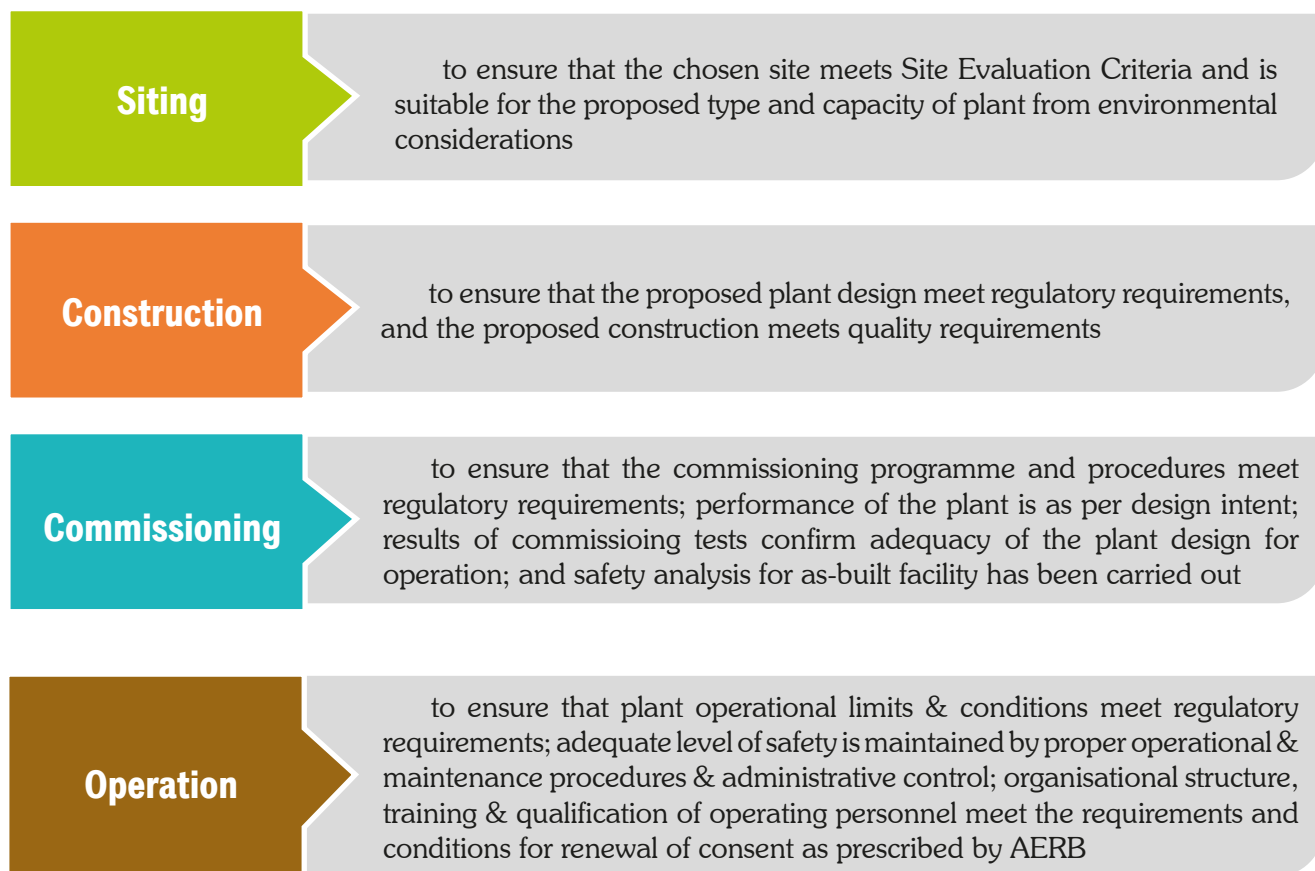


1.1 SAFETY REVIEW MECHANISM OF NUCLEAR FACILITIES

Nuclear facilities in India are sited, designed, constructed, commissioned and operated in accordance with strict quality and safety standards. Though prime responsibility of safety lies with utility, Atomic Energy Regulatory Board (AERB) oversees the safety of the nuclear and radiation facilities and has been mandated to frame safety policies, lay down safety standards

and requirements. AERB has established a regulatory framework, which involves stipulating the safety requirements, issuance of regulatory consents after safety review, verification of compliance through safety reviews and inspections during various stages viz. siting, construction, commissioning, operation etc.

All nuclear facilities undergo an elaborate and in-depth safety review during various stages. The objective of safety review and assessment at various consenting stages is illustrated below:



Safety reviews related to the consenting decisions and safety monitoring during various stages are carried out through multi-tier safety committees. The committees include experts in relevant fields including process design, control and instrumentation, thermal hydraulics, structural analysis, reactor physics, seismology etc. relevant to nuclear and radiation safety. The higher level committees include experts from academia, national R&D institutes and government bodies. The multi-tiered system of safety review follows the principle of “management by exception”, following graded approach and is based on principles, requirements and criteria specified by AERB in its regulatory documents.

In this approach, the issues of greater significance are given consideration at higher level committees for their satisfactory resolution. Recommendations of these committees concerning various safety issues and consents are further considered by AERB for arriving at regulatory decisions. This arrangement ensures comprehensiveness of the reviews and effective compliance with the specified requirements. Additionally, AERB carries out periodic regulatory inspections to check conformance with regulatory requirements and consenting conditions.

The licence for operation of the facilities is given after ensuring its satisfactory construction and commissioning as per the approved design, complying with the quality requirements and the specified safety/regulatory requirements. The licence for operation is given with a specified validity period. Renewal of licence for operation is considered based on separate application along with a comprehensive safety review as per the laid down requirements and process.

In the case of operating NPPs, there is requirement for carrying out a comprehensive periodic safety review (PSR) once in ten years, as per the laid down requirements. The PSR involves a thorough assessment of the safety of the plant in comparison with the current safety requirements and practices, covering a number of

identified safety factors. The PSR facilitates a cumulative assessment of plant ageing, modifications, safety performance, advances in science and technology and feedback of operating experience. The PSR provides opportunities for identifying and implementing safety upgrades/enhancements in the plants as well as the regulatory programmes, as necessary. This regulatory approach ensures that the safety levels of the plants are maintained and enhanced to remain comparable with the contemporary safety standards/practices throughout the operating life of the plant.

Review of Security Aspects

AERB has also been entrusted with the responsibility of review and assessment of nuclear security aspects (having impact on safety) for different types of nuclear facilities in India. AERB has issued various regulatory documents specifying nuclear security requirements in this regard. Depending on the project stage, security aspects are reviewed against relevant regulatory requirements. Multi-tier approach is adopted for review of security aspects also.

The safety status of the nuclear facilities, significant events and enforcement actions during the year 2019 are covered in the following sections.

1.2 NUCLEAR FACILITIES UNDER CONSTRUCTION

AERB has established an elaborate system for in-depth safety review of Nuclear Power Projects (NPP) and Fuel Cycle Facilities (FCF) that are under construction. For this purpose, different stages of ‘regulatory consent’ have been identified as following:

During year 2019, the status of various nuclear power projects and fuel cycle facilities under siting, construction and commissioning are being reviewed by AERB are presented in Table 1.1 and 1.2 respectively.



Table 1.1: Status of various Nuclear Power Projects

Project Stage	Project	District/ State	Utility/ Licensee/ Applicant	Type	Review Status
Site evaluation	Jaitapur Nuclear Power Project (JNPP)-1-6, Ratnagiri	Ratnagiri/ Maharashtra	NPCIL	1650 MWe EPR (light water reactor) each, of French Design	Site Evaluation is in progress
	Kaiga NPP-5&6	Karwar / Karnataka	NPCIL	700 MWe PHWRs each, of indigenous design	Site Evaluation is in progress
Construction	Kudankulam Nuclear Power Project (KKNPP)-3&4 Kudankulam	Tirunelveli/ Tamil Nadu	NPCIL	1000 MWe VVER (light water reactor) each, of Russian Design	Clearance for FPC granted in June, 2017
	KKNPP-5&6, Kudankulam	Tirunelveli/ Tamil Nadu	NPCIL	1000 MWe VVER (light water reactor) each, of Russian Design	Clearance for site excavation (first stage of construction consent) was issued in November, 2018
	Gorakhpur Haryana Anu Vidyut Pariyojana (GHAVP)-1&2, Gorakhpur	Fatehabad/ Haryana	NPCIL	700 MWe PHWRs each, of indigenously design	Clearance for site excavation (first stage of construction consent) was issued in January, 2018
	Rajasthan Atomic Power Project (RAPP)-7&8, Rawatbhata	Chittorgarh / Rajasthan	NPCIL	700 MWe PHWRs each, of indigenous design	Clearance for major Equipment Erection (last stage of construction consent) was issued in March 2015
Commissioning	PFBR, Kalpakkam	Kancheepuram/ Tamil Nadu	Bhartiya Vidyut Nigam (BHAVINI)	500 MWe prototype Fast Breeder reactor each, of indigenous design	Clearance for receipt, handling and storage of 42 number of fresh fuel subassemblies at fuel building was issued in June, 2019
	KAPP-3&4, Kakrapar	Tapi, Gujarat	NPCIL	700 MWe PHWRs each, of indigenous design	Clearance for hot conditioning and associated tests granted in August, 2019 for KAPP Unit#3

Table 1.2: Status of various Fuel Cycle Facilities (under Siting, Construction and Commissioning)

Stage	Project	Dist./ State	Utility/ Licensee/ Applicant	Project Details	Remarks
Siting	Away from Reactor spent fuel storage facility for KKNPP-1&2 (AFR)	Tirunelveli/ Tamil Nadu	NPCIL	Away from Reactor spent fuel storage facility for storing spent nuclear fuel of KKNPP-1&2 (AFR)	Review of Siting application is under progress
Construction	Fast Reactor Fuel Reprocessing Facility (FRFCF), Kalpakkam	Kancheepuram/ Tamil Nadu	IGCAR	Integrated facility for recycling spent fuel from PFBR. The project includes fuel fabrication & assembly, reprocessing and waste management facilities	Permission for resumption of construction activities involving earthmoving was given on November 8, 2018
	PHWR Fuel Fabrication Facility and Zircaloy Fabrication Facility, Rawatbhata,	Chittorgarh/ Rajasthan	Nuclear Fuel Complex, Kota	Fabrication facility for PHWR fuel and Zircaloy components	Construction consent granted in February, 2018
Construction & Commissioning	Demonstration Fast Reactor Fuel Reprocessing Plant (DFRP), Kalpakkam	Kancheepuram/ Tamil Nadu	IGCAR	Reprocessing facility for spent fuel from Fast Breeder Test Reactor (FBTR).	Clearance for Acid-TBP run (Inactive run) for PPF, DFRP issued on March 12, 2019 & cold commissioning is in progress

The information on the meetings of the important safety review committees for facilities undergoing reviews related to siting/construction/commissioning is given in Table 1.3.

Important outcome of the safety review and assessments related to nuclear power projects and fuel cycle facilities are given in subsequent paragraphs.

Table 1.3: Safety Review Committee Meetings of the Nuclear Power Projects & Fuel Cycle Facilities (under Construction)

Project Safety Committee	Number of Meetings
ACPSR-NPPs (for PHWR, PFBR & LWR)	1
ACPSR-FCF	-
PDSC-FBR	3
PDSC-LWR	3
PDSC-PHWR	12
PDSC (DFRP, FRFCF and DFMF)	1
CESC	7
SEC	4
CRSA	3
Total	34

*Apart from these meeting, many In-house Group meetings organised for safety review

1.2.1 NPP UNDER CONSTRUCTION: REVIEW STATUS

Safety review activities related to the Nuclear Power Projects (refer Table 1.1) continued during the year.

A1. Light Water Reactor Based NPPs

(i) Kudankulam Nuclear Power Project - 3&4 (KKNPP- 3&4)

KKNPP Unit-3&4 plant design is a repeat design of KKNPP Unit-1&2, which was extensively reviewed in AERB. Review process for Unit-3&4 is optimized to review of design differences impacting safety and compliance to AERB safety code on 'Design of Light Water Reactors based Nuclear Power Plants'. AERB had granted clearance for First Pour of Concrete (FPC) on June 23, 2017 with certain stipulations. Presently, civil construction work is in progress at KKNPP-3&4.

Review of Revised (Rev. 1) Preliminary Safety Analysis Report (PSAR) w.r.t. Reactor Coolant System, Engineered Safety Features, Instrumentation & Control, Electrical Systems, Radioactive Waste Management System and Radiation Protection & salient changes w.r.t. PSAR (Rev-0) is in progress.



Core Catcher Erection in KKNPP-3



Liner Erection Works in Reactor Building of KKNPP-4

Design Basis Report (DBR) on system for retention and cooling of molten core (core catcher) was also reviewed along with NPCIL request for erection of core catcher of KKNPP-3&4. Based on satisfactory review it was concluded that there is no hold for erection of the core catcher.

Reports on geological mapping, confirmatory geotechnical investigations, analysis and design of essential loads pump house (UQC) building structure and construction related documents were reviewed towards compliance to the stipulations and NPCIL was permitted to take up the construction of UQC.

AERB carried out review of design adequacy checks for critical locations in civil engineering structures following AERB safety standards and concrete mix designs for normal and heavy concrete.

(ii) Kudankulam Nuclear Power Project - 5&6 (KKNPP- 5&6)

NPCIL application for FPC along with relevant PSAR Chapters are under review with major focus on design differences w.r.t. KKNPP-3&4.

A.2 Fast Breeder Reactors Based NPPs

(i) Prototype Fast Breeder Reactor (PFBR)

Clearance for receipt, handling and storage of 42 numbers of fresh fuel sub-assemblies (FSA) at Fuel Building (FB) was issued on June 28, 2019 after detailed safety review and assessment of the application along with the supporting documents. FSAs have been

received at PFBR and are now stored in FB. This area is under access control and area surveillance as well as monitoring of contamination, air activity and stack activity are being periodically done. Releases reported are below detection limit (BDL).

