सत्यमेव जयते

Government of India

Protection of present & future generations

परमाणु ऊर्जा नियामक परिषद
पऊनिप
AERB
ATOMIC ENERGY REGULATORY BOARD

AERB BULLETIN

2014-15

Chairman AERB is the Competent Authority under the following Rules issued under the Atomic Energy Act, 1962:

Atomic Energy (Radiation Protection) Rules, 2004

Atomic Energy (Working of Mines, Minerals and Handling of Prescribed Substance) Rules, 1984

Atomic Energy (Safe Disposal of Radioactive Wastes) Rules, 1987

Atomic Energy (Factories) Rules, 1996

"Our mission is to ensure that the use of ionizing radiation and nuclear energy in India does not cause undue risk to the health of people and the environment.

FUNCTIONS OF AERB

- Develop safety policies in nuclear, radiation and industrial safety areas for facilities under its purview.
- Develop Safety Codes, Guides and Standards for siting, design, construction, commissioning, operation and decommissioning of different types of nuclear and radiation facilities.
- Grant consents for siting, construction, commissioning, operation and decommissioning, after an appropriate safety review and assessment, for establishment of nuclear and radiation facilities.
- Ensure compliance with the regulatory requirements prescribed by AERB during all stages of consenting through a system of review and assessment, regulatory inspection and enforcement.
- Prescribe the acceptance limits of radiation exposure to occupational workers and members of the public and acceptable limits of environmental releases of radioactive substances.
- Review the emergency preparedness plans for nuclear and radiation facilities and during transport of large radioactive sources, irradiated fuel and fissile material.
- Review the training program, qualifications and licensing policies for personnel of nuclear and radiation facilities and prescribe the syllabi for training of personnel in safety aspects at all levels.
- Take such steps as necessary to keep the public informed on major issues of radiological safety significance.
- Promote research and development efforts in the areas of safety.
- Maintain liaison with statutory bodies in the country as well as abroad regarding safety matters.
- Review the nuclear and industrial safety aspects in nuclear facilities under its purview.
- Review the safety related nuclear security aspects in nuclear facilities under its purview.
- Notifying to the public, the 'nuclear incident', occurring in the nuclear installation in India, as mandated by the Civil Liability for Nuclear Damage Act, 2010.

AERB Board meeting in progress

ABOUT AERB

The Board of Management of Atomic Energy Regulatory Board (AERB) consists of a Chairman, five Members of which four members are experts from from IIT, Bombay, AIIMS, New Delhi, IICT, Hyderabad & NGRI, Hyderabad along with a Secretary. AERB Secretariat currently has a staff strength of more than 300 personnel organized in ten Divisions at its headquarter in Mumbai, Safety Research Institute (SRI) at Kalpakkam and Regulatory Regional Centres at Kalpakkam, Kolkata and New Delhi. AERB is supported by the Safety Review Committee for Operating Plants (SARCOP), Safety Review Committee for Applications of Radiation (SARCAR) and Advisory Committees for Project Safety Review (ACPSRs). ACPSR recommends to AERB issuance of consents at different stages of plants till its operationalisation, after reviewing the submissions made by the plant authorities, based on the recommendations of the associated Design Safety Committees. The SARCOP carries out safety surveillance and enforces safety stipulations in the operating facilities. The SARCAR recommends measures to enforce radiation safety in medical, industrial and research institutions, which use radiation and radioactive sources. AERB also receives advice on codes and guides and on generic issues from the Advisory Committees. The administrative and regulatory mechanisms which are in place ensure multi-tier review by experts in the relevant fields available nation wide. These experts come from reputed academic institutions and governmental agencies.

The Atomic Energy Regulatory Board (AERB) was constituted on November 15, 1983 by the President of India by exercising the powers conferred by Section 27 of the Atomic Energy Act, 1962 (33 of 1962) to carry out certain regulatory and safety functions under the Act.

AERB's safety regulatory requirements are brought out in a set of Codes and Guides; more than 150 such documents have been developed and published by AERB over the years. Nuclear and radiation facilities and activities require Consents from AERB for various stages during the lifetime of the facillity viz., siting, construction, commissioning, operation and decommissioning. These Consents are granted after ensuring that the regulatory requirements are met. At each stage a comprehensive review in a multi-tier structure of safety committees is carried out at AERB.

PREFACE

The chill of the winter has already started making its presence felt. The morning dew, the mid-day breeze, the evening mists have set the perfect backdrop for the festive season. AERB extends season's greetings to all its readers. We at AERB are pleased to see the encouraging response to our initiative to bring out the annual edition of AERB Bulletin, which attempts to present information contained in the Annual Report, for a leisurely read.

In March 2015, AERB subjected itself to first ever peer review by an international team of IAEA, consisting of eighteen domain experts from various countries during twelve day long IRRS Mission. We are pleased to share that the general finding of the mission is an encouraging acknowledgement of the compliance of the regulatory regime established by AERB with the essential IAEA safety requirements. The exhaustive preparation, the experience and outcome of the peer review is covered in detail in the special feature included in this edition of Bulletin.

You will also be happy to know that our past efforts of launching e-governance for regulation of radiation facilities has met with stupendous success. The efforts were acknowledged nationally and AERB was rewarded with the prestigious SKOCH SMART governance award. We are happy to include another special feature on the success story of e-LORA in this edition of Bulletin.

Yet another significant moment this year was AERB's participation in the diplomatic conference for Convention on Nuclear Safety wherein the Vienna Declaration on Nuclear Safety was adopted, which sets a new global benchmark for nuclear safety. AERB was a key player in the formulation of the Vienna Declaration.

This year AERB issued several important regulatory safety documents which include two important Safety Codes: one on 'Site Evaluation of the Nuclear Facilities' and another on 'Design of Light Water Reactor based Nuclear Power Plants'.

Focussed initiatives were taken to expand public outreach activities by participating in major science and technology exhibitions such as Nuclear Energy Expo, Indian Science Congress, Indo-Japan International Conference etc. We are pleased to inform that despite being relatively new entrants in such fora, our earnest efforts met with overwhelming response particularly from school children and their parents.

Retaining the essence of earlier editions, this annual bulletin provides in a nutshell the major activities of AERB during 2014-15. Efforts have been made to include more visuals and to keep the technical content simple. We would be happy to elicit feedback on this attempt and suggestions for further improving this bulletin.

8
Regulatory safety documents developed in 2014-15

>200
Safety review meetings conducted in 2014-15

>11300
Regulatory consents granted in 2014-15

~1400
Regulatory inspections conducted in 2014-15

Contents.....

NUCLEAR POWER PROJECTS

AERB has established a regulatory framework, which involves stipulating the safety requirements, issuance of regulatory consents, verification of compliance through safety reviews & inspections during various stages from siting, design, construction, commissioning, operation etc. All nuclear power projects undergo an elaborate and in-depth safety review during their various consenting stages.

