading a Division/Directorate in AERB. The second survey was designed to elicit feedback on the attributes the employee thinks are important towards assessment of their superiors, namely the immediate superior, Section Head and Division Head.

The details on Human Resource & Infrastructure Development and initiatives towards organisational climate excellence are provided in Chapter-11.

Events and Activities for AERB Employees

AERB organised various activities such as Republic day, Swachhata Pakhwada, National Safety Day, and International Women's Day, etc. to engage with the employees.

The details on Events and Activities for AERB Employees are presented in Chapter-12.

Official Language Implementation

AERB celebrated National Hindi Day, World Hindi Day and conducted a variety of programs to promote and encourage the use of Hindi as the official language in its official works.

The details on Official Language Implementation are presented in Chapter-13.

Finance

AERB receives funds from the Government of India for meeting its revenue and capital expenditure. The annual expenditure during the year 2022-23 was Rs.114.89 Cr.

The details on Finance is presented in Chapter-14.