Decoupling and recoupling of Large Rotatable Plug (LRP) bearing is planned for investigation of high torque observed during trial rotation of LRP. As preparatory work for the investigation, main vessel preheating system has been shut down for cooling the main vessel and both the secondary sodium loops are completely drained. AERB Site Observers Team (SOT) deputed at Kalpakkam Site has been independently observing ongoing commissioning activities at PFBR with respect to regulatory safety aspects.



PFBR BHAVINI Site

A.3 Pressurized Heavy Water Reactor (PHWR) Based NPPs

(i) KAPP-3&4 and RAPP-7&8

Safety review of various submissions for the twin units of 700 MWe PHWRs at Kakrapar, Gujarat (KAPP-3&4) and Rawatbhata, Rajasthan (RAPP-7&8) is in progress. Review Groups in AERB are progressively reviewing relevant submissions on Safety analyses, Stress analysis reports, Environmental Qualification (EQ) reports, Independent Verification and Validation (IV&V) reports, Commissioning Procedures for both projects, Commissioning reports of KAPP-3 and Technical Specifications for Operation.

NPCIL application for authorization of Primary Heat Transport (PHT) System Hot Conditioning and Light Water Commissioning (LWC) of KAPP-3 was reviewed and clearance for KAPP-3 hot-conditioning and associated hot tests was granted on August 07, 2019.

Subsequently, NPCIL submitted an application for seeking permission for remaining LWC tests of KAPP-3. After satisfactory review, clearance for balance LWC tests was granted on November 01, 2019.

Based on review observations, some of the commissioning tests (in PHT hot condition) were repeated at KAPP-3, e.g. Passive decay heat removal system (PDHRS) test, PHT pressure decay test, Shutdown cooling pump hot valve-in test, Channel

outlet temperature monitoring system (CTMS) RTD performance test etc.

NPCIL submitted an application seeking permission for draining and drying of PHT System for KAPP-3 after completion of PHT related commissioning tests. After satisfactory review, permission for draining of Light water from PHT system was granted on December 16, 2019.

In KAPP-4, civil construction and erection of equipment/ components are under progress. Pre-stressing activity of Unit-4 Inner Containment was completed.

As part of flood mitigation measures for KAPP-1 to 4, construction of box culverts in two of the three identified portions was completed and opened to public. Lowering of adjacent ground surface to a specified level on both sides of box culvert is in progress. Process for initiating the work of third portion is under progress.



KAPP-3&4 Main Plant Area

AERB Team along with Plant Personnel during Commissioning of KAPP-3



Civil construction and erection of equipment/components are under progress in RAPP-7&8. In RAPP-7, IC Dome Concreting and Pre-stressing activities have been completed. Erection of feeders, steam generators(SG), PDHRS tanks, and pressuriser has been completed. Erection of safety and safety related piping and equipment is under progress. In RAPP-8 North & South SG vault 132M EL and IC wall construction including ring beam has been completed.

AERB Site Observer Teams (SOT) were deputed at Kakrapar and Rajasthan Site for physical verification of compliances and to witness various activities.



RAPP-7&8 Main Plant Area

(ii) GHAVP-1&2

Subsequent to grant of excavation consent by AERB, NPCIL commenced the excavation activities for main plant buildings of GHAVP-1&2. Ground improvement by replacing soil by compacted soil-cement has been undertaken to address the potential liquefaction concerns. Excavation and ground improvement works at the site is nearing completion.

NPCIL application for FPC of GHAVP-1&2 is under review at AERB. Preliminary analysis and design of safety related structures considering the inputs of geotechnical investigations have been reviewed by AERB. Considering the characteristics of founding strata viz-a-viz configuration and layout of structures, combined pile-raft type of foundation system is proposed for certain safety related structures and raft foundation is proposed for others. Confirmatory geotechnical investigations and initial pile load tests are under progress. These tests were also witnessed by AERB. Finalization of analysis/design considering the inputs from confirmatory geotechnical investigations and initial pile test results are under progress.

Design of GHAVP-1&2 is similar to KAPP-3&4 and RAPP-7&8, except for site specific changes. PSARs of GHAVP-1&2 as required for FPC, have been reviewed with a focus on design/layout differences in GHAVP w.r.t. KAPP-3&4 and site-specific features.

(iii) KAIGA-5&6

AERB received an application for Siting Consent for two units of 700MWe PHWRs at Kaiga (Kaiga Units - 5&6) from NPCIL along with Site Evaluation Report (SER) and reports on other related topical studies in December 2018. Detailed review of submissions is being carried out by Site Evaluation Committee (SEC). Review of reports pertaining to impact of site on plant, plant on site, and other identified aspects are under review. Site evaluation committee for KAIGA-5&6 visited Kaiga site to obtain first-hand knowledge of site characteristics. Subsequently, NPCIL has also submitted the application for Excavation Consent for KAIGA-5&6 in October 2019. The application and accompanying reports were reviewed by AERB to ascertain its adequacy, considering the requirements of AERB/NPP&RR/SG/G-1 and observations on the same were communicated to NPCIL.

Highlights of Safety Review of PHWRs under Construction

Main aspects of KAPP-3&4 and RAPP-7&8 safety review included revised PSARs, Commissioning Procedures, Commissioning Reports, Proposed Technical Specifications for Operation, KAPP-3 Primary Containment (PC) Integrated Leak Rate Test (ILRT) and Structural Integrity Test (SIT) reports, IV&V of Computer based systems (CBS), Environmental Qualification Reports and basis of acceptance of identified equipment etc.

(a) KAPP-3 Primary Containment Integrated Leak Rate Test (ILRT)

As part of pre-commissioning activities for KAPP-3, the full pressure structural integrity test and integrated leak rate test of the containment was conducted. AERB officers witnessed the tests as independent observers. Procedures of ILRT and KAPP-3 PC ILRT report were reviewed. The results of structural integrity tests are under review.

(b) KAPP-3 PHT Hot Conditioning and Light Water Commissioning

AERB teams conducted seven special inspections w.r.t. commissioning of KAPP-3 for verification of Construction completion certificates (CCCs)/ System transfer documents (STDs), PHT Hot conditioning, Commissioning of shutdown cooling system, Passive decay heat removal system (PDHRS) and Emergency core cooling system (ECCS) integrated test. Commissioning procedures and reports of KAPP-3 hot conditioning and light water commissioning tests were reviewed.

(c) Review of Ground Improvement in GHAVP-1&2

In GHAVP-1&2, to eliminate the potential for soil liquefaction, scheme of ground improvement was being implemented. Pile-raft foundation will be adopted for GHAVP-1&2 nuclear buildings. Casting of test piles for validation studies and confirmatory geo-technical investigations are under progress.

1.2.2 FCFs UNDER CONSTRUCTION: REVIEW STATUS

Safety review activities related to the fuel cycle facilities (refer Table 1.2) continued during the year.

B.1 Demonstration Fast Reactor Fuel Reprocessing Plant (DFRP)

DFRP is being set up at Kalpakkam for reprocessing of spent fuel from Fast Breeder Test Reactor (FBTR) on regular basis and demonstration of reprocessing process of PFBR spent fuel. In the main process plant, pre-commissioning checks were completed. AERB

has completed safety review and assessment of the application for commencing acid-Tri-Butyl Phosphate (TBP) run (initial inactive commissioning) along with requisite supporting submissions. Clearance was issued for acid-TBP run in March 2019 and AERB is continuing the safety review of the facility.

Civil construction activities in the Head End Facility of the plant, which houses the cells required for receiving and initial processing of spent fuel subassemblies are completed. Hot Cells and decontamination chamber lining works and erection of complementary shielding is completed. Service piping fabrication and installation work is in progress.

B.2 Fast Reactor Fuel Cycle Facility (FRFCF)

FRFCF is an integrated facility being set up at Kalpakkam. The facility will be used for recycling the spent fuel from PFBR, including fuel fabrication and assembly, reprocessing and waste management. AERB had issued consent for construction of this facility in the year 2013 and subsequently granted extension of Consent for Construction during December 2016. Subsequent to a fatal accident on August 29, 2018, AERB suspended the construction activities involving earthmoving at FRFCF project site. Based on review and assessment, permission for resumption of construction activities involving earthmoving was given on November 8, 2018. Presently, civil construction activities of Waste Management Plant (WMP), Core Subassembly Plant (CSP), Fuel Fabrication Plant (FFP) and Reprocessed Uranium Plant (RUP) are in progress. AERB is following up the safety aspects related to construction.

B.3 Nuclear Fuel Complex, Kota (NFC-K)

500 Tons Per Annum (TPA) PHWR Fuel Fabrication Facility (PFFF) and 165 TPA Zircaloy Fabrication Facility



Delay Tanks in DFRP



Process Control Laboratory of DFRP



Multi Pin Chopper in FRFCF



Laser based Pin Bow In FRFCF

(ZFF) are being setup at Nuclear Fuel Complex (NFC), Kota. In first phase, two modules each of 250 TPA PFFF and 65 TPA ZFF will be set up and 100 TPA Zircaloy Fabrication Facility will be added in second phase in near future.

NFC-Kota application for plant construction consent was reviewed and AERB issued construction consent on February 05, 2018 with certain stipulations. Compliance to these stipulations is being verified through RIs. Currently civil and structural works for Plant and Non-Plant Buildings are being carried out in NFC-Kota.

B.4 Away from Reactor Spent Fuel Storage Facility of KKNPP-1&2

NPCIL has earlier submitted siting application for Away From Reactor (AFR) of KKNPP-1&2 along with supporting documents. Review of Site Evaluation Report (SER) is completed. NPCIL submissions addressing clarifications sought on Post Irradiation Examinations (PIE) to be considered for AFR with regard to Radiological Impact Assessment (RIA) were reviewed.

B.5 Construction of On-site Emergency Support Centre (OESC) at Operating NPP

With regard to operating plants, AERB reviewed the analysis and design reports for construction of On-site Emergency Support Centre (OESC) at KAPP site. The

design basis for OESC at all sites except NAPS has been reviewed and accepted. Following the accepted criteria, OESC is being designed for an earthquake level of 1.2 times the safe shutdown earthquake, and qualified for beyond design basis earthquake applicable for the site.

1.3 OPERATING NUCLEAR POWER PLANTS AND RESEARCH REACTORS

1.3.1 Operational Safety Review

AERB carries out safety review and surveillance of operating NPPs & Research Reactors following multi-tier review process. Exhaustive review takes place during review of application for renewal of licence for operation and resolution of other safety issues that would emanate during plant operation. Currently there are 22 operating NPPs in the country. The details of these NPPs indicating their capacity, commencement of operation and validity of current operating licence is given in Table 1.4.

1.3.2 Consents / Clearances / Permissions Issued

AERB renews licences for operation of NPPs under the Atomic Energy Act, 1962 (and rules framed thereunder), the Factories Act, 1948 and authorization for safe disposal / transfer of radioactive waste under GSR-125 for next 5 years on satisfactory safety review.

Table 1.4: List of Operating NPPs

NPP	Site/District/State	Unit	Type	Gross Cap. (MWe)	Commencement of Operation	Validity of Licence
Tarapur Atomic Power Station	Tarapur / Palghar / Maharashtra	TAPS-1	BWR	160	Oct.-1969	March 2021
		TAPS-2		160		
		TAPS-3	PHWR	540	Aug.-2006	August 2021
		TAPS-4		540	Sept.-2005	
Rajasthan Atomic Power Station	Rawatbhata / Chithaurgarh / Rajasthan	RAPS-1 [#]	PHWR	100	Dec.-1973	August 2024
		RAPS-2		200	Apr.-1981	
		RAPS-3		220	Jun.-2000	October 2022
		RAPS-4		220	Dec.-2000	
		RAPS-5		220	Feb.-2010	March 2020
		RAPS-6		220	Mar.-2010	
Kakrapar Atomic Power Station	Kakrapar / Tapi / Gujarat	KAPS-1	PHWR	220	May-1993	July 2024
		KAPS-2		220	Sept.-1995	
Madras Atomic Power Station	Kalpakkam / Kancheepuram / Tamil Nadu	MAPS-1	PHWR	220	Jan.-1984	December 2020
		MAPS-2		220	Mar.-1986	
Narora Atomic Power Station	Narora / Bulandshahar / Uttar Pradesh	NAPS-1	PHWR	220	Jan.-1991	June 2023
		NAPS-2		220	Jul.-1992	
Kaiga Generating Station	Kaiga / North Uttar Kannada / Karnataka	KGS-1	PHWR	220	Nov.-2000	May 2022
		KGS-2		220	Mar.-2000	
		KGS-3		220	May-2007	April 2023
		KGS-4		220	Jan.-2011	
Kudankulam Nuclear Power Plant	Kudankulam / Tirunelveli / Tamil Nadu	KKNPP-1	PWR	1000	Dec.-2014	July 2020
		KKNPP-2		1000	Dec.-2017	

[#] Unit under shutdown since 2004 and the reactor core is defueled

During the year, a number of applications from the utilities were reviewed and licences for operations / clearances / permissions were issued. Important among these are as follows:

- Renewal of licence for operation of RAPS-1&2 under the Atomic Energy Act, 1962 (and rules framed thereunder) & the Factories Act, 1948 and authorization for radioactive waste disposal/transfer under GSR-125 up to August 31, 2024.
- Renewal of licence for operation of KAPS-1&2 under the Atomic Energy Act, 1962 (and rules framed thereunder) & the Factories Act, 1948 and authorization for radioactive waste disposal/transfer under GSR-125 up to July 31, 2024.
- Renewal of licence for operation of KKNPP-1&2

under the Factories Act, 1948 up to July 31, 2020.

1.3.3 Safety Review of Operating Nuclear Facilities and Research Reactors

During the year, TAPS-1 to 4, RAPS-2 to 6, KGS-1 to 4, MAPS-2, NAPS-1&2, KKNPP-1&2 and KAPS-2 were operational. KAPS-1 was synchronized to grid after satisfactory completion of EMCCR activities on May 24, 2019 and has been operating satisfactorily since then. RAPS-1 is in shutdown condition since October 2004. MAPS-1 was shut down since January 30, 2018 due to leak from pressure tubes.