Siting	Construction	Commissioning	Operation
the chosen site is suitable for the proposed type and capacity of the plant from environmental considerations	the proposed plant design and the applicant's statements and commitments meet the regulatory requirements, the proposed construction meets quality requirements	the test program and procedures are consistent with requirements, the performance of the plant is as per design intent, the results of tests confirm the adequacy of the design for regular operation of the plant, safety analysis for the as-built facility has been carried out to meet the regulatory requirements	the operational limits and conditions are consistent with regulatory requirements and an adequate level of safety is maintained during operation, through proper operational and maintenance procedures and administrative control, organisational structures, training and qualification of operating personnel meet the requirements, and conditions for renewal of consent as prescribed by AERB are met

Siting

- Gorakhpur, Haryana
  4x700 MWe PHWRs
- Jaitapur, Maharashtra
  6x1650 MWe PWRs
- Kudankulam, Tamilnadu
  4x1000 MWe PWRs

Construction

- Rawatbhatta, Rajasthan
  2x700 MWe PHWRs
- Kakrapara, Gujrat
  2x700 MWe PHWRs
- Kalpakkam, Tamilnadu
  1x500 MWe PFBR

Commissioning

- Kudankulam, Tamilnadu
  2x1000 MWe PWRs

NUCLEAR POWER PROJECTS - SITING

Nuclear Power Corporation of India Ltd. (NPCIL) has proposed to install progressively 6 units of European Pressurised Reactors (EPR), each of 1650 MWe PWR at Jaitapur site on the western coast of Maharashtra and 4 units of 700 MWe Pressurised Heavy Water Reactors (PHWRs) at Gorakhpur in Haryana.

AERB continued the exhaustive process of site evaluation for both these sites wherein the impact of site on the plant including extreme earthquake, flood and meteorological conditions, the impact of plant on the site under normal and accidental conditions and feasibility of implementation of emergency plans are assessed.

Four more Russian design VVERs (KKNPP 3-6) of 1000 MWe each is proposed at Kudankulam site. Siting clearance for Units 3 to 6 was granted by AERB in February 2011. Infrastructure development for KKNPP 3&4 is in progress. Safety review by AERB of submissions related to excavation clearance stage i.e site specific data, lay out, geotechnical data, design basis ground motion, tsunami hazard assessment etc is in progress.

For the Advanced Pressurised Water Reactors (AP-1000) planned to be set up in India, AERB undertook the review of the general technical information on overall design and operational safety requirements.

Site Evaluation of Jaitapur Nuclear Power Project (6 x 1650 MWe EPRs) and Gorakhpur Haryana Anu Vidyut Pariyojna (4 x 700MWe PHWRs) is under progress.

Review w.r.t site excavation of 2 x 1000 MWe Kudankulam Nuclear Power Project 3-4 is in progress.

Site Evaluation Committee visits Gorakhpur site

NUCLEAR POWER PROJECTS - CONSTRUCTION

Twin units of indigenously designed 700 MWe Pressurised Heavy Water Reactors (PHWRs) are being set up at Kakrapar (KAPP 3&4) and Rawatbhata (RAPP 7&8) respectively. These reactors are similar in design except for site specific changes. These reactors when commissioned will be first set of 700 MWe units.

AERB granted clearance for "First Pour of Concrete" for KAPP 3&4 in November 2010 and for RAPP 7&8 in July 2011. Subsequently, AERB is continually reviewing the progress of the construction activities and have issued various permissions for intermediary stages.

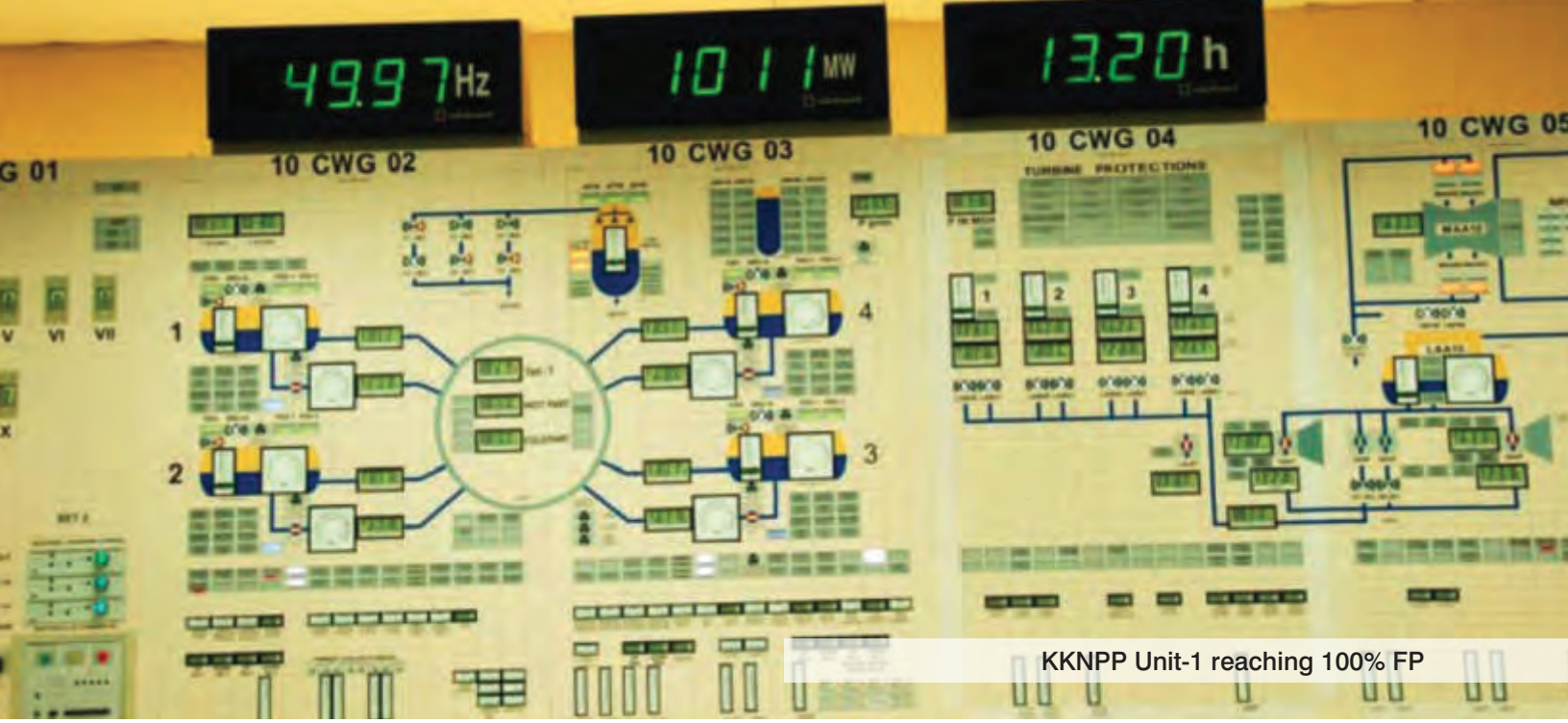
Civil construction activities related to safety and non-safety buildings are in progress in both of these sites. In KAPP 3&4, end shield grouting after welding with calandria was completed and erection of diesel generators and start-up transformers is in progress. In RAPP 7&8, end shields and calandria were lowered in calandria vault and their alignment is in progress. Calandria is the main vessel which houses the nuclear fuel.

Clearance for Erection of Major Equipment at KAPP 3&4 (May 26, 2014).

Permission for Grouting of the End-shields of KAPP-3&4 (September 29, 2014).

Clearance for Erection of Major Equipment at RAPP-7&8 (March 5, 2015).

Installation of Pre-Fabricated Ring Liner at KAPP-3



KKNPP Unit-1 reaching 100% FP

NUCLEAR POWER PROJECTS - COMMISSIONING

Clearance for Raising Reactor Power of KKNPP-1 up to 90% FP and for limited duration at 100% FP for Conduct of Specified Tests (May 1, 2014).

Extension of validity of Clearance for Raising Reactor Power of KKNPP-1 up to 90% FP and for limited duration at 100% FP for Conduct of Specified Tests (June 13, 2014).

Clearance for Operation of KKNPP-1 upto 100% FP for Limited Duration (August 30, 2014).

Extension of validity for Clearance for Operation of KKNPP-1 up to 100% FP for limited duration (December 30, 2014).

Clearance for Hot Run of KKNPP-2 (Commissioning Sub-Phase A3) (February 26, 2015).

AERB granted Clearance to Kudankulam Nuclear Power Plant Unit 1 for raising reactor power up to 90% Full Power (FP) and further for limited duration up to 100% FP for conducting specified tests up to December 31, 2014. During power raise reactor was shut down for investigation of elevated thrust pad bearing temperature of Turbine. After completing the maintenance work, it was started and synchronized to grid on December 7, 2014. Based on the stabilized plant performance at 1000 MWe and as a part of continuous safety supervision towards regular operation, Clearance for Operation up to 100% FP was extended till April 30, 2015.

After completion of pre commissioning activities at Kudankulam Nuclear Power Project - Unit 2, the unit carried out pre-operational integrated leak rate test and hydro test of the containment. Subsequently, primary system heat-up for steam line flushing and subsequent heat-up to rated temperature and pressure as part of hot run was carried out. AERB observers were posted at site to witness these tests.

In the upcoming Proto Type Fast Breeder Reactor at Kalpakkam, majority of the equipment have been erected and reactor top closed. Erection of transfer arm and inclined fuel transfer machine were in progress. Preparatory works towards reactor containment building leak test and integrity tests of secondary sodium circuits are in progress. Commissioning activities related to auxiliary systems are also in progress.

Nuclear Power Plants and Research Reactors under Operation

AERB Board visits KAPS1&2

All Nuclear Power Plants and Research Reactors operated safely during the year.

Radiation doses to all occupational workers were within the limit.

The releases from all the plants to the environment continued to remain only a small fraction of the allowable discharge limits.

The effective dose to public due to the radioactive discharges were estimated to be far less than the annual limit of 1mSv prescribed by AERB.

LICENSES ISSUED / RENEWED

Renewal of License for operation of TAPS-1&2 upto Mar, 2016

Renewal of License for operation of RAPS-1&2 upto Dec, 2016

Renewal of License for operation of MAPS upto Dec, 2015

Renewal of License for operation of KAPS-1&2 upto Jul, 2019

Permission for 23rd irradiation campaign of FBTR (research reactor)

> 255 operators in various positions were licensed in different Nuclear Power Plants

THERE ARE 20 NUCLEAR POWER PLANTS PRESENTLY UNDER OPERATION* IN OUR COUNTRY WITH AN INSTALLED CAPACITY OF 4780 MWe.

Madras Atomic Power Station (MAPS) - 1&2 at Kalpakkam, Tamilnadu
Narora Atomic Power Station (NAPS) - 1&2 at Narora, Uttar Pradesh
Kakrapar Atomic Power Station (KAPS) - 1&2 at Kakrapar, Gujarat
Rajasthan Atomic Power Station (RAPS) - 1 to 6 at Rawatbhata, Rajasthan
Tarapur Atomic Power Station (TAPS) - 1 to 4 at Tarapur, Maharashtra
Kaiga Generating Station (KGS) - 1 to 4 at Kalpakkam, Tamilnadu
*RAPS-1 under defulled condition

2 Research Reactors under purview of AERB are Fast Breeder Test Reactor & KAMINI at Kalpakkam, Tamilnadu

Unlike some countries, in India, AERB does not grant an operational license for design life of a plant but grants it for a limited period for not more than 5 years. Over a period, this practice has become one of the cornerstones in the regulation of operating nuclear power plants in India and has proved to be a very powerful tool in assessing and enhancing safety of NPPs.

Operating plants undergo continuous safety review through periodic reports and regulatory inspections supplemented by exhaustive five yearly reviews which takes place during review of application for renewal of license. This review involves detailed safety review of safe operation of NPP as per its design intent, safety systems performances, improvements in safety, etc.

In addition to this, a periodic safety review (PSR) is carried out once in ten years, which is a much more comprehensive safety review and includes additional factors like advancement in technology, feedback of operating experience from within India as well as from other countries, comparison of safety standards, cumulative effects of plant ageing, probabilistic safety assessments etc.

Based on these reviews, license for operation of NPPs were either renewed or extended.

Safety Upgrades at NPPs post Fukushima

All identified short term measures like external hook-up points, additional emergency lighting backed up by solar cells and majority of medium term safety measures / upgrades such as introduction of seismic trip, strengthening of back-up power supply, augmentation of onsite water storage, wherever required and additional mobile pumps and fire tenders have been implemented at all stations. The implementation of long term measures involves carrying out certain R & D studies, procurement of equipment and erection etc. and is expected to be completed by December, 2016.

FUEL CYCLE FACILITIES

FRONT END

AERB continued its safety surveillance on the exploration sites of Atomic Minerals Directorate for Exploration and Research (AMD) located at southern, northern, western, eastern, central and south-central regions of India.

All the seven uranium mines (Jaduguda, Bhatin, Narwapahar, Turamdih, Banduhurang, Mohuldih and Bagjata) and two operating mills (Jaduguda and Turamdih) of Uranium Corporation of India Ltd. (UCIL) in the Singhbhum belt of Jharkhand and the underground mine at Tummalapalle in Karnataka operated safely. After detailed review and satisfactory resolution of the identified issues, AERB granted permission for raising the dam height of Turamdih tailings pond.

All the three operating thorium mining and mineral separation plants at Chavara, Manavalakurichi and Chhatarpur of Indian Rare Earths Ltd. (IREL) operated safely. There was no radiological impact due to the cyclone 'Hudhud' at eastern coast.

Clearance for operation of Monazite Processing Plant (MoPP) at Chatrapur was issued for limited quantity of production. The mineral separation plants at all IREL sites have been upgraded to produce 96% monazite which will be feed for MoPP at Chhatarpur. IREL Udyogamandal, continued to process secondary sources of uranium. Batch wise production of high purity rare earths commenced. Permission was granted for phase wise dismantling of old buildings and structures at IREL Udyogamadnal.

All fuel fabrication plants at Nuclear Fuel Complex (NFC), Hyderabad and Zirconium Complex, Pazhayakayal operated safely. The proposal by NFC to set up a fuel fabrication facility at Kota was reviewed comprehensively and consent for siting was granted.

- 9 Uranium mines
- 3 Uranium mills
- 3 Thorium mines
- 2 Thorium mines
- 3 Fuel fabrication sites
- 4 Heavy water plants
- Diversified projects of HWB
- Secondary sources of Uranium processing

Heavy Water is currently being produced in four Heavy Water Plants (HWP) at Kota, Manuguru, Hazira and Thal. All these plants operated safely during the year. Heavy Water production at HWP-Baroda,HWP-Tuticorin and HWP-Talcher remained suspended due to non-availability of feedstock from the associated fertilizer plants.

AERB renewed the license for operation of HWP-Thal for a period of five years i.e. up to December 31, 2019 after satisfactory review and resolution of the identified issues, namely ageing management program for critical equipment and safety assessment with respect to external events such as floods, wind etc.

AERB continued its safety supervision over various diversified projects of Heavy Water Board such as production of organic solvents at HWP-Baroda, Tuticorin and Talcher.

Consents Issued / Renewed

Grant of Consent for raising dam height from 198m RL to 208m RL at Turamdih tailings pond.

Grant of Consent for Siting and Construction of Boric Acid Conversion and BF3 Gas Generation Facility at HWP - Talcher up to February 29, 2020.