Number of meetings conducted by various Safety Committees/Standing Committees / Expert Groups during the year is given in Table 1.5.

Table 1.5: Meetings of Safety Committees

Name of the Committee / Expert Group	No. of Meetings
SARCOP	17
LWR Safety Committee (TAPS-1&2 & KK-1&2)	8
PHWR Safety Committee -1 (RAPS-1&2, MAPS-1&2, NAPS & KAPS-1&2)	18
PHWR Safety Committee-2 (KGS-1&2, KGS-3&4, RAPS-3&4 & RAPS-5&6)	8
PHWR Safety Committee -3 (TAPS-3&4)	6
IGCAR Safety Committee (RR, CORAL, FRTG, RML & RCL)	6
Standing Committee on Reactor Physics (SC-RP)	16
Standing Committee on Control, Instrumentation & Computer Based Systems (SCCI & CS)	6
Expert Group on Equipment Qualification (EG-EQ)	2
Expert Group on Coolant Channels (EGCC)	9
Total	96

The Safety Status of Operating NPPs and Research Reactors is described below:

(i) Rajasthan Atomic Power Station (RAPS-1&2)

RAPS-1&2 underwent Periodic Safety Review (PSR) as a pre-requisite for renewal of its operating licence beyond August 2019. Station had submitted applications for renewal of licence under the Factories Act, 1948 and authorization for radioactive waste disposal/transfer. Based on the outcome of the PSR, the licence was extended up to August 31, 2024.

The applications were reviewed by AERB following multi-tier review process. Review assessment indicated that the performance of RAPS-2 w.r.t. nuclear, radiological and industrial safety had been satisfactory. The results of In-Service Inspections (ISI) were found to be satisfactory and plant is capable for safe operation for next five years. Based on the review, station has planned to replace boiler hairpins. Radioactive effluent discharges remained well below the limits specified in technical specification. Effective dose to member of public residing at exclusion zone was well within the limit prescribed by AERB (Refer chapter 4 of this report). Station possesses technical & administrative capability for safe operation of the plant. Station has well-established programme for utilization of operating



SARCOP Members' Visit to RAPS-1 & 2 during review of PSR



SARCOP Members' Visit to RAPS-1&2 during review of PSR

experience and had implemented a number of safety modifications.

Station had implemented all short & medium term safety upgrades identified based on review of Fukushima NPP accident. Long term post Fukushima safety upgrades such as installation of Post-Accident Hydrogen Management System (PAHMS) & Containment Filtered

Venting System (CFVS) and establishment of On-site Emergency Support Centre (OESC) are expected to be completed by December 2020.

RAPS-1 is under shutdown since 2004. Reactor core is in defueled state and mandatory surveillances are being carried out as per approved technical specifications.

(ii) Kakrapar Atomic Power Station (KAPS)-1&2

Licences for operation of KAPS-1&2 were valid till July 31, 2019. As per regulatory requirement, KAPS-1&2 submitted application for renewal of this licences/ authorization, which was reviewed in AERB. Based on the assessment of the application, AERB renewed licences for operation of KAPS-1&2 under the Atomic Energy Act, 1962 (and rules framed thereunder) & the Factories Act, 1948 and authorization for safe disposal/ transfer of radioactive waste under GSR-125 for next 5 years i.e. up to July 31, 2024.

KAPS-1&2 has undergone En-masse Coolant Channel Replacement (EMCCR) campaigns following the events of pressure tube leak/break. During the long EMCCR outage, number of safety upgrades were implemented. After completion of EMCCR activities,

Shri D.K. Shukla, ED, AERB and Chairman, SARCOP delivering a talk on 'Human Organisational and Technical Factors for Safety' to the RR Site Officers and Staff



KAPS-1&2 were synchronized to grid on May 24, 2019 & September 22, 2018 respectively. The performance of units with respect to nuclear, radiological and industrial safety had been satisfactory before and after the EMCCR campaign. The results of In-Service Inspections (ISI) were found to be satisfactory and plant is capable for safe operation for next five years. Radioactive effluent discharges remained well below the limits specified in technical specification. Effective dose to a member of public residing at exclusion zone was well within the limit prescribed by AERB (Refer chapter 4 of this report). Station has a well-established program for utilization of operating experience and had implemented a number of safety modifications based on this programme. Station had implemented all short & medium term safety upgrades identified based on review of Fukushima NPP accident. Long term post Fukushima safety upgrades such as installation of PAHMS & CFVS and establishment of OESC are expected to be completed by next Biennial Shutdowns (BSD) of units.

(iii) Kudankulam Nuclear Power Plant (KKNPP)-1&2

AERB had earlier renewed the licence for operation for a limited period i.e. up to March 10, 2019, due to pending completion of the review of fatal accident occurred in October 2018 at KKNPP site. Subsequently, station submitted significant event report and compliance to AERB recommendations made during review of the accident along with request for renewal of the licence. AERB review indicated that station management had taken necessary steps for improvements in safety management and had committed to demonstrate the improvements through improved safety performance. In view of the above, licence for operation of KKNPP-1&2 under the Factories Act, 1948 was renewed up to July 31, 2020.

(iv) Madras Atomic Power Station (MAPS-1&2)

MAPS-1 is shut down since January 30, 2018. The coolant channels O-09 & Q-09, which were observed to have developed leak, were cut & removed from reactor core and transported to BARC for Post Irradiation Examination (PIE). PIE of these pressure tubes has been completed and the reports are under review in NPCIL. Inspection of large number of coolant channels was undertaken to assess their healthiness. The review of findings is being carried out by NPCIL.

End shield (north) leak rectification work was also taken up. For this, two more pressure tubes i.e. L-12 and P-09 were also cut & removed. Leaks from end shield were rectified by installing special seal plugs on Calandria Side Tube Sheet (CSTS) of north end shield. Present leak rate from end shield is ~130 ml/hour. Fitness for service of end shield (north) and coolant channels is being assessed.

(v) Continuous Operation of Kaiga Generating Station (KGS) Unit-1

KGS-1 was synchronized to grid on May 13, 2016 after completion of Biennial Shutdown (BSD) activities. After completion of 962 days of continuous operation, the unit was shut down for BSD activities on December 31, 2018. During shutdown, surveillances of safety and safety related Structure, System, and Components (SSC) were carried out in 'as is condition'. The results of these surveillances were found to be satisfactory. The data obtained on performance of plant SSCs would be useful w.r.t. long term operation of the NPPs. After completion of BSD activities, KGS-1 was synchronized to grid on February 21, 2019.



Kaiga Generating Station

(vi) Periodic Safety Review (PSR) of KKNPP-1&2 and RAPS-5&6

The licences for operation of KKNPP-1&2 and RAPS-5&6 are valid up to July 31, 2020 and March 31, 2020 respectively. As per the revised draft AERB guide on 'PSR for NPPs' (AERB/SG/NPP/O-12), the utility is required to submit PSR basis document before embarking on PSR activity. The basis documents received from both stations were reviewed and accepted.

(vii) Review of Fatal Accident at Narora Atomic Power Station (NAPS)

An incident had occurred at NAPS on July 11, 2018, which resulted in fatality of one contract person. During the event, victim fell from the bund wall of 1.2 meter height and subsequently succumbed to death. Review of this event indicated deficiencies in the safety management during performance of this activity. In the light of this event, AERB had issued directive that all DAE units should prepare a list of routine and non-routine activities being carried out in their premises. Job specific Hazard Analysis should be performed for all the identified activities. Steps should be taken to ensure adherence to safety requirements and ensuring safety supervision especially during non-routine works at site.

(viii) Permission for Irradiation Campaign of FBTR

The 27th irradiation campaign of Fast Breeder Test Reactor (FBTR) was conducted during September 29, 2018 to January 30, 2019. Subsequently, FBTR sought permission for 28th irradiation campaign. The main objectives of 28th campaign were continuation of irradiation of sodium bonded metallic fuel pins, irradiation of Tungsten Carbide capsule (grid plate potential material), continuation of long term irradiation of structural materials and irradiation of actinide samples. Based on review of application, AERB permitted the commencement of 28th irradiation campaign of FBTR. The campaign was conducted during April 02 to September 30, 2019. Subsequently, based on review, permission for commencement of 29th irradiation campaign has also been granted.

1.3.4 Safety Assessment of Operating NPPs in the wake of Fukushima Accident

Safety assessments carried out post Fukushima NPP accident had indicated that Indian NPPs have inherent strength in dealing with external hazards. However, certain safety enhancements were identified for strengthening the defences against rare external events exceeding the design bases and enhancing severe accident mitigation capabilities. These actions were classified as short, medium and long term measures/safety upgrades. Implementations of short and medium term safety measures/upgrades have been already completed.

The long term enhancements identified were;

(a) enhancing severe accident management programme,

(b) strengthening hydrogen management provisions,

(c) provision of containment filtered venting, and

(d) creation of on-site emergency support centre.

These required research & development efforts, analysis, detailed engineering and testing/qualification. The severe accident management guidelines for different NPP designs (PHWR, BWR & PWR) were developed based on technical bases reviewed & accepted by AERB and are now in place at all NPPs. The activities related to R&D, engineering, testing & qualification related to the rest of the long term enhancements have been completed and their on-site implementation is now in progress. The present status of long term safety upgrades/measures is as below:

(a) Strengthening Hydrogen Management Provisions

The hydrogen management scheme in Indian PHWRs includes provision of suitable number of Passive Catalytic Recombiner Devices (PCRD) along with provisions for homogenizing the containment atmosphere and maintenance of the inert steam atmosphere. Activities related to indigenous development, testing and qualification of PCRDs addressing the post-accident hydrogen management needs for the Indian PHWR containments have been completed. Installation of PCRDs along with the associated instrumentation and equipment of Post-Accident Hydrogen Management System (PAHMS) is in progress in the operating NPPs. PCRDs have been installed in MAPS-2, KGS-1&2, NAPS-1, KAPS-1 and RAPS-5. For the PWR units of KKNPP-1&2, the Passive Autocatalytic Recombiners (PARs) for hydrogen management are already incorporated as part of the design. In TAPS-1&2, containment inerting system has been indigenously refurbished and the system is put in operation.

(b) Provision of Containment Filtered Venting System (CFVS)

Technology development of CFVS System has been completed and detailed engineering of the system has been finalized after analysis and testing. CFVS has been installed in TAPS-1&2 (BWR). Installation of CFVS is in progress in PHWR based NPPs, where the requirement has been envisaged. For the PWR units at KKNPP-1&2, the requirement of containment venting is not envisaged.



Nitrogen Inerting System at TAPS-1&2



Experimental Facility for CFVS at TAPS-3&4

(c) Creation of On-Site Emergency Support Centre (OESC)

AERB has framed requirements and guidelines for establishing On-Site Emergency Support Centres (OESCs) at all NPPs, which takes into account the NPPs at the given site and the accident scenarios. After regulatory approvals, construction of the OESCs at two sites (Tarapur and Kakrapar) is in progress.

1.3.5 Licensing of Operating Staff

Operating personnel of NPPs responsible for control room operation namely Shift Charge Engineer (SCE), Assistant Shift Charge Engineer (ASCE) and Control Engineer (CE) are required to go through a rigorous licensing/relicensing process. This includes clearing checklists, written exams, walkthrough and finally

qualification interviews. A candidate after successfully completing the pre-requisites of licensing procedure, appears before the licensing committee constituted by AERB for qualification interview. This committee has member(s) from AERB. On satisfactory performance, the candidate is licensed/re-licensed for the given position.

During the year, 20 meetings were held for licensing/re-licensing of operating personnel responsible for control room operations at various operating NPPs. Total of 163 candidates were licensed / relicensed. In addition to above 17 personnel for FBTR operation (Senior Shift Engineers (2), Junior Shift Engineers (2), Control Room Assistants / Field Supervisors (8), Operator (1), Shift Chemist (2), Junior Reactor Physicists(2)) and one Shift In-charge for KAMINI operation were licensed. Details are given in Table 1.6.



Excavation in Progress for Construction of OESC at Kakrapar, Gujarat site

Table 1.6: Licensing of Operating Staff

Plants	No. of persons licensed					Licensing Committee Meetings
	SCE	ASCE	ASCE (F)	CE	CE (F)	
TAPS-1&2	5	3	-	3	-	2
TAPS-3&4	1	7	-	3	-	1
RAPS-1&2	3	1	1	6	1	2
RAPS-3&4	3	5	3	7	4	2
RAPS-5&6	3	0	1	7	0	2
MAPS-1&2	3	2	4	8	1	2
NAPS-1&2	-	2	1	4	1	1
KAPS-1&2	2	0	1	2	0	1
KGS-1&2	6	4	2	10	2	3
KGS-3&4	4	7	1	13	3	3
KKNPP-1&2	0	7	-	6	-	1
Total	30	38	14	69	12	20

Table 1.7: List of Facilities Authorised for Safe Disposal / Transfer of Radioactive Waste

S. No.	Name of DAE Organisation	No. of Facilities
1	Uranium Corporation of India Limited (UCIL)	11
2	Indian Rare Earth Limited (IREL)	1
3	Nuclear Fuel Complex (NFC)	6
4	Nuclear Power Corporation of India Limited (NPCIL)	14
5	IGCAR + SRI (AERB)	5
6	Board of Radiation & Isotope Technology (BRIT)	4
7	Technology Demonstration Plant (HWB)	1
Total Number of Authorisations		42

**LBL, JONAKI, BRIT is exempted from waste authorisation*

1.3.6 Authorisation for Safe Disposal / Transfer of Radioactive Wastes

At present, the renewal of authorization for Safe Disposal / Transfer of Radioactive Wastes for DAE Facilities is integrated with the renewal of Licence for Operation under AERPR-2004. A list of DAE facilities authorised for safe disposal/transfer of radioactive waste is indicated in Table 1.7.