Extension of Consent for Siting & Construction of 3TPA Niobium Thermit Production Facility at NFC, Hyderabad up to March 31,2017.

Grant of Consent for siting of PHWR Fuel Fabrication Facility at Rawatbhata, Kota for a period of three years.

Thorium mining in progress

FUEL CYCLE FACILITIES

BACK END

Compact Reprocessing of Advanced Fuels in Lead Cell (CORAL) was constructed to develop technology for reprocessing of fast reactor fuel. AERB had accorded permission for operation of CORAL up to December 31, 2014 for reprocessing of six number of FBTR spent fuel sub-assemblies. Subsequently, IGCAR has implemented the action plan for resolution of most of the pending recommendations such as installation of Capper-Decapper in containment box, provision for monitoring concentration of hydrogen in waste storage tank, provision of air purging system for waste storage tanks during SBO, Seismic qualification of waste storage tanks of CORAL. The seismic analysis and seismic margin assessment for other SSCs is in progress.

Demonstration Fast Reactor Fuel Reprocessing Plant (DFRP) is a fore-runner of the reprocessing facility FRFCF (Fast Reactor Fuel Cycle Facility) to close fuel cycle of PFBR, being setup by IGCAR at Kalpakkam. It is divided into 2 concrete cell facilities called Head End Facility (HEF) and Process Plant Facility (PPF).

Renewal of License for operation of CORAL, RpG, IGCAR up to March 2016 or completion of reprocessing of 14 Fuel Sub-Assemblies (FSAs) whichever is earlier.

Construction of both cells have been completed and equipment erection, associated piping with modification works are in progress in HEF. Safety review of pre-commissioning activities is in progress.

Fast Reactor Fuel Cycle Facility is an integrated fuel cycle plant being set up at Kalpakkam to facilitate closure of fast reactor fuel cycle. There are five dedicated plants with common services and utilities. The clearance for construction was granted in 2013, at present excavation works are in progress.

CORAL Facility

NORM INDUSTRIES

7 BSM facilities licenses renewed

2 new BSM facilities licensed

AERB continued to exercise its safety supervision over the Beach sand minerals (BSM) Facilities. This year application for renewal of license of seven existing BSM facilities were reviewed. Based on the review of the past performance of the facilities related to radiation exposure, generation of monazite enriched tailings and their disposal, adequacy of storage area for the tailings for the next five years and availability of radiological safety officer, radiation monitoring instruments etc, the licenses were renewed. In addition, fresh licenses were also issued to two new BSM facilities. With this, the total number of licensed non-DAE BSM facilities by AERB in the country stands twenty-five.

AERB has issued registration for Columbite Tantalite Processing Facilities at Taloja for processing of Columbite Tantalite ore with the stipulation for safe handling of Uranium Bearing Slag.

AERB has directed all the rock phosphate fertiliser plants to submit quarterly analysis report of imported rock phosphate and the resultant phosphogypsum for assessment of Uranium & Radium content.

AERB is presently examining the radiological issues in Oil and Gas Industries, specially with respect to exposure from scales in pipelines.

AERB had examined the radiological issues associated with Fly ash and observed that there is neglible radiological impact on the outside environment. However, as abundant caution, AERB has made certain recommendations with respect to clean-up systems in thermal power plants.

Mined out site back filled with silica sand

R&D CENTRES & INDUSTRIAL PLANTS

INDUS-1 at Raja Ramanna Centre for Advanced Technology (RRCAT), Indore is a storage ring where electron beam of energy 450 MeV at 100mA current is stored. The electron beam while circulating in the storage ring emanates low energy synchrotron radiation which is tapped through 5 licensed beamlines for various experimental studies. The operational performance of INDUS-1 was reviewed by AERB and found satisfactory.

INDUS-2 at RRCAT, Indore is a synchrotron cum storage ring and is under commissioning trials with beam energy at 2.5 GeV and stepwise increase of beam current from 100mA. The safety aspects are being periodically reviewed by AERB. Proposal for regular operation of the machine is under review.

Other accelerators at RRCAT, Indore: A 10MeV & 10 kW Power Electron Linac is under operation at RRCAT. Status of ongoing accelerator projects such as 10 MeV TW-INDUS Linear Accelerator, 2.5 MeV Industrial DC Accelerator, 20 MeV electron Microtron, 10MeV Free Electron Laser (FEL) LINAC, Infra red FEL-LINAC, Agricultural Radiation Processing Facility at Choithram Mandi, Indore, as well as laser projects are being periodically reviewed.

The room temperature (k-130) cyclotron at Variable Energy Cyclotron Centre (VECC), Kolkata operated safely delivering alpha and proton beams at various energies.

The commissioning activities of super conducting cyclotron at VECC, Kolkata which aims at acceleration of heavy ions under liquid helium temperature, continued with periodic safety review by AERB. Installation of the components for Radioactive Ion Beam facility including construction of a new building is under progress with periodic regulatory supervision by AERB.

DAE through VECC is setting up a medical cyclotron at Chakgaria, in Kolkata. This cyclotron will have three beam lines for production of radioisotopes which will be

VECC, Kolkata

- Room temperature cyclotron & Radioactive Ion Beam facility
- Super conducting cyclotron
- Medical cyclotron

RRCAT, Indore

- INDUS-1 &2 synchrotron cum storage ring
- Electron Microtron, DC Accelerator & LINACs
- Lasers

IGCAR, Kalpakkam

- Tandetron accelerator
- Heavy Ion accelerator, 150 & 30 kV accelerator
- Neutron generator based on RFQ - LINAC

Grant of Consent for first stage of testing of 20 MeV Microtron.

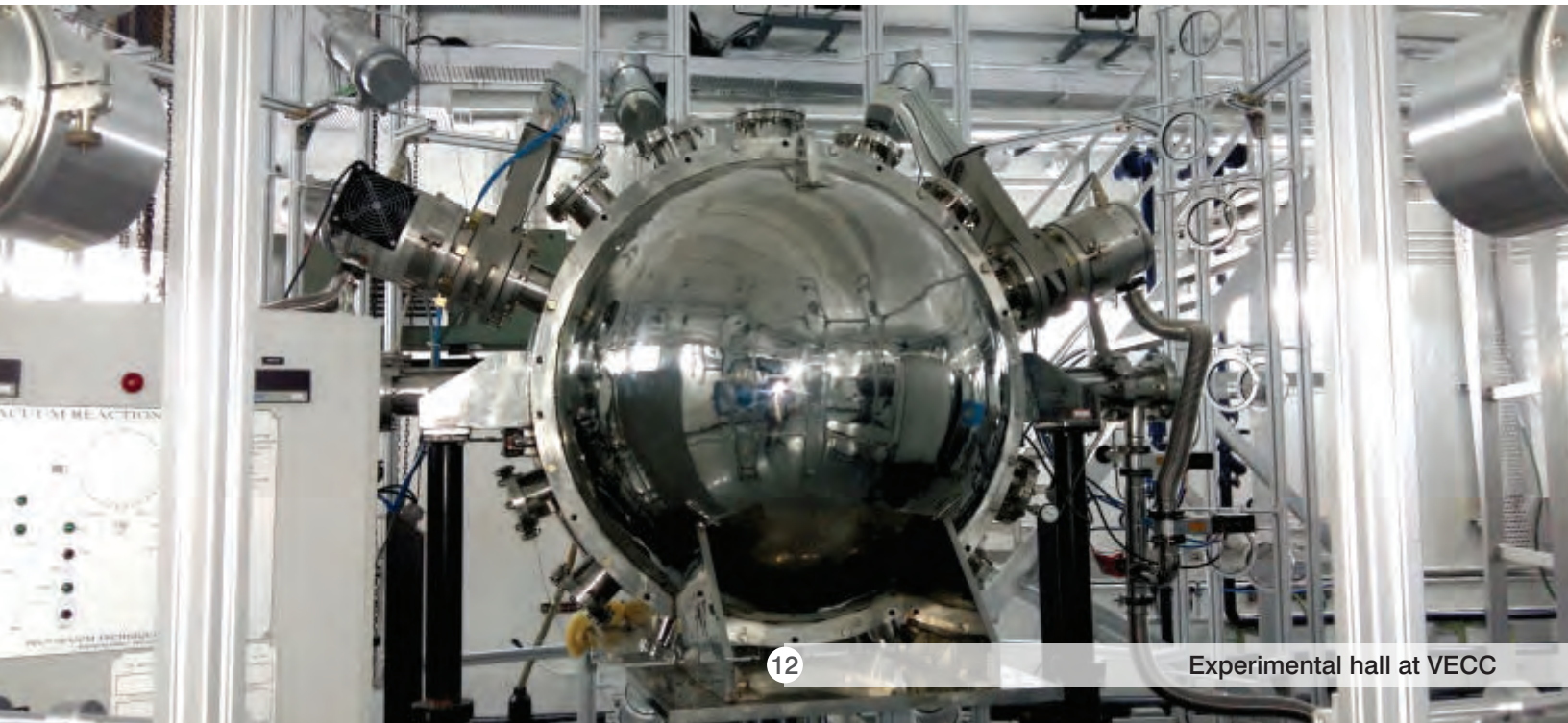
Grant of Consent for commissioning of 10 MeV, 5 kW TWINDUS Linac-1 up to January 31, 2017.