1.4 NUCLEAR FUEL CYCLE AND OTHER RELATED INDUSTRIAL FACILITIES

1.4.1 Operational Safety Review

The nuclear fuel cycle facilities and other related industrial facilities under the regulatory control of

AERB are mines and ore processing plants of Uranium Corporation of India Ltd. (UCIL), mineral separation plants and chemical processing plants of Indian Rare Earths Limited (IREL), Nuclear Fuel Complex (NFC), Zirconium Complex (ZC), Heavy Water Plants (HWP), Atomic Minerals Directorate for Exploration and Research (AMD) and some of the facilities of Indira Gandhi Centre for Atomic Research (IGCAR). In addition to this, Beach Sand Minerals (BSM) and other facilities handling Naturally Occurring Radioactive Materials (NORM) are also regulated by AERB with respect to radiological safety aspects. The status of Nuclear Fuel Cycle and other Industrial Facilities is presented in Table 1.8.

Table 1.8: Status of Nuclear Fuel Cycle Facilities and Other Industrial Facilities

Type of Facility	Name	Functional Status	District / State	Scope of the Facility	Validity of Current Licence
Facilities Operated by UCIL					
Mines	Narwapahar	In operation	Singhbhum (E)/ Jharkhand	Underground uranium mine	March 31, 2023
	Turamdih	In operation	Singhbhum (E)/ Jharkhand	Underground uranium mine	December 31, 2023
	Bagjata	In operation	Singhbhum (E)/ Jharkhand	Underground uranium mine	June 30, 2020
	Mohuldih	In operation	Singhbhum (E) / Jharkhand	Underground uranium mine	October 31, 2024
	Jaduguda	Shutdown	Singhbhum (E)/ Jharkhand	Underground uranium mine	January 31, 2023
	Bhatin	Shutdown	Singhbhum (E)/ Jharkhand	Underground uranium mine	April 30, 2023
	Tummalapalle	In operation	Y.S.R. Kadapa/ Andhra Pradesh	Underground uranium mine	February 28, 2023
	Banduhurang	In operation	Singhbhum (E)/ Jharkhand	Opencast uranium mine	June 30, 2021
Ore Processing Facilities (Mills)	Jaduguda	In operation	Singhbhum (E)/ Jharkhand	Uranium Ore Processing	December 31, 2020
	Turamdih	In operation	Singhbhum (E)/ Jharkhand	Uranium Ore Processing	February 28, 2021
	Tummalapalle	Under Trial operation	Y.S.R. Kadapa/ Andhra Pradesh	Uranium Ore Processing	June 30, 2020
Facilities Operated by IREL					
Mines	Chavara	In operation	Kollam/ Kerala	Mineral Separation	August 31, 2024
	Manavalakurichi	In operation	Kanyakumari/ Tamil Nadu	Mineral Separation	August 31, 2024
	OSCOM Chatrapur	In operation	Ganjam/ Odisha	Mineral Separation	August 31, 2024
Ore Processing Facilities	OSCOM Chatrapur	In operation	Ganjam/ Odisha	Monazite Processing	April 30, 2020
Others	Udyogamandal	In operation	Ernakulum/ Kerala	Rare earths compounds and Uranium production	November 11, 2023
Facilities Operated by NFC					
Nuclear Fuel Fabrication Facilities	NFC, Hyderabad	In operation	Hyderabad/ Telangana	Fuel Fabrication	August 31, 2022
	Zirconium Complex, Pazhayakayal	In operation	Tuticorin/ Tamil Nadu	Reactor Grade Zirconium sponge production	June 30, 2021

Type of Facility	Name	Functional Status	District / State	Scope of the Facility	Validity of Current Licence
Facilities Operated by HWB					
Heavy Water Plants	HWP-Kota, Rawatbhata	In operation	Rawatbhata/ Rajasthan	Heavy Water production	December 31, 2020
	HWP-Manuguru	In operation	Khammam/ Telangana	Heavy Water production	June 30, 2020
	HWP-Baroda	Heavy water production suspended In operation (Solvent and K & Na metal plant)	Baroda/ Gujarat	Tributyl Phosphate (TBP) & Potassium metal production	May 31, 2021
	HWP-Hazira	In operation	Hazira/ Surat/ Gujarat	Heavy Water production	July 31, 2023
	HWP-Thal	In operation	Raigad/ Maharashtra	Heavy Water production	December 31, 2024
	HWP-Tuticorin	Heavy water production suspended In operation (Diversified activities like solvent production plant)	Tuticorin/ Tamil Nadu	Production of solvents: TiAP, DHOA, D2EHPA-II	Licence for operation of VSSP, Tuticorin is valid till July 31, 2023
	HWP-Talcher	Heavy water production suspended In operation (Diversified activities like solvent production plant)	Angul/ Odisha	Production of solvents: TBP, ¹⁰ B enriched Boron, D2EHPA, TOPO, TAPO, DNPPA	August 31, 2020
	TDP-Chembur	Main Plant operation is Shut down (Some systems are being operated in closed loop for developmental activities)	Mumbai/ Maharashtra	Crude Sodium Di-Uranate	October 31, 2021

1.4.2 Consents/Clearances/Permission Issued

AERB continued its regulatory supervision of fuel cycle facilities. During the year, applications from the various DAE units were reviewed and licences were renewed/ issued/extended under the Factories Act, 1948 / the Atomic Energy Act, 1962 (and rules framed thereunder). The licences are valid for a period of maximum five years.

- (i) Licence for operation of Mohuldih mine was renewed up to October 31, 2024.
- (ii) Licence for operation of HWP- Hazira was renewed up to July 31, 2023.
- (iii) Licence for operation of HWP-Thal was renewed up to December 31, 2024.
- (iv) Licences for operation of Beach Sand Minerals (BSM) Facilities at IREL, Manavalakurichi (MK), Chavara & OSCOM were renewed up to August 31, 2024.
- (v) Licence for operation of M/s Kerala Minerals and

Metals Limited (KMML), Chavara, Kerala was renewed up to August 31, 2024.

- (vi) Permission for resumption of ore production at Jaduguda and Bhatin mine.
- (vii) Extension of validity of the consent for trial operation of Tummalapalle mill.
- (viii) Authorization for Operation of Sodium Facility for Component Testing (SFCT).
- (ix) Existing licence amended for Enhancement of sponge production capacity of Zirconium Complex (ZC), Pazhayakayal from 250 to 300 MT per year.
- (x) Amendment in existing licence for operation of Versatile Solvent Synthesis Pilot Plant (VSSP) at HWP-Tuticorin to include operation of HWP main plant.

1.4.3 Safety Review of Fuel Cycle Facilities

Number of meetings conducted by various safety committees for fuel cycle facilities and other industrial facilities during this period is given Table 1.9.

Table 1.9: Meetings of Safety Review Committee of Fuel Cycle Facilities

Name of the Committee	No. of Meetings
NFSC-1 (erstwhile, UCIL-AMD Safety Committee & BSM-NORM Safety Committee)	5
NFSC-2 (erstwhile, NFC Safety Committee)	2
NFSC-3 (erstwhile, HWP Safety Committee and ECIL Safety Committee)	6
Total	13

The highlights of Safety Review of the operating Fuel Cycle and other Industrial Facilities are given below:

(i) Uranium Corporation of India Limited (UCIL)

The uranium mines at Narwapahar, Turamdih, Bagjata, Mohuldih, Banduhurang and Tummalapalle were under operation. UCIL mines at Jaduguda and Bhatin resumed mining activities since December 13, 2019. During the year, the mills at Jaduguda and Turamdih were under normal operation while Tummalapalle mill is in trial operation during the year.

(a) Renewal of Licence for Operation of Mohuldih Mine

The licence for operation of Mohuldih mine of UCIL issued under the Atomic Energy Act, 1962 (and rules

framed thereunder) and authorization for radioactive waste disposal/transfer under GSR-125 was valid up to October 31, 2019. UCIL renewal application for operation of Mohuldih mine was reviewed by AERB. Safety review indicated that during the licence period, the operational & radiological status of these facilities was satisfactory. The average individual dose of the mine workers were well within the regulatory limit. Solid, liquid and gaseous wastes disposed/transferred from the facility were within AERB authorized limits. Based on satisfactory review, AERB renewed the licence for operation and authorization for radioactive waste disposal/transfer of Mohuldih mine for a period of five years i.e. up to October 31, 2024.

(b) Permission for Ore Production in Jaduguda and Bhatin Mine

UCIL mines at Jaduguda and Bhatin were under shut down due to non-availability of clearances by State Government and Ministry of Environment & Forests (MoEF). On receipt of required clearances, UCIL submitted applications to AERB for restarting the ore production from these two mines. These applications were reviewed, based on satisfactory review AERB granted permission for resumption of ore production in Jaduguda mine and Bhatin mine.

(c) Extension of validity of the Consent for Trial Operation of Tummalapalle Mill

The consent for trial operation of Tummalapalle mill was valid up to December 31, 2019. UCIL application for grant of licence for regular operation of Tummalapalle mill was reviewed in AERB. Safety review indicated that UCIL has achieved overall uranium recovery at par with that envisaged in the design. UCIL is in the process of addressing AERB requirements w.r.t achieving the permeability in the tailings pond area and establishing the reason for observed higher natural uranium values in the bore wells in the villages adjoining the tailings pond. In view of this, AERB has extended the validity of the existing consent for trial operation and authorization (under the Atomic Energy (Safe Disposal of Radioactive Wastes) Rules, 1987) of Tummalapalle mill for six months i.e. up to June 30, 2020 to allow UCIL to resolve the above issues satisfactorily.

(ii) Indian Rare Earths Limited (IREL)

Rare Earth Division (RED) at IREL Udyogamandal and Mineral Separation Plants (MSP) of IREL at Chavara, Manavalakurichi and Chatrapur operated

safely during the year. Monazite up-gradation plants at IREL Orissa Sand Complex (OSCOM), Manavalakurichi and Chavara were operational. Monazite Processing Plant (MoPP) at IREL OSCOM, Chatrapur were in operation.

(a) Renewal of Licences for Operation of Beach Sand Minerals (BSM) Facilities

The licences for operation of Beach Sand Minerals (BSM) Facilities at IREL, Manavalakurichi (MK), Chavara and OSCOM issued under the Atomic Energy Act, 1962 (and rules framed thereunder) were valid up to August 19, 2019. Safety review indicated that during the licence period, the operational & radiological status of these facilities was satisfactory. No significant variation was observed in the background radiation level and air activity. Average individual dose to the radiation workers was well within the AERB prescribed limit. Based on satisfactory review, AERB renewed the licence for operation of BSM facilities at IREL, Manavalakurichi (MK), Chavara and OSCOM under the Atomic Energy Act, 1962 (and rules framed thereunder) up to August 31, 2024.

(b) Renewal of Licence for Operation of M/s KMML, Chavara

The licence for operation of M/s Kerala Minerals and Metals Limited (KMML), Chavara, Kerala under the Atomic Energy Act, 1962 (and rules framed thereunder) was valid up to August 19, 2019. Safety review indicated that during the licence period, the operational & radiological status of this facility was satisfactory. The average individual dose of the mine workers were well

within the regulatory limit. The facility has adequate space for storage of monazite enriched tailings for next 5 years. Based on satisfactory review, AERB renewed the licence for operation of M/s Kerala Minerals and Metals Limited (KMML), Chavara, Kerala up to August 31, 2024.

(iii) Nuclear Fuel Complex (NFC) & Zirconium Complex (ZC)

All the plants of NFC, Hyderabad and ZC, Pazhayakayal operated safely during the year.

(a) Capacity Enhancement of Zirconium Complex (ZC), Pazhayakayal

Licence for operation issued under the Factories Act, 1948 of Zirconium Complex (ZC), Pazhayakayal to produce 250 MT of Zirconium Sponge per year is valid up to June 30, 2021. AERB had reviewed the application from ZC, Pazhayakayal for enhancement of Zirconium Sponge production capacity from 250 MT to 300 MT per year. Safety review indicated that enhancement in sponge production capacity would be achieved by process modifications and improvement in recovery of the product. Based on review, AERB permitted for enhancement in sponge production capacity at ZC, Pazhayakayal from 250 MT to 300 MT per year.

(iv) Heavy Water Plants (HWP)

Heavy water plants at Kota, Manuguru, Hazira and Thal were operational, whereas HWPs at Baroda, Tuticorin and Talcher were non-operational due to unavailability of feed synthesis gas from fertilizer plant. Presently, HWP-Baroda is engaged in production of potassium metal,



SARCOP Members' Visit to IREL, OSCOM

sodium metal and Tri Butyl Phosphate (TBP) solvent. Diversified projects namely, Versatile Solvent Production Plant (VSPP) at HWP-Talcher and Versatile Solvent Synthesis Plant (VSSP) at HWP-Tuticorin are operational. Technology Demonstration Plant (TDP), Chembur is under trial. During the year following licence applications were reviewed:

(a) Renewal of Licence for Operation of HWP-Hazira

The licence for operation issued under the Factories Act, 1948 of HWP-Hazira to produce 110 MT/year of reactor grade heavy water was valid up to July 31, 2018. In the year 2018, the licence was renewed for limited duration i.e. up to January 31, 2019 due to pending aspects such as mechanical testing of main cracker tubes, completion of consequence analysis of the cracker tube failure, revision of ISI Code of Practice, retrofitting of control room etc. Subsequently, HWP-Hazira submitted revised application along with actions taken towards resolution of pending issues. Based on satisfactory progress made by HWP-Hazira towards resolution of pending issues, AERB renewed the licence for operation of HWP-Hazira under the Factories Act, 1948 up to July 31, 2023.

(b) Renewal of Licence for Operation of HWP-Thal

Licence for operation issued under the Factories Act, 1948 of HWP-Thal was valid till December 31, 2019. HWP-Thal submitted application for renewal. Safety review indicated that the performance of plant was satisfactory during licence period. ISI of the SSCs was carried out as per the ISI code of practice and no major abnormality was observed. HWP-Thal has implemented programme for ageing management of important plant SSCs. The tubes of Main Cracker-A are planned to be replaced after completion of service life of 1.2 lakh hours. Based on the review AERB renewed the licence for operation HWP-Thal, under the Factories Act, 1948 up to December 31, 2024.

(c) Amendment of Licence for Operation of HWP-Tuticorin

In the year 2018, Versatile Solvent Synthesis Pilot Plant (VSSP) at HWP- Tuticorin (HWP-T) was renewed up to July 31, 2023. While granting this licence AERB recommended HWP-T to seek licence for main plant also which was under shutdown since May 2007. Subsequently, HWP-T had submitted application for renewal of licence

of main plant. Based on satisfactory review in AERB, the licence was amended to include the operation of HWP main plant. It was stipulated that commissioning for restart (with Hazardous Chemicals-SynGas, NH_3 , KNH_2 etc.) and operation of the main plant shall be carried out after obtaining necessary clearances from AERB.

(v) Authorization for Operation of Sodium Facility for Component Testing (SFCT)

Fast Reactor Technology Group (FRTG), IGCAR is involved in design, construction and operation of various sodium facilities for the purpose of testing of materials, components, equipment for use in FBRs. In 2016, AERB had granted permission for commissioning of Sodium Facility for Component Testing (SFCT) for sodium testing of scaled down components of future FBRs and general sodium technology experiments.

After completion of all the commissioning activities, FRTG had submitted application for authorization of operation of SFCT. Safety Review indicated that SFCT had successfully completed the commissioning of the facility. All mandatory documents required for operation of the facility were available with the facility. Based on review AERB granted authorization for operation of SFCT.

(vi) Atomic Minerals Directorate for Exploration and Research (AMD)

Exploration work at various sites of AMD in northern, southern, eastern, western, central and south-central region was in progress.

(vii) Beach Sand Minerals (BSM) & Naturally Occurring Radioactive Materials (NORM) Facilities

Periodic radiological reports submitted by the facilities were reviewed by AERB. No abnormality was observed during review.

1.4.4 Licensing of Plant Personnel in FCF

Operating personnel of Fuel Cycle Facilities are required to go through a rigorous Licensing process. This includes clearing checklists, written exams, walkthrough and finally qualification interviews. A candidate after successfully completing the pre-requisites of licensing procedure, appears before the licensing committee for qualification interview. This committee has member(s) from AERB. On satisfactory performance, the candidate is authorization/re-authorization for the given position.

During the year, 8 meetings were held for authorization/re-authorization of operating personnel from HWP and NFC, and total of 87 candidates were authorised/re-authorizes, as detailed below:

- (i) Licensing committee of Heavy Water Plants met on six occasions and 63 operation personnel (Shift In-charge, field Engineer and Control Panel Operator) were authorized/ re-authorized.
- (ii) Licensing committee of Nuclear Fuel Complex met on two occasions and 24 operation personnel (Shift In-charge) were authorized/re-authorized.

1.5 OVERALL SAFETY PERFORMANCE OF NUCLEAR FACILITIES

1.5.1 Safety Performance of Nuclear Facilities under Construction

(a) KKNPP-3 to 6

There was one fatal accident at the temporary dyke area of KKNPP-3 to 6 and another one accident of serious nature occurred at Fabrication Shop#2 in the infrastructure area of KKNPP-3&4. AERB reviewed these accidents and measures to prevent recurrences of such incidents in future were recommended and conveyed to the site for compliance. Further details are given under section 1.8.2.

(b) PFBR

Pre-commissioning/commissioning activities at PFBR are in progress. There was no major reportable incident at PFBR calling for enforcement action during the period.

(c) KAPP-3&4, RAPP-7&8 and GHAVP-1&2

There was one fatal accident at RAPP-7&8 during major equipment erection and another one at GHAVP-1&2 during excavation activities. AERB reviewed these accidents and concluded that the event was a result of lack of supervision, training and lack of safety work permit system. Measures to prevent recurrences of such incidents in future were recommended and conveyed to the site for compliance. Further details are given under section 1.8.2.

(d) KAIGA-5&6

There was no major reportable incident calling for enforcement actions at KAIGA-5&6.

(e) DFRP and FRFCF

There was no major reportable incident calling for enforcement actions during commissioning activities at DFRP and construction at FRFCF.

(f) NFC-Kota

Construction of the plant buildings is under progress at NFC-Kota Site. There was no major reportable incident at NFC-K calling for enforcement actions during the period.

1.5.2 Safety Performance of Nuclear Facilities in Operation

The operational performance and significant events are reviewed and the required modifications were implemented. The operational performance of all the NPPs remained satisfactory. TAPS-1 to 4, RAPS-2 to 6, KGS-1 to 4, MAPS-2, NAPS-1&2, KKNPP-1&2 and KAPS-2 were operational. KAPS-1 was synchronized to grid after satisfactory completion of EMCCR activities on May 24, 2019 and operating satisfactorily since then. RAPS-1 is shut down since October 2004. MAPS-1 was shut down since January 30, 2018 due to leak from pressure tubes.

All the 45 significant events occurred at operating NPPs were reviewed in detail in AERB to see the adequacy of investigations, corrective actions, lessons learnt and the need for further regulatory actions. One significant event reported at RAPS-2, details of the incident is given under section 1.8.1.

All fuel cycle facilities operated safely during the period. However, there was one fatal accidents at IREL, OSCOM, the details of incident is given under section 1.8.2.

1.6 R&D UNITS AND OTHER FACILITIES IN CONSTRUCTION AND OPERATION

Safety review of Variable Energy Cyclotron Centre (VECC), Raja Ramanna Centre for Advanced Technology (RRCAT), Indira Gandhi Centre for Atomic Research (IGCAR), Electronics Corporation of India Limited (ECIL) and Board of Radiation & Isotope Technology (BRIT) was done apart from the Fuel Cycle Facilities. The status of R&D units and other facilities is presented in Table 1.10.

Table 1.10: Status of R&D and Other Facilities

Type of Facility	Name	Functional Status	Scope of the Facility	Validity of Current Licence
Facilities operated by VECC, Kolkata, West Bengal				
Particle Accelerator Research Facility (PARF)	Room Temperature Cyclotron (K-130)	In operation	Heavy ion acceleration	August 31, 2022
	Super Conducting Cyclotron (K-500)	Commissioning	Heavy ion acceleration	No time limit
	Medical Cyclotron Project	Stage-1 Commissioning	Cyclotron machine along with 3 beam lines for production of radio-pharmaceuticals and 2 beamlines for research purpose	July 30, 2020
Facilities operated by RRCAT, Indore, Madhya Pradesh				
LASER	150 TW Ti: Sapphire Laser System	In operation	90 TW- for regular and 150 TW-trial (25 femto-second)	June 30, 2021
PARF	TWINDUS LINAC-1 Agricultural Radiation Processing Facility (ARPF)	In operation	Electron Acceleration, 10 MeV, 5 kW Technology Demonstration for Food Irradiation	January 25, 2021
	TWINDUS LINAC-2	Trial Run Operation	Electron Acceleration, 10 MeV, 5 kW	January 25, 2021
	TWINDUS LINAC-3	Installation, Testing and Commissioning	Electron Acceleration 10 MeV, 5 kW	June 4, 2021
	INDUS-1	In operation	450 MeV, 100 mA Electron Storage Ring	September 30, 2023
	INDUS-2	In operation	2.5 GeV, 200 mA Synchrotron Radiation Source (SRS)	March 31, 2021
Accelerator	Electron LINAC	In operation	10 MeV, 10 kW	June 30, 2021
LASER	1 PW Laser System	Construction Completed	1 PW (femto second)	----
Superconducting RF Cavity	Horizontal Test Stand for Superconducting RF Cavities	Commissioning and Operation	SCRF Cavity at 650 MHz	June 20, 2022
Facilities operated by IGCAR, Kalpakkam, Tamil Nadu				
Accelerator	1.7 MV Tandatron Accelerator	In operation	1.7 MV	August 31, 2021
	150 kV Accelerator	In operation	150 kV	August 31, 2021
Facilities operated by ECIL				
Electronic Component Development	ECIL, Hyderabad	In operation	Production of Instrumentation, Control & Communication systems and other electronic components	June 30, 2020
	ECIL, Tirupati	In operation	Production of Nuclear Industrial Instrumentation systems, EVM & VVPAT power packs etc.	October 31, 2021

1.6.1 Variable Energy Cyclotron Centre (VECC)

The Room Temperature Cyclotron (K-130) was under operation delivering alpha and proton beams of various energies and intensities. Commissioning of Super-conducting cyclotron and Radioactive Ion Beam facility is in progress. The Stage-1 commissioning consent was issued to medical cyclotron facility, which will be used, for commercial production of isotopes for Positron Emission Tomography (PET) and Single Photon Emission Computed Tomography (SPECT) as well as high end technological research. During the year, following proposal was reviewed by AERB.

Stage-1 Commissioning of Medical Cyclotron, VECC, Kolkata

Application for Stage-1 Commissioning of Medical Cyclotron and its associated beamlines was reviewed by AERB and the consent was granted on July 30, 2019 with one year validity, i.e. till July 30, 2020.

1.6.2 Raja Ramanna Centre for Advanced Technology (RRCAT)

INDUS-1 Synchrotron Radiation Source (SRS) was under operation with beam energy of 450 MeV and beam current of 100 mA delivering synchrotron radiation through seven beamlines. INDUS-2, which is a synchrotron cum electron storage ring, was under operation at 2.5 GeV (max) beam energy and beam current of 200 mA (max). Twelve beamlines of INDUS-2 have already been authorised by AERB for carrying out experiments. In addition to these, major accelerators, other accelerators and Laser Facilities/Projects at RRCAT are being periodically reviewed. The following proposals/issues related to RRCAT were reviewed.

(a) Trial Run Permission for TWINDUS LINAC-2 at ARPF

RRCAT had licence for operation of Agricultural Radiation Processing Facility (ARPF) with TWINDUS LINAC-1, which is a technological demonstration facility for food irradiation. RRCAT applications for trial run operation of TWINDUS LINAC-2 was reviewed and granted permissions on January 25, 2019, valid till January 25, 2021. Another proposal for installation, testing and commissioning of TWINDUS LINAC-3 was also reviewed by AERB and granted permission on June 4, 2019, valid till June 4, 2021.

(b) Commissioning and Operation of HTS and Permission for Testing of Superconducting RF Cavities

RRCAT applications for commissioning and operation of Horizontal Test Stand (HTS) and permission for testing of Superconducting RF Cavities (SCRF) in HTS facility were reviewed by AERB and consent was granted on June 20, 2019, which is valid till June 20, 2022.

1.6.3 Electronics Corporation of India Limited (ECIL)

ECIL facilities at Hyderabad and Tirupati operated safely during the year.

1.6.4 Board of Radiation & Isotope Technology (BRIT)

BRIT facilities at Navi Mumbai and its Regional centres at various location in the country are involved in production of radio-isotopes used in radiation facilities as well as radio-pharmaceutical used mainly in nuclear medicine application. BRIT, Navi Mumbai and other facilities submitted applications for renewal of operational licence during the year. Based on the outcome of the Periodic Safety Reports, the respective licence were extended as detailed below;

- Renewal of licence of BRIT, Navi Mumbai under the Atomic Energy Act, 1962 (and rules framed there under) & the Factories Act, 1948 and authorization for radioactive waste disposal/transfer under GSR-125 up to January 31, 2024.
- Renewal of licence for operation of BRIT-RAPPCOF, Kota under the Atomic Energy Act, 1962 (and rules framed thereunder) & the Factories Act, 1948 and authorization for radioactive waste disposal/transfer under GSR-125 up to January 31, 2024.
- Renewal of licence for operation of Regional Centre-BRIT, Hyderabad under the Atomic Energy Act, 1962 (and rules framed thereunder) & the Factories Act, 1948 up to January 31, 2024.

1.7 INDUSTRIAL SAFETY OF NUCLEAR FACILITIES

Industrial Safety Awards and Fire Safety Awards are given by AERB to promote Industrial Safety and Fire Safety in DAE Units. The awards for the year 2018 were presented to the winners during the 36th DAE Safety &

Occupational Health Professionals Meet held at NFC Hyderabad.

1.7.1 Industrial Safety Award

AERB presents Industrial Safety Awards every year to the DAE units which achieve highest performances in Industrial Safety. These awards are given based on the relevant inputs/data received from each unit and its assessment with the set parameters that include longest accident free period, implementation of safety

management system, injury statistics, dangerous occurrence, type of plant and operation, safety training imparted to personnel and efforts made by the plant towards improving safety.

For Industrial Safety award DAE units are categorized based on nature of plant operation as Production Units-I and II, R&D and Other Low Risk Units, and Construction Units category.

The winners of the AERB Industrial Safety Awards-2018 in various categories are as follows.

Category	Name of the Winner Unit(s)
Production Units - I (NPPs & HWP)	Heavy Water Plant (HWP)-Thal
Production Units - II (Others)	Zirconium Complex, Pazhayakayal
R&D and other Low Risk Units	Heavy Water Plant (HWP)-Tuticorin
Construction Units	Rajasthan Atomic Power Project (RAPP) - 7&8

Chairman, AERB and Executive Director, AERB presented the Industrial Safety Awards to the representatives of winning units during DAE Safety Professional meet. Dr. Dinesh Srivastava, Chairman & CE, NFC and Smt. Sheela, DCE (Safety), NFC were present during the occasion.