Extension of Consent for construction of Agricultural Radiation Processing Facility (ARPF) at Choithram Mandi, Indore up to December 31, 2016.

used for preparation of radiopharmaceuticals. In addition, there will be two experimental beam lines for material science and liquid metal target studies. Design safety aspects is under review by AERB.

Accelerators at Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam: Safety surveillance of research reactors and fuel cycle facilities at IGCAR have already been dealt with in previous sections. Apart from these, IGCAR also houses 1.7 MV Tandetron accelerator, 400 kV Heavy Ion accelerator, 150 kV Accelerator and a 30 kV accelerator. These accelerators provide ion beams in the energy range of 30 keV to 3.4 MeV for conducting studies on irradiation effects in materials and research in materials science. In addition, a neutron generator based on the Radio Frequency Quadrupole (RFQ) – linear accelerator (LINAC) is being installed for undertaking various neutron shielding experiments, assay of fissile materials (in radioactive waste), standardizing different neutron measurement techniques and other applications such as neutron induced activation analysis & neutron radiography.

All the manufacturing units of Electronics Corporation of India Ltd. (ECIL), Hyderabad operated safely Consent was granted by AERB for regular operation of High Range Gamma Calibration Facility. AERB also granted consent for construction for an additional Effluent Treatment Plant and a server & transformer room after satisfactory review of layout of transformer room & power distribution from the transformer.



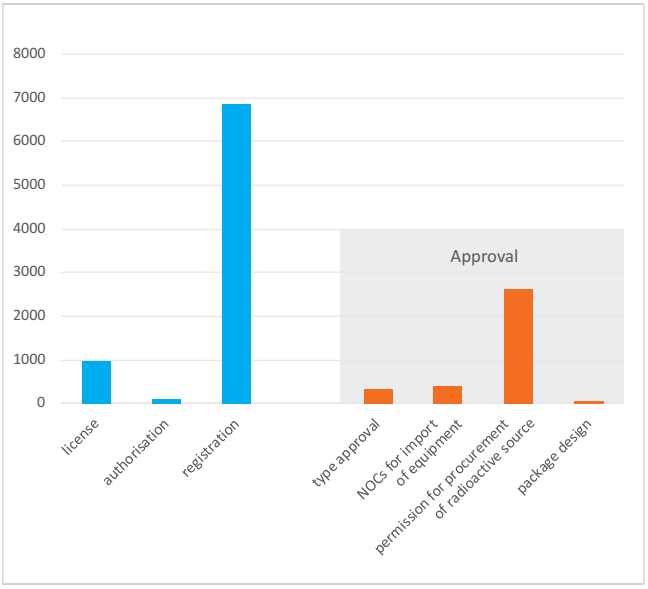
Experimental hall at VECC

RADIATION APPLICATIONS

In the modern age, radiation sources (i.e. radioactive isotopes and radiation generating equipment) are being used in multifarious and ingenious ways to achieve over all societal health and prosperity.

There is an inherent hazard involved in handling of these sources. Proper design, handling and disposal methodologies offset these hazards and ensure safe and intended use of these radiation sources. The Atomic Energy Regulatory Board regulates the use of these radiation sources so that they do not cause any undue harm to the radiation workers, general public, patients and the environment.

These sources vary in their hazard potential. Accordingly, the statutory requirements are graded and may require multiple stages of approval to address the hazard, before final issuance of consent to operate the facility / equipment namely LICENCE, AUTHORISATION, REGISTRATION and APPROVAL. AERB has put into operation a web based system of e-licensing of Radiation Applications (e-Lora) which enables automation of regulatory processes for various radiation facilities located across the country and enhance its efficiency and transparency.



Licence

- Radiotherapy
- Medical Cyclotron
- Interventional Radiology
- Computed Tomography & PET-CT/SPECT CT
- Radiation Processing Facilities
- Industrial Radiography

Authorisation

- Gamma Irradiation Chambers
- Blood Irradiators
- Branchy Therapy
- Nuclear Medicine facilities
- Nucleonic Gauges manufacturing facilities
- Consumer Products manufacturing facilities

Registration

- Radio Immuno Assay Labs
- Medical Diagnostic X-Ray Equipment
- Nucleonic Gauges
- Radioactive Traces In Research

Industry

Radiation Processing Facilities (RPF) including Gamma Irradiators, electron beam accelerators are used mainly for sterilisation of healthcare products, crosslinking of polymers in cable industries. Some of the facilities are also used for radiation processing of food items for various purposes such as inhibit sprouting, delay in ripening, microbial decontamination, Insect disinfestation, 6 shelf line extension etc. The activity range is about few PBq (~10 Ci). They are of high radiation hazard potential.

Industrial Radiography using Industrial Radiography Exposure Device (IRED), is one of the important non-destructive methods used for study of weld joints, castings etc. Radioisotopes like Ir-192, Co-60, Tm-170, Se-75 and different energies of X-rays are being are used in the field of industrial radiography. The activity range is from few TBq (few tens of Ci) to few tens of TBq (few hundreds of Ci). The X-ray energy range is from few hundreds of keV to few MeV. They are of high to moderate radiation hazard potential.

Gamma Irradiation Chambers (GIC) are basically used for irradiation of blood and in research activities. Usually Co-60 radioisotope is used in this application. The activity ranges from few tens of TBqto few hundreds of TBq. They are of high to moderate radiation hazard potential.

The Industrial Radiation Gauging Device (IRGD) are used for online monitoring of quality control parameters such as thickness, level, density, coating thickness, elemental analysis etc; Sources used for nucleonic gauges consist of gamma sources such as Co-60, Cs-137, Am-241 etc., beta sources such as Sr-90, Kr-85, Pm-147, Tl-204, etc, neutron sources such as Am-241-Be. The activity range is from MBq (mCi) to GBq (Ci). They are of low radiation hazard potential.

Radioactive sources are used in well logging application for exploration of oil, coal, geophysical logging etc. The sources used are mainly Cs-137, Am-241-Be, and some calibration sources such as Co-60, Ra-226, Th-232 etc. and neutron generator eg. Deuterium-Tritium Generators etc. The activity range is from kBq (micro Ci) to GBq (Ci). They are of medium radiation hazard potential.

Medicine

In teletherapy (branch of Radiotherapy), radiation is used to treat malignancy. The radioisotopes like, Co-60, and radiation generators like Linear Accelerators are used. They are of high radiation hazard potential.

In brachytherapy (branch of radiotherapy in which the source is kept very near to the lesion) the isotopes used are Ir-192, Cs-137, Sr-90, Ru-106, I-125 with activity range is MBq (mCi) to GBq (Ci). They are of medium hazard potential.

X-rays are used in Medicine as an important diagnostic tool. Diagnostic Radiology using x-rays are

- Interventional Radiology equipment (Cath Lab):
  These equipment are used in operation theatres for various interventional procedures and are of high to moderate radiation hazard potential to medical professionals operating the equipment. The C-Arm equipment is of low to moderate hazard potential.
- Computed Tomography:
  These equipment are of low to moderate hazard radiation potential.
- The general purpose radiography and dental equipment:
  These constitute around 70-80% of all x-ray equipment that are used and are of low to very low radiation hazard potential.
- Mammography, Bone Mineral Densitometer:
  These equipments are of very low radiation hazard potential.

In Nuclear Medicine, Radio-pharmaceuticals, such as Tc-99m, I-131, Thalium-201 and F-18 are used for diagnosis and treatment.

Usually the radioisotopes are produced in research reactors, but some radioisotopes that are used in Nuclear Medicine are also produced from Medical Cyclotron facilities.

The medical cyclotron facilities are of high radiation hazard potential. The Nuclear medicine centres are of low to moderate radiation hazard potential.

Other Uses

Consumer Goods manufacturing facilities

Small radioactive sources in Smoke detectors Thorium gas mantle and starters. They are of very low hazard potential. Hence, approval is accorded to manufacturing facilities of this equipment.

Thorium gas mantles

Facilities using sealed sources

Though, sealed radioactive sources are used in various industrial and medical applications, but under this heading, sealed source means the sealed sources that are used in education, research and calibration purposes. The activity range is from kBq (μCi) to GBq (Ci). They are of low to moderate radiation hazard potential.

Facilities using unsealed sources

Unsealed sources are used in various research and academic institutions, such as agriculture, veterinary science etc; They are of low radiation hazard potential.

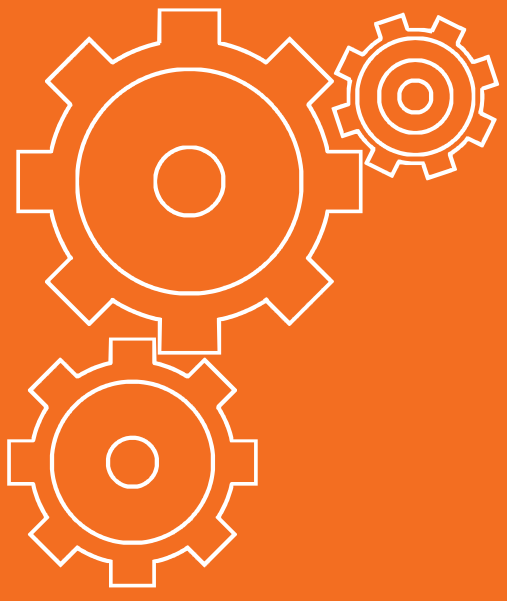
Permission for fabrication of Cobalt Teletherapy Sources (CTS) at RAPP Cobalt Facility (RAPPCOF)

In the year 2011, AERB had given permission for fabrication of one batch of Cobalt Teletherapy Sources (CTS) at RAPPCOF, based on the detailed review of the facility, addressing the issues related to spread of contamination. The campaign was conducted successfully in December 2011.

Subsequently, RAPPCOF had submitted application seeking permission for fabrication for six nos. of CTS. The application was reviewed in detail in AERB. Based on the satisfactory reviews of the application, permission was granted by AERB for fabrication of six nos. of CTS at RAPPCOF.

Smoke detectors

INDUSTRIAL SAFETY



AERB is responsible for administration of the Factories Act, 1948 and Atomic Energy Factories Rules, 1996 in all the units of DAE under its purview. AERB reviews the industrial and fire safety aspects during stagewise consenting process, inspections and document development.

AERB also focuses on the construction safety aspects of nuclear projects by carrying out special inspections of nuclear power projects in addition to the quarterly inspections and quarterly inspections of other nuclear facilities under construction. The fire safety aspects of the nuclear facilities are verified by checking the compliance with the requirements of AERB Safety Standard on “Fire Protection Systems for Nuclear Facilities” and periodic review of Fire Hazard Analysis of the facilities.

Licenses were issued/renewed under the provisions of the Factories Act, 1948 (as amended in 1987) and the Atomic Energy (Factories) Rules, 1996.

The nuclear power projects employ large number of contractor workforce, which is dynamic in nature and also there is a large spread of activities. In order to have an effective monitoring and to ensure highest level of industrial safety at these construction sites, special regulatory inspections on industrial safety were carried out once in six months.

Competent persons are designated for various DAE units are appointed under the provisions of the Factories Act, 1948 (as amended in 1987) and Rule 31 of the Atomic Energy (Factories) Rules, 1996 for the purpose of carrying out tests, examinations and inspections under various Section (s) of the Factories Act, 1948, namely for civil construction & structural work, operation of dangerous machines, lifts and hoists, lifting machinery and lifting tackles, pressure plant, dangerous fumes, supervision of handling of hazardous substances and ventilation system. During the financial year, Ninety Six (96) persons were designated as competent persons in different DAE units.

Certifying Surgeons are appointed by AERB, under Section 10 of the Factories Act, 1948 (as amended in 1987) and under Rule 5 of Atomic Energy (Factories) Rules, 1996 for carrying out the duties prescribed in Rule 7 of Atomic Energy (Factories) Rules, 1996.

AERB reviews the fatal accidents at DAE units and lessons learnt are disseminated to all DAE units. This year there were two fatal accidents, one each at RAPP 7&8 and RAPS 1&2 which were duly investigated.

License for operation of Heavy Water Plant-Thal under Section 6 of the Factories Act, 1948 was renewed on December 19, 2014 for a period of five years.

Licence for Operation of Rajasthan Atomic Power Station 5&6 under Section-6 of the Factories Act 1948 was renewed on March 31, 2015 for a period of five years.

A total of 115 regulatory inspections were conducted during the year with respect to industrial and fire safety aspects. Additional 15 industrial safety focused special inspections at construction sites of nuclear power projects and 4 quarterly inspections of nuclear fuel cycle facilities under construction were carried out.

Environmental Radiation Survey of Uranium Tailings pond

WASTE MANAGEMENT & ENVIRONMENTAL SAFETY

"The disposal of radioactive wastes is governed by the Atomic Energy (Safe Disposal of Radioactive Wastes) Rules, 1987 promulgated under the Atomic Energy Act, 1962.

During 2014-15, approvals were issued for disposal of 44,467 radioactive sources in facilities within the country and 415 sources for exporting back to the original supplier.