Winning Unit Heavy Water Plant (HWP)-Thal receiving Industrial Safety Award



Winning Unit Zirconium Complex, Pazhayakayal receiving Industrial Safety Award



Winning Unit Heavy Water Plant (HWP)-Tuticorin receiving Industrial Safety Award



Winning Unit Rajasthan Atomic Power Project (RAPP)-7&8 receiving Industrial Safety Award

1.7.2 Fire Safety Award

This award was instituted by AERB to ensure that maximum efforts are made by the DAE units to prevent occurrences of fire incident and ensure that appropriate management system is in place to prevent fire in these units. The award is based on the marks computed based on management system, efforts for improvement, training and fire incident statistics. DAE units are categorised as Category-I and Category-II

units based on fire potential. Following units were the winners of the AERB Fire Safety Awards - 2018 in these categories.

Chairman, AERB and Executive Director, AERB presented the Fire Safety Awards to the representatives of winning units during 36th DAE Safety Professional meet at NFC, Hyderabad. Dr. Dinesh Srivastava, Chairman & CE, NFC and Smt. Sheela, DCE (Safety), NFC were present during the occasion.

Category	Name of the Winner Unit(s)
Category-I (High Fire Risk Units)	Kakrapar Atomic Power Station (KAPS) - 1&2 & Heavy Water Plant (HWP) - Kota
Category-II (Low Fire Risk Units)	Heavy Water Plant (HWP) - Baroda



Winning Unit Kakrapar Atomic Power Station (KAPS) - 1&2 receiving Fire Safety Award



Winning Unit Heavy Water Plant (HWP)-Kota receiving Fire Safety Award



Winning Unit Heavy Water Plant (HWP)-Baroda receiving Fire Safety Award

1.7.3 Occupational Injury Statistics of DAE Units

The compilation of Occupational Injury Statistics for the year 2019 for DAE units (other than BARC facilities, AMD and mines of IREL & UCIL) provides the data on accidents and analysis of number of injuries and loss of man-days. Details are presented in Table 1.11.

- During the calendar year 2019, there were 31 reportable injuries including 5 fatalities with a loss of 30,994 man-days compared to 18 reportable injuries including 5 fatalities with a loss of 32,122 man-days in 2018.
- The year 2019 recorded a Frequency Rate (FR) of 0.19 as compared to 0.11 in the year 2018 and a

Severity Rate (SR) of 193 as compared to 204.61 in 2018. Similarly, the year 2019 recorded an Injury Index of 0.0374 as compared to 0.023 in the year 2018 and an Incidence Rate of 0.53 as compared to 0.288 in 2018.

- There was no notifiable disease reported during the period from any of the operating units of DAE under the purview of AERB.

Distribution of reportable injuries in DAE units in 2019 are presented in terms of percentage in Figure 1.1.

Year-wise Frequency Rate (FR), Severity Rate (SR), Injury Index (II), Incidence Rate (IR) and Fatal Injuries (FI) in DAE Units are shown in Figure 1.2, 1.3, 1.4, 1.5 and 1.6 respectively.

Table 1.11: Unit-wise Comparison of Reportable Occupational Injuries in DAE Units (2019)

Unit	C1 No. of Lost Time (Reportable) Injury	C2 No. of Man-days Lost	C3 No. of Fatal Injury	C4 No. of Employees	C5 Number of Man-hours Worked	C6 Frequency Rate $\frac{(C1 \times 10^6)}{C5}$	C7 Severity Rate $\frac{(C2 \times 10^6)}{C5}$	C8 Injury Index $\frac{(C6 \times C7)}{1000}$	C9 Incidence Rate $\frac{(C1 \times 10^3)}{C4}$
NPP	4	6194	1	12550	37413367	0.11	166	0.0177	0.32
Construction Projects	9	18316	3	24180	74172197	0.12	247	0.0300	0.37
HWP	1	85	0	4573	11688144	0.09	7	0.0006	0.22
IREL	1	6000	1	548	701062	1.43	8558	12.2078	1.82
NFC & ZC	3	136	0	4555	11281051	0.27	12	0.0032	0.66
UCIL Mills	1	7	0	2588	4922520	0.20	1	0.0003	0.39
ECIL	2	0	0	2492	6016176	0.33	0	0.0000	0.80
IGCAR	1	14	0	3465	7864168	0.13	2	0.0002	0.29
BRIT	3	119	0	1011	1078472	2.78	110	0.3069	2.97
VECC	0	0	0	1041	2056000	0.00	0	0.0000	0.00
RRCAT	6	123	0	1526	3068744	1.96	40	0.0784	3.93
Total	31	30994	5	58529	160261901	0.19	193	0.0374	0.53

(Note: The FR and IR are rounded off to two number of decimal places. The II is rounded off to four number of decimal places. The SR is rounded off to nearest number.)

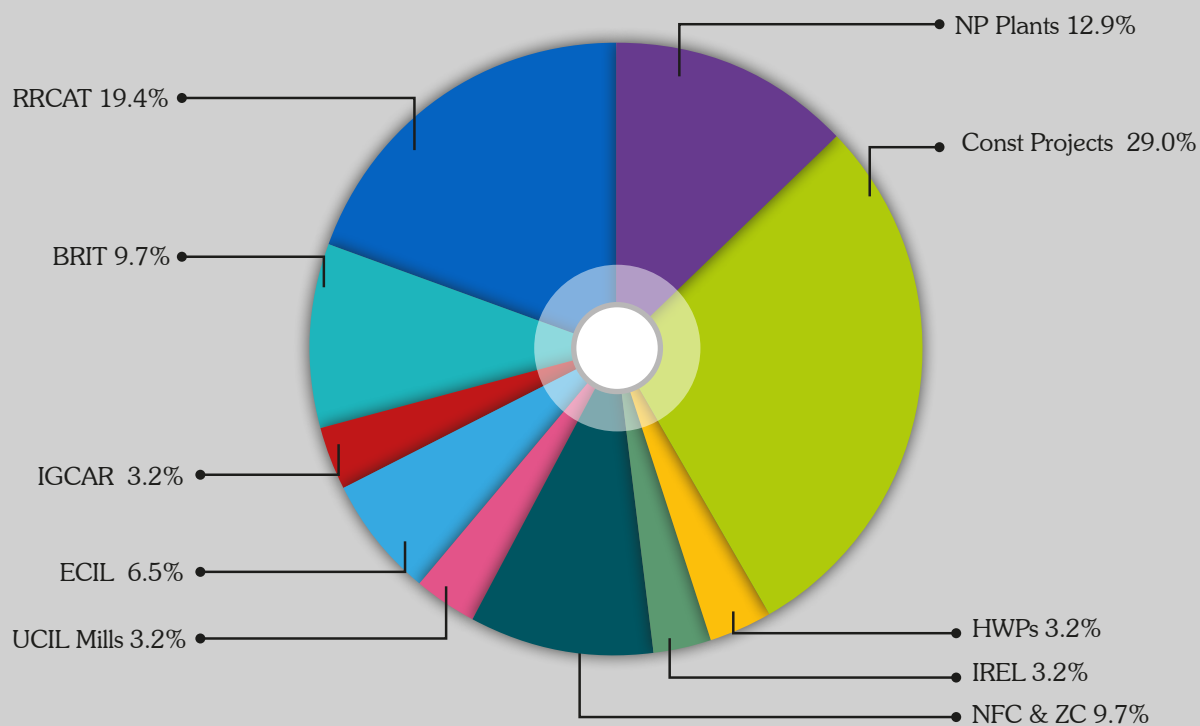


Fig 1.1 Distribution of Reportable Injuries in DAE Units

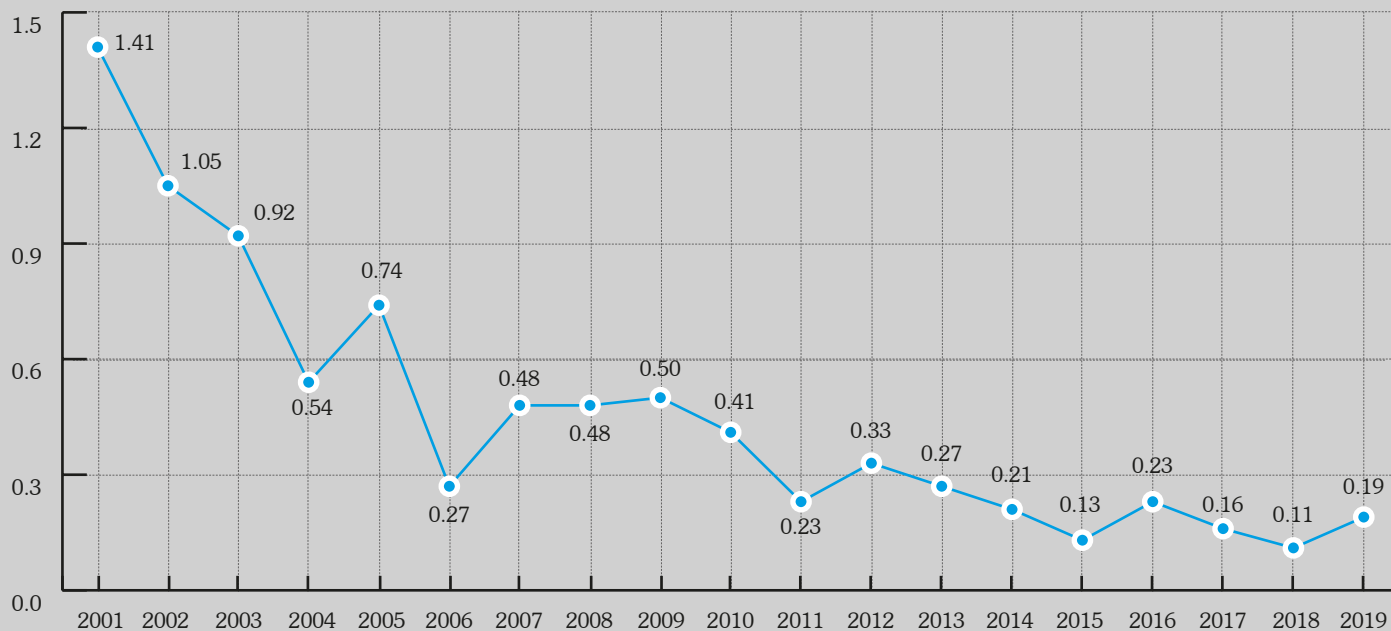


Fig. 1.2 : Year-wise Frequency Rate in DAE Units



Fig. 1.3 : Year-wise Severity Rate in DAE Units

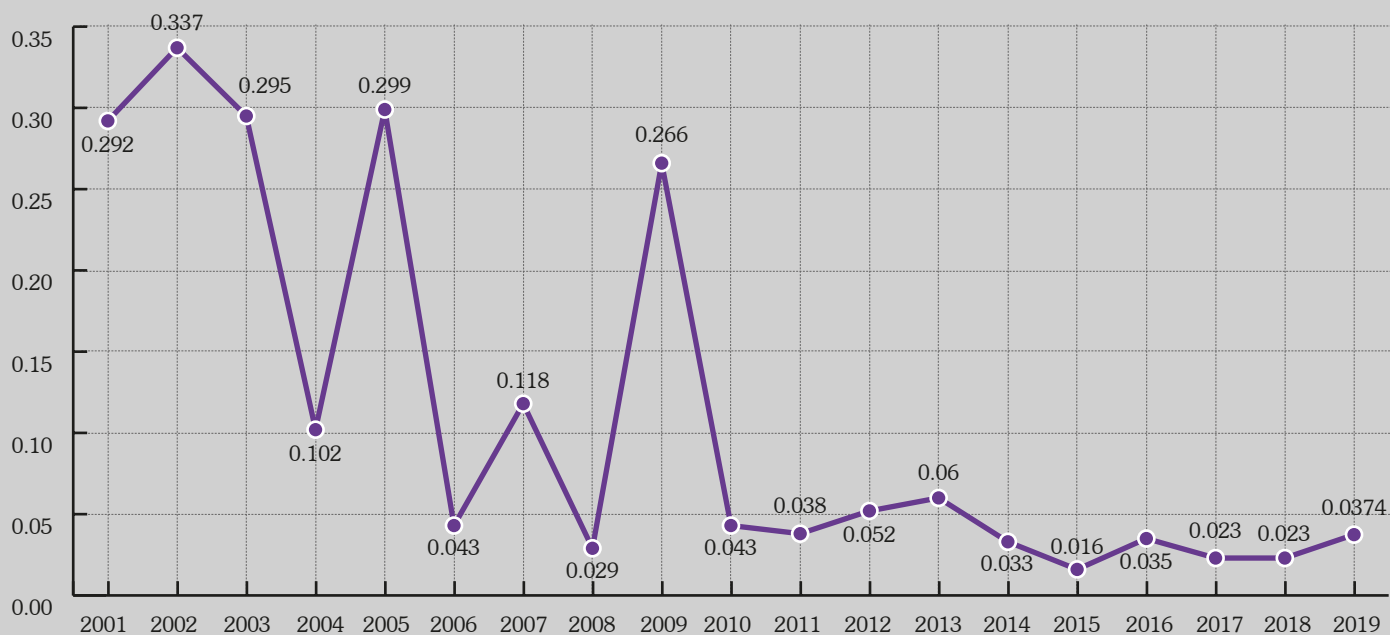


Fig. 1.4 : Year-wise trend of Injury Index in DAE Units



Fig. 1.5 : Year-wise trend of Incidence Rate in DAE Units

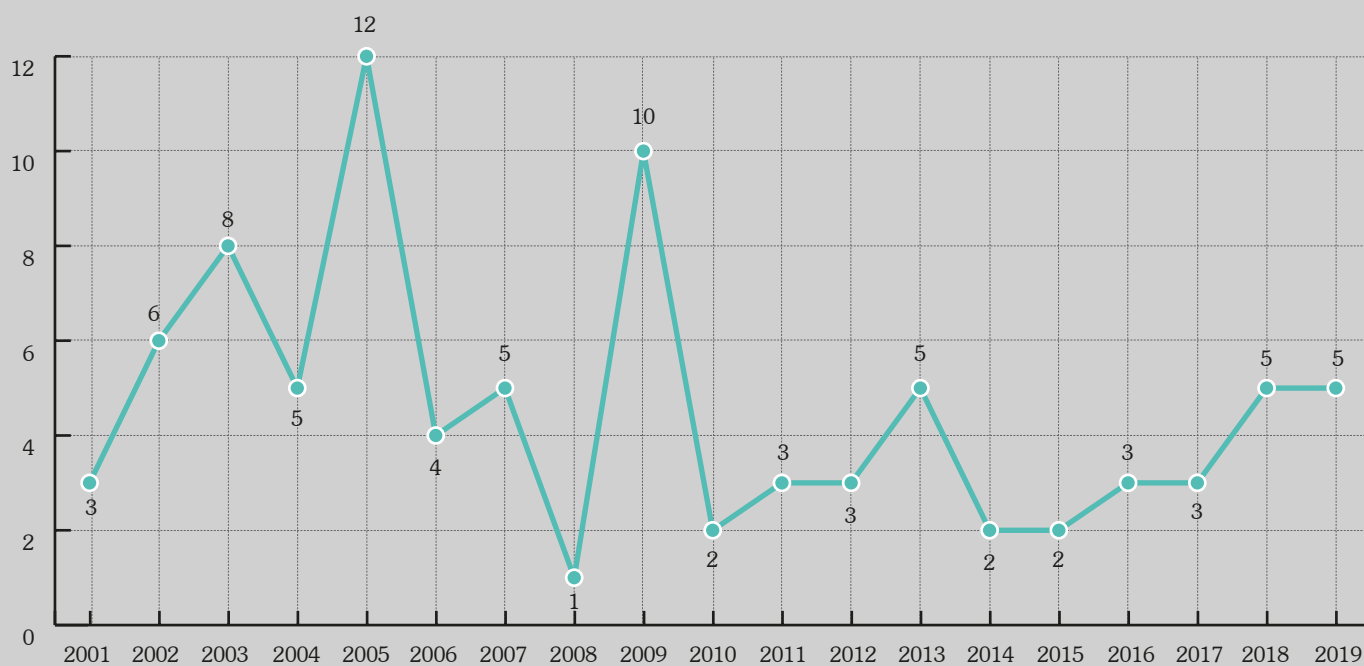


Fig. 1.6 : Year-wise Fatal Injuries in DAE Units

1.8 SIGNIFICANT EVENTS

AERB requires NPPs to report certain events that occur in the plant which have or may have impact on operational safety. Under the reporting system established by AERB, the events reportable to AERB are divided into two categories, termed as,

- (a) Events
- (b) Significant Events

This categorization of events is done based on their safety significance and importance to operational safety experience feedback. Based on the established reporting criteria, Event Reports (ER) and Significant Event Reports (SER) are submitted to AERB. The SERs received from the operating NPPs are rated on the International Nuclear and Radiological Event Scale (INES) of International Atomic Energy Agency (IAEA). The INES rates events at seven levels (1 to 7) depending on their safety significance as shown in figure 1.7 below.

Events rated at level 4 and above are termed as 'Accidents'. The accidents at Chernobyl NPP in former USSR (now in Ukraine) in April 1986 and Fukushima NPPs in Japan in March 2011 were rated at level 7

on INES. Events rated at levels 1, 2 and 3 are called 'Incidents'. The level 0 or below scale means events that have no nuclear and radiological safety significance.

1.8.1 Significant Events and INES rating of NPP

All the significant events reported were reviewed in detail by AERB and measures to prevent recurrence of such events were recommended.

(i) Significant Events in NPPs under Construction

During the year no significant event was reported in NPP under construction.

(ii) Significant Events in Operating NPPs

During 2019, a total of 45 significant events were reported from operating NPPs. Out of these, 40 significant events were rated at level 0 and one event (at RAPS-2) was rated at level 1 on INES. INES rating of one event at TAPS-3&4 is under review at AERB.

Three significant events, one each at RAPS-5&6, KGS-1 and KKNPP-1&2 were not rated on INES as these were related to industrial safety and had no relevance to nuclear and radiological safety. The number of SERs in each NPP and their ratings on INES are given in Table-1.12.

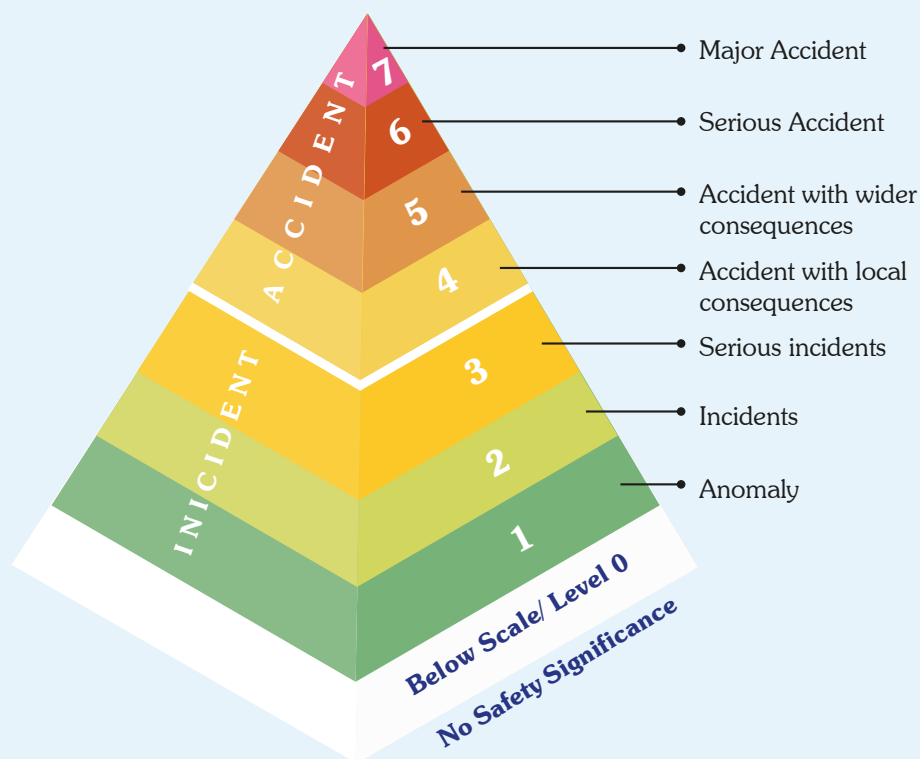


Fig. 1.7: INES Scale

Table 1.12: INES Rating of Significant Events in NPPs Reported during Calendar Year (2019)

NPPs	INES Rating of Events	
	INES-0	INES-1
TAPS-1 & 2	2	0
TAPS-3 & 4	3	0
RAPS-1 & 2	7	1
RAPS-3 & 4	3	0
RAPS-5 & 6	6	0
MAPS-1& 2	3	0
NAPS-1 & 2	1	0
KAPS-1 & 2	2	0
KGS-1 & 2	8	0
KGS- 3 & 4	1	0
KKNPP-1&2	4	0
Total	40	1

* INES rating of one event at TAPS-3&4 is under review in AERB.

For the purpose of analysis, the events reported during year 2019 were also categorized as per the IAEA-IRS coding system. The classification of systems failed / affected during the significant events is given in Figure-1.8. The classifications of direct causes and root causes of the significant events are given in Figure-1.9 & 1.10 respectively.

• **Significant Event Rated at Level-1 on INES is briefed below:**

On January 13, 2019, RAPS-2 was shut down due to water leakage from secondary side of multiple boiler hairpins. The investigation was carried out after the shutdown revealed that leakage was due to generic phenomenon (i.e. under deposit corrosion) which had led to wall thinning and pinholes in the boiler hairpins, near the weld joint between tube-sheet and boiler hairpin shell. After the event, the vulnerable area was inspected in all other boiler hairpins of RAPS-2 and other similar units and requisite remedial measures were implemented.