Wastes generated from nuclear facilities are in the form of gaseous, liquid and solid. The public dose limit of 1mSv is apportioned among the various facilities located at a given site in a conservative manner. This apportioned dose is further subdivided among atmospheric, aquatic and terrestrial pathways and also among radionuclides which are specific to the installation.

Spent radioactive sources from radiation facilities must be safely disposed off once they reach the end of their useful life. These sources are disposed off at different disposal sites such as Board of Radiation and Isotope Technology (BRIT), Bhabha Atomic Research Centre (BARC), Central Waste Management Facility (CWMF), Kalpakkam, Electronics Corporation of India (ECIL), Hyderabad and Narora Atomic Power Station (NAPS). The sources are also exported back to the original supplier abroad, in case of imported sources.

WASTES FROM NUCLEAR POWER PLANTS

Gaseous Emissions

H-3

< 10%
of limit

Tritium remained within 10% of the Technical Specifications limit

Ar-41

< 5%
of limit

Argon-41 remained within 5% of the Technical Specifications limit except in older generation plants such as RAPS 1&2 and MAPS which is upto 25% (due to use of air instead of CO_2 as annular gas)

FPNG

< 10%
of limit

Fission Product Noble Gasses remained within 10% of the Technical Specifications limit

I-131

< 1%
of limit

Iodine-131 remained mostly within 1% of the Technical Specifications limit except for Boiling Water based Reactor TAPS-1&2 which is within 5%

Liquid effluents

H-3

< 25%
of limit

Tritium remained within 25% of the Technical Specifications limit

Gr.β

< 10%
of limit

Gross beta remained within 10% of the Technical Specifications limit

Solid wastes

Solid wastes generated from nuclear power plants are generally low level waste which are decontaminated, compacted and disposed off in engineered near surface disposal facilities.

SAFETY IN
TRANSPORT OF RADIOACTIVE MATERIALS

"During 2014-15, 36 Type B(U)/(M) packages and 26 Type A packages were approved for transportation.

Transportation Cask

The widespread use of ionizing radiation has brought in the necessity of voluminous transport of the radioactive material from one place to another, many a times through public domain.

The transportation of radioactive material (including that of nuclear material), is governed by regulations specified by AERB in Safety Code for the transport of radioactive materials and is line with the International requirements specified by IAEA for safe transport of radioactive material. All transport consignments require Approval from AERB under AE(RP) Rules 2004. These consignments are required to be accompanied by a TREM card which contains emergency phone numbers to be contacted during accidental conditions.

The design of the radioactive package should be such that during the entire process of transport, it is ensured that the radioactive material remains contained and shielded to avoid unacceptable radiation exposure to cargo handlers and public. As the activity and nature of radioactive material to be transported varies over a wide range i.e. from few kBq (few μCi) to few PBq (thousands of Ci), a graded approach is used in selection of the packaging. "Type A packages", are used for of transport radioactive material of activity not exceeding the specified limits and need to be registered with AERB. "Type B packages" are subjected to a stringent approval procedure and are required to fulfill the safety standards.

EMERGENCY PREPAREDNESS
IN NUCLEAR AND RADIATION FACILITIES

Emergency Standby

Abnormal plant conditions with potential to develop into accident situations, if timely preventive actions are not taken.

Plant Emergency

Accident situations due to release of hazardous chemicals/radioactive materials, fire/explosion in the plant but with consequences confined within the plant boundary.

Site Emergency

Accident situations in the plant involving radioactivity transgressing the plant boundary but confined to the site, or involving release of hazardous chemicals/ explosion/fire, whose effects are confined to the site, with off-site consequences expected to be negligible.

Off-site Emergency

Accident situations with excessive release of radioactivity or release of large amounts of hazardous chemicals/ explosion/fire, with consequences likely to extend and transgress public domain, calling for intervention.

Nuclear Power Plants (NPPs) are designed with defence-in-depth philosophy which includes various safety barriers and systems to guard against any possible nuclear accident. In spite of all these, if any emergency situation arises due to an accident, well defined plans are laid down as required by AERB to tackle such situations.

During 2014-2015, seven site emergency exercises and one off site emergency exercise were conducted in power plants. Site emergency exercise (once in six months) and Off-site emergency exercises (once in a year) were also carried out at hydrogen sulphide based Heavy Water Plants at Manuguru and Kota.

AERB observer providing feedback to district officials

AERB inspection team at IREL OSCOM

REGULATORY INSPECTIONS

Regulatory Inspections are carried out to ensure compliance with consenting conditions and AERB safety requirements.

Apart from routine inspections AERB also conducts special (Reactive) and unannounced (Surprise inspections).

More than 85% of major observations of last year's inspections have been complied in nuclear facilities. Remaining are in progress as per schedule.

Facilities Inspected	No. of routine inspections conducted
Operating Nuclear Power Plants and associated facilities	27
Nuclear Power Projects and associated facilities	29
Nuclear Fuel Cycle Facilities, R&D units and industrial plants of DAE	39
Radiation Facilities	1292

10 Special Regulatory Inspections were carried out for Nuclear Power Plants.

ENFORCEMENT ACTIONS

Warning Letter was issued to radiation processing facility for carrying out design modifications in the design of product carriers without taking prior approval from AERB. This had led to the source frame with Co-60 getting stuck along with the product box during irradiation.

Warning Letters were issued to radiography agencies based at Nagpur and Rahuri from where radiography sources (Roli-1) containing Ir-192 were stolen due to inadequacy in security measures.

Withdrawal of Certificate of Site-in-charge of a radiography institution and its Radiographer was ordered for a period of three months due to serious procedural lapse on the part of the radiography team using Techops-680 source containing 30Ci of Co-60 which led to radiation exposure of a welder about two years ago.

Suspension of operation of all material handling operations involving tower cranes was ordered at a Nuclear Power construction site following a fatal accident which took place on November 06, 2014 during shifting of a bundle of reinforcement bars using a tower crane. NPCIL was asked to take immediate corrective actions to prevent such recurrences. Based on the satisfactory review of the submissions made by NPCIL, AERB granted clearance for operations of tower cranes on December 17, 2014.

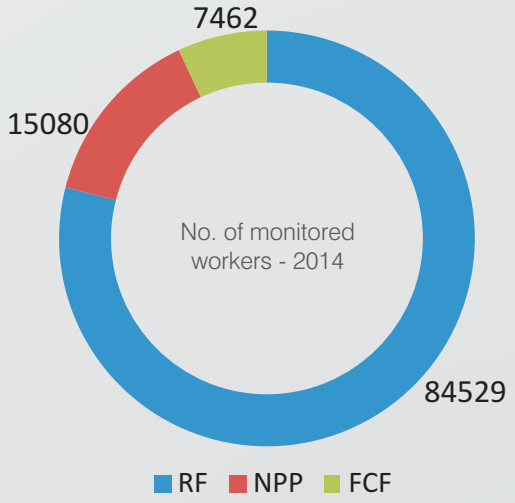
Several graded enforcement options are available to AERB to ensure that the Licensee takes timely corrective actions whenever needed. The actions taken by AERB are based on aspects such as safety significance of the deficiency, seriousness of violations, the repetitive nature and/or deliberate nature of the violations.

Enforcement actions may include one or more of the following:

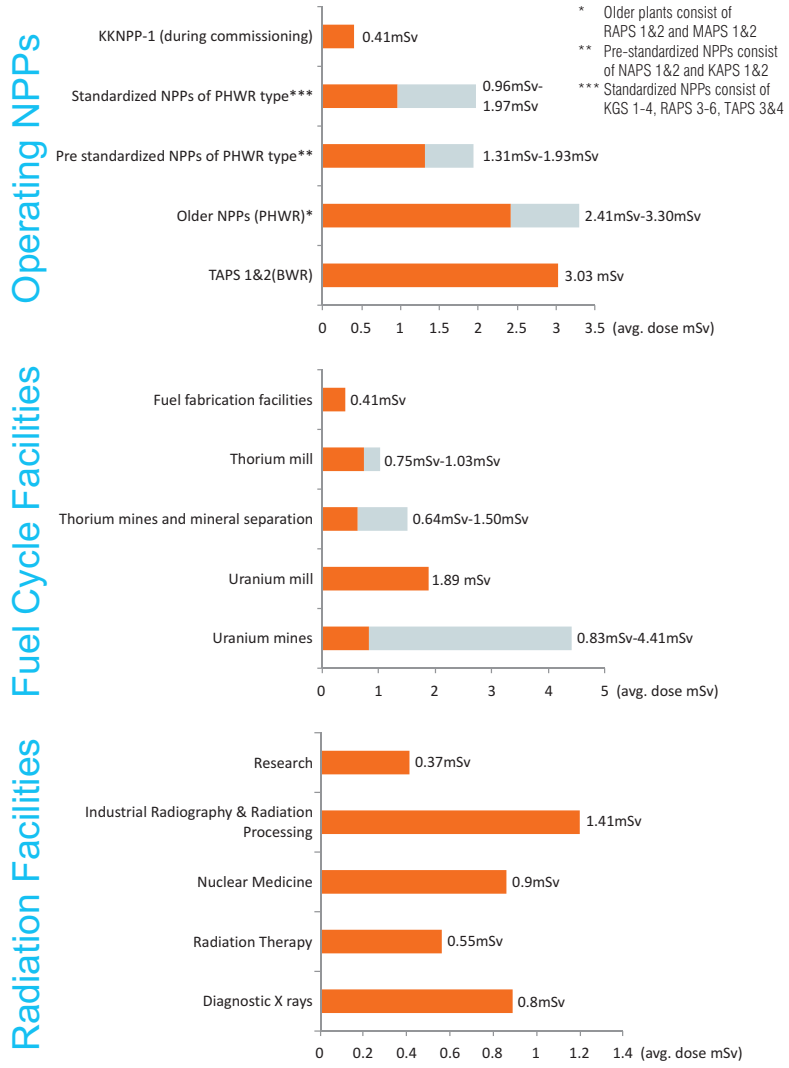
- A written directive for satisfactory rectification of the deficiency or deviation detected during inspection;
- Written directive to consentee for improvement within a reasonable time frame;
- Orders to curtail or stop activity;
- Modification, suspension or revocation of operating consents; and Penalties

SAFETY STATISTICS
OCCUPATIONAL EXPOSURE

AERB has prescribed a dose limit of **30 mSv** in year for occupational radiation exposure, with the condition that it should not exceed 100 mSv in a span of 5 years. This limit is more stringent than the ICRP recommended limit followed around the world.



No worker received dose greater than the annual investigation level of 20mSv in Nuclear Power Plants (NPPs) & Fuel Cycle Facilities (FCFs). With respect to Radiation Facilities (RFs), two radiation workers in industrial radiography and radiation processing facility received radiation dose greater than 50mSv due to non standard operating practice. AERB has issued notices to concerned institutions to prevent recurrence of such incidents.

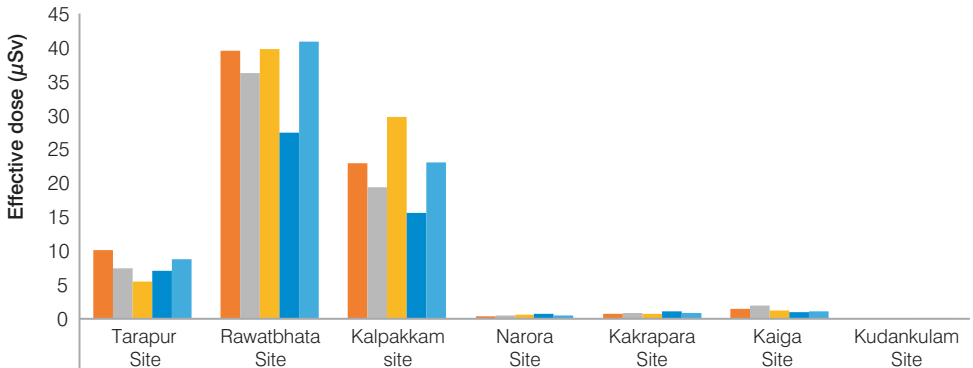


SAFETY STATISTICS
PUBLIC EXPOSURE

AERB has prescribed a public dose limit of **1 mSv** (1000 micro-sieverts) per year.

Radiation dose to members of the public near the operating plants is estimated based on measurements of radionuclide concentration in items of diet, i.e., vegetables, cereals, milk, meat, fish, etc and through intake of air and water.

Public dose estimated from NPP is found to be only a fraction of public dose limit (1000 micro-sieverts) prescribed by AERB.



	Tarapur Site	Rawatbhata Site	Kalpakkam site	Narora Site	Kakrapara Site	Kaiga Site	Kudankulam Site
2010	10.15	39.60	22.93	0.42	0.75	1.47	
2011	7.42	36.30	19.50	0.48	0.88	1.90	
2012	5.52	39.88	29.88	0.56	0.78	1.24	
2013	6.94	27.4	15.52	0.56	0.92	0.8	0.001
2014	8.71	41.01	23.14	0.44	0.76	1.10	0.081

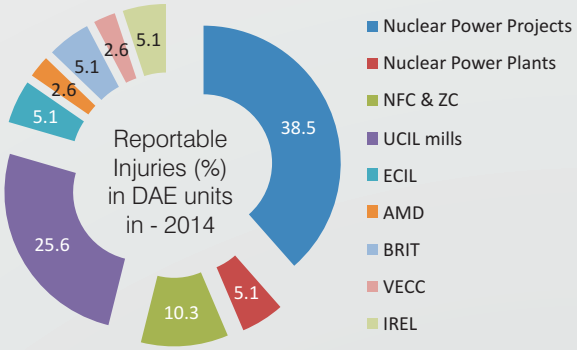
Estimated Public dose at Exclusion Zone Boundary of NPP sites

Perspective of Doses

Threshold for Mortality	2,000,000
Radiation Sickness Appears	1,000,000
First Signs of Radiation Effects	500,000
Emergency Worker Dose Limit/yr	250,000
Risk of Health Effects insignificant	100,000
Thyroid Scan	43,000
Thallium Cardiac Stress Test	36,000
Occupational Dose Limit/yr	30,000
One Chest CT Scan	7,000
Natural Background/yr	2,400
Public Dose Limit/yr	1,000
One Chest X-ray	100
One 10 hr. Air flight	50
Actual Annual Radiation Dose From Operation of NPPs at Exclusion Boundary	< 15

All Values in Micro-Sievert

SAFETY STATISTICS
INDUSTRIAL SAFETY



There were 29 reportable injuries i.e. injuries resulting in absenteeism for 48 hours in 2014 including 2 fatalities in the calendar year. In 2014, 374 Near-Miss Accidents were reported from different units of DAE. About 22.46% of the reported near miss accidents were related to "Fall / slip of the person on the same level."

No occupational diseases were reported from any of the DAE units during 2014-15.

"Industrial Safety Standard in DAE units fare better than corresponding Non-DAE industries

Frequency Rate