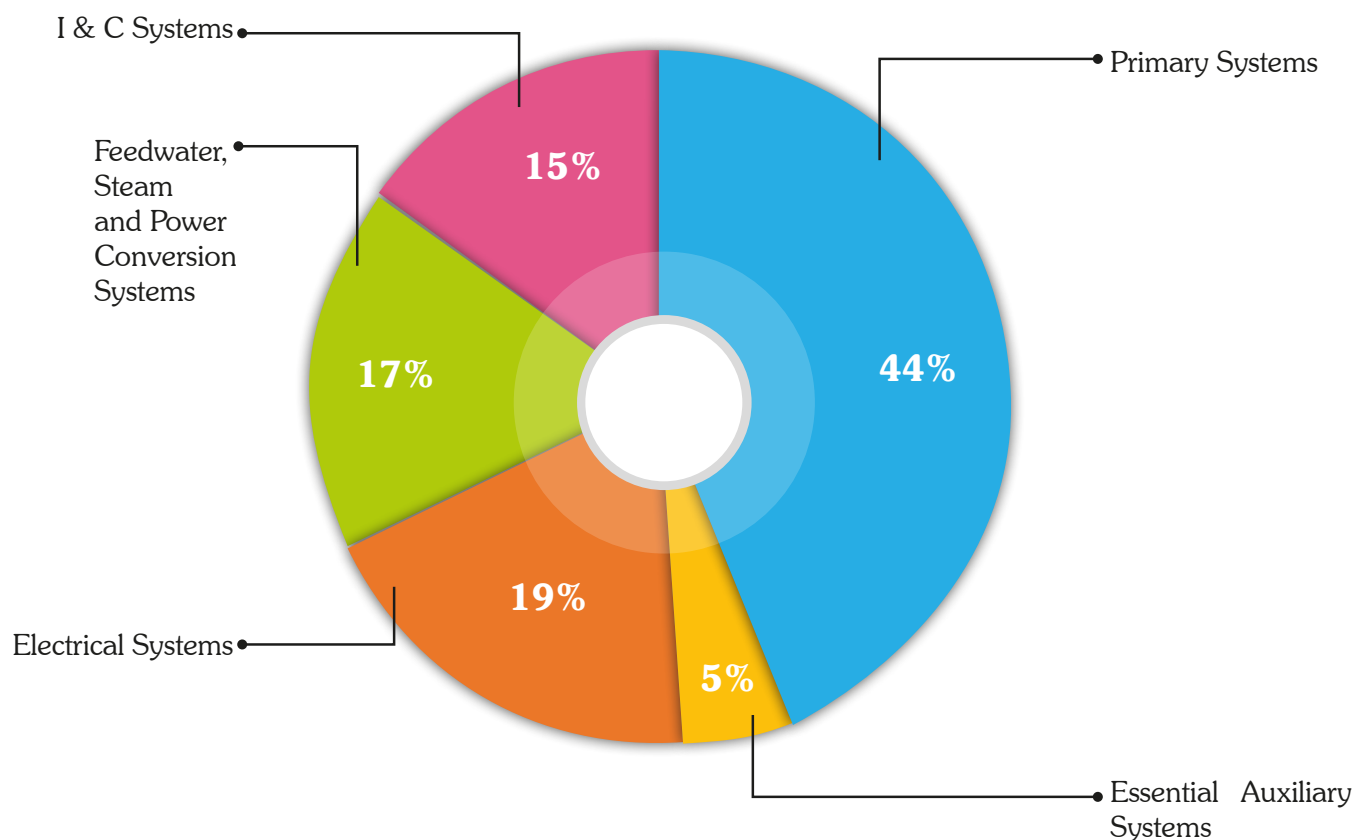


Fig. 1.8: Classification of Failed/Affected Systems of SERs

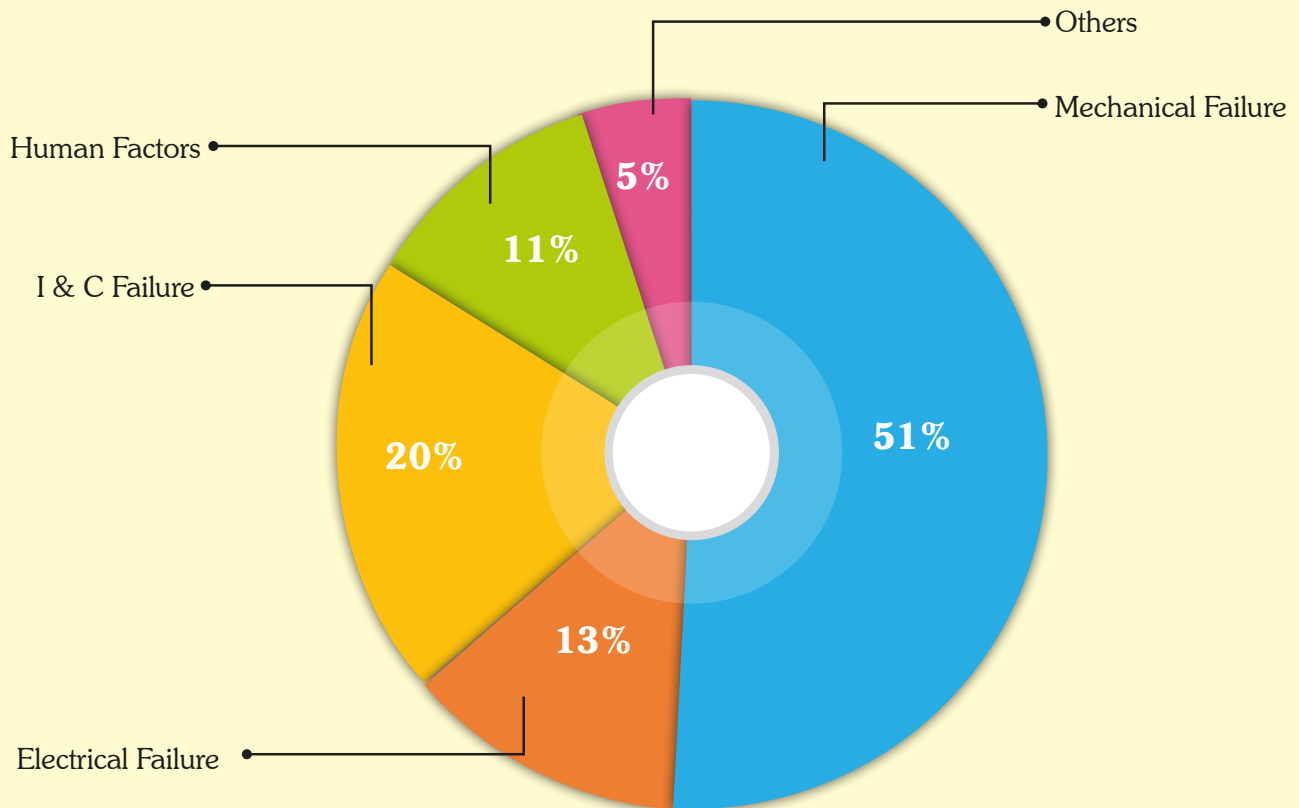


Fig. 1.9: Classification of Direct Causes of SERs

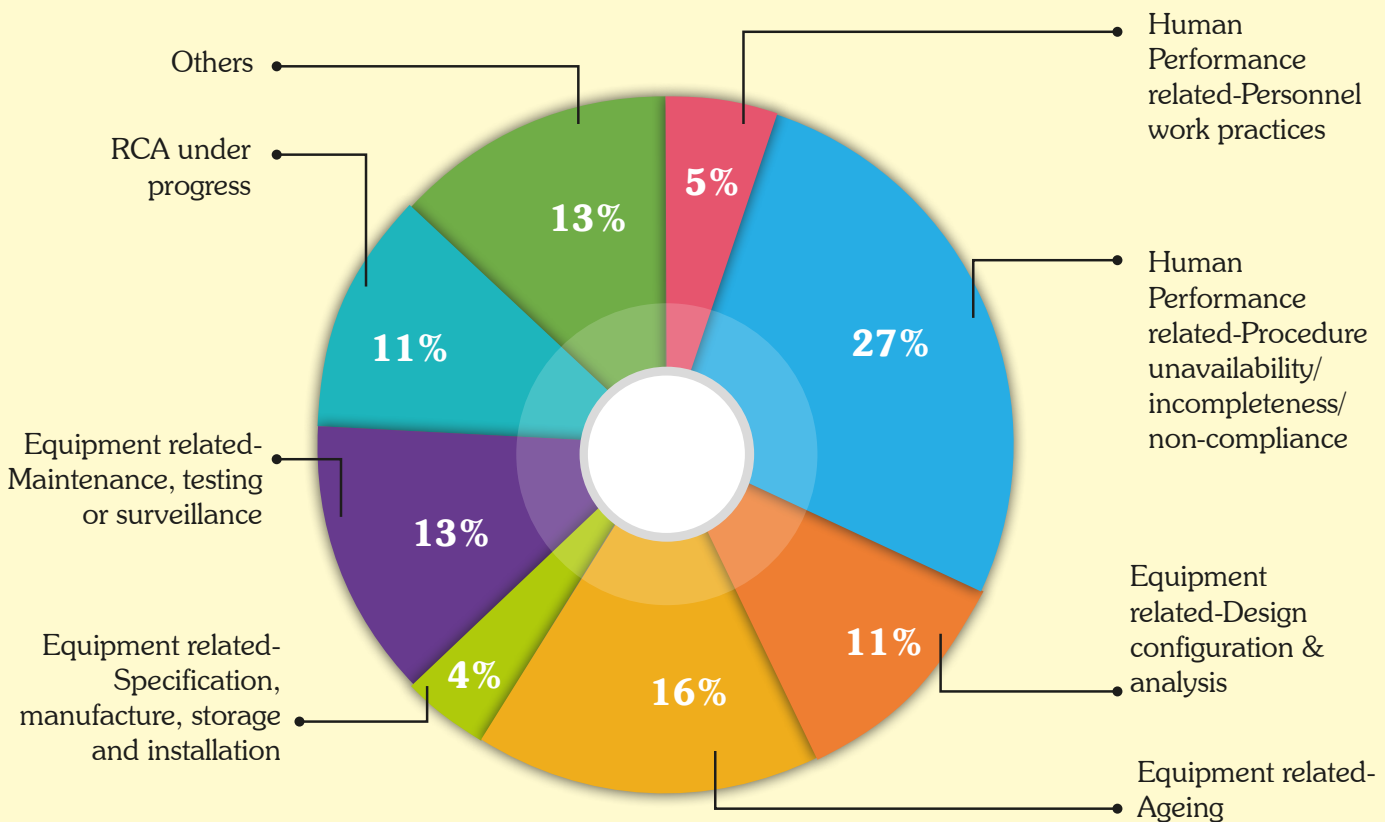


Fig. 1.10: Classification of Root Causes of SERs

1.8.2 Significant Events related to Industrial Safety

Significant events reported to AERB were reviewed in detail and measures to prevent the recurrence of such incidences were recommended. The analyses and recommendations of the accident were forwarded to all units of DAE for information and lessons to be learnt from these incidents. A brief description of events, associated review and recommendations/directives of AERB is given below.

(a) Kudankulam Nuclear Power Project (KKNPP-3 to 6)

On April 15, 2019, a fatal accident took place at the temporary dyke area of KKNPP-3 to 6. The victim employed by contractor engaged in the repair work of an excavator along with the operator, fell down from a height of around 2.5 m. He was immediately shifted to the first-aid centre of the contractor and subsequently to hospital at Nagercoil. The victim succumbed to his injuries on April 16, 2019.

(b) Kudankulam Nuclear Power Project (KKNPP-3&4)

On April 28, 2019, an accident of serious nature occurred at Fabrication Shop # 2 in the infrastructure area of KKNPP-3&4. Left hand of the victim (an operator with the contractor) got entangled in a drilling machine while cleaning the drilling chips. The left hand was severed nearly from the middle of the forearm. The victim was given first-aid in the ambulance and was immediately shifted to Hospital at Nagercoil.

AERB stopped all construction activities at KKNPP-3 to 6. AERB recommended NPCIL for conducting general review of safety management systems at all NPCIL sites with specific attention to recent events and associated factors. In response, NPCIL submitted the proposed corrective and safety enhancement measures to strengthen Occupational Health Safety (OHS) System at their Stations and Projects. Considering the actions for enhance safety by NPCIL, AERB granted permission to resume the construction activities of KKNPP-3 to 6 (except for areas where accidents had occurred) on May 1, 2019 subject to implementation of corrective measures towards enhancement of Industrial

and Fire Safety (I&FS) aspects as identified by NPCIL committees and effective safety supervision by NPCIL.

These incidents and NPCIL submissions were reviewed in detail by AERB wherein certain recommendations were made. NPCIL identified measures required to strengthen OHS in nuclear projects. The compliance for implementation was periodically verified by SOT at Site and was also verified in subsequent RI of KKNPP-3&4. Considering the actions initiated to enhance safety and sample check during regulatory inspection, the construction activities in the areas where accidents had occurred at KKNPP-3 to 6 were allowed to be resumed on July 03, 2019.

(c) Rajasthan Atomic Power Project (RAPP-7&8)

Work of erection of “I” sections Girders for mounting of EOT crane track in mechanical workshop of RAPP-7&8 was being carried out by Contractor. On August 13, 2019 for shifting of a girder from fabrication shop to work area, a group of 7 workers led by foremen were working. The girder was being shifted by rolling it on pipe pieces as a roller and pushing with the crowbar from backside. During the process, the girder slipped from pipes & toppled on its right side. Seeing this, other worker on right side moved away safely, while the victim slipped and his right leg received injury as he was caught in between the girder and floor. He succumbed to the injuries on September 19, 2019 during the treatment at hospital.

Root cause of the accident was use of hazardous methodology of material handling and contributory causes were inadequate supervisory oversight from senior engineers of Contractor and unavailability of job-specific Safe Work Permit and Job Hazard Analysis (JHA). NPCIL was asked to develop job-specific JHAs after design detailing and engineering taking cognizance of field constraints, development of a better methodology for transportation of girder from the fabrication to erection location, strengthening training programme and competency evaluation method for workers, tool-box talk prior to job commencement, strengthening competency of line management personnel in Health & Safety aspects etc. The responses from RAPP-7&8 Site would be checked during RI for verification of stated corrective & preventive actions.

(d) Gorakhpur Haryana Anu Vidyut Pariyojana (GHAVP-1&2)

Ground improvement work was in progress in GHAVP-1&2 main plant area. On early morning of March 29, 2019, a dumper after unloading the mixed soil, was heading towards plant No. 1 for loading mixed soil. En-route, it hit the victim (Civil Supervisor of Contractor) who was deputed at the spot for supervising the rolling operation. He was taken to the Hospital for immediate treatment. However, on April 02, 2019, victim succumbed to the injuries.

Review of investigation report at AERB revealed deficiencies in communication mechanism between contractor and site and lack of safety management of NPCIL at site. Contributory causes were inadequate procedural adherence, ineffective communication, lack of questioning attitude and lack of awareness of unsafe work conditions. AERB team carried out special RI on April 05, 2019. A warning letter was issued to site asking to implement measures to prevent recurrence of such accident. NPCIL was recommended strict adherence to the safe working procedures, adequate rest rooms/suitable shelters, training of line supervisors to enhance risk perception to prevent accidents, sufficient authority to the supervisor to stop the work in case of unsafe work conditions etc. It was also recommended that NPCIL-HQ shall review the actions initiated by GHAVP site.

Compliance of recommendations are being checked during RI for verification of stated corrective actions.

(e) Kaiga Generating Station (KGS-1&2)

A fatal accident occurred at KGS-1 on February 04, 2019. The contract worker was working as a crane operator for overhauling of Turbine Generator of KGS-1 during biennial shutdown. On the day of event, he was

relieved from the duty by morning shift crane operator. Later, he was found lying unconscious on the crane access walkway platform and subsequently declared dead on same day at KGS hospital. The preliminary post-mortem report indicated internal injuries which could not be attributed to natural causes. In view of this, AERB recommended that the event should be considered as an industrial accident till receipt of final post-mortem report and its review in AERB. Based on the investigation of the event, AERB has asked all DAE facilities to review the safety aspects of all the material handling equipment & operations and take necessary corrective actions.

(f) Indian Rare Earths Limited (IREL) OSCOM

A fatal accident occurred at IREL, OSCOM on July 06, 2019. A tanker was deployed to load chlorine solution and transport it for further processing. During loading operation, a contract worker fell from top of tanker (3.3 m height) which resulted in serious injuries on his skull and face. The victim succumbed to his injuries on July 07, 2019 while undergoing medical treatment at hospital.

AERB review indicated unstable surface of the tanker top, lack of arrangement for arresting a possible fall and inadequate JHA were the cause of the accident. AERB recommended IREL to review the lapses in the safety management systems including organisational failures and to provide technical solutions to minimize the need of human intervention during tanker loading operation and review the post-accident medical management.

AERB asked all other facilities also to review the safety aspects of tanker loading and unloading operations at plant/site and to take necessary actions to ensure provision of safe working conditions for these activities.

e-LORA system for Radiation Facilities

eLORA Login Page
https://elora.aerb.gov.in/ELORA/populateLoginAction.htm

Government of India
Atomic Energy Regulatory Board
e-Licensing of Radiation Applications (eLORA) System

हिंदी संस्करण AERB Website

Guidelines
▼
Guidelines for Institute Registration
Guidelines for Radiation Professional Registration
Licensed Diagnostic Radiology facilities in India and approved service agencies
Type approved equipment list
Feedback
Unregistered Institute Excessive Exposure Investigation Report Submission
▼
Processing time for issuance of Regulatory Consents
▼
Help to operate eLORA System
▼

Know Your Application Status
Institute Registration Application
Radiation Professional Registration Application
Verification of Consent/Document issued through eLORA

eLORA Application Processing Statistics
To know more about number of radiations
Click here for details

Frequent Queries
RP/Institute registration status | Reason for non-acceptance
Correction in e-mail id and mobile no. | Login issues | Profile/role issues | Practice issues
Check application status | Correct submitted data
Institute Registration | Step by step help | Raise an issue to AERB
Registration of RP | Training Courses | Feedback
Authorised QA/Service/Supplier for DR
TA equipment | List of survey meter/dosimeter suppliers
For regulatory support you may contact Help Desk No. 022-25990675 during working days between 10:00 AM - 05:00 PM **New**

Login
● Institute ○ Radiation Professional ○ RSO
Username*
Password*
Practice* --Select One--
Institute Role* --Select One--
Installation Type* --Select One--
Login
Forgot / not received my password
Forgot / not received my User Id
Forgot/Wrong email id & mobile no

Registration Form
Register Institute
Register Radiation Professional (RP)
Register Incoming Employer - after Initiation of Employer Change Process

CAUTION X-RAY
방사선 주의
Ways to achieve Radiation Safety in Diagnostic Radiology Facility
Click to know more

aerb.gov.in/index.php/english/quick-help-on-e-lora

Home | Careers@AERB | Tenders | FAQ | Feedback | Index A-Z | Site Help | Accessibility Options | हिंदी Search A- A A+

Government of India
AERB
Atomic Energy Regulatory Board

The mission of the AERB is to ensure the use of ionising radiation and nuclear energy in India does not cause undue risk to the health of people and the environment.

About Us | Regulatory Process | Facilities & Activities | Publications | Acts & Regulations | Contact

Quick Help on e-LORA

e-LORA Operational Help for the Radiation Facilities

- RSO Approval-Employer Change-NC Response-Safety Status Report
- Radiotherapy
- Nuclear Medicine
- Diagnostic Radiology
- Industrial Radiography
- Nucleonic Gauges
- Gamma Irradiation Chambers
- Gamma Radiation Processing Facilities
- Industrial Accelerators/Research accelerators

Frequently Asked Queries
(on click, pdf file will be downloaded)

- Radiation Professional/Institute Registration Status/Reason for Non acceptance
- Type Approved (TA) Equipment
- Authorized QA Service, Supplier of Diagnostic Radiology (DR)
- List of Survey Meter-Dosimeter Suppliers
- How to verify your mobile number and email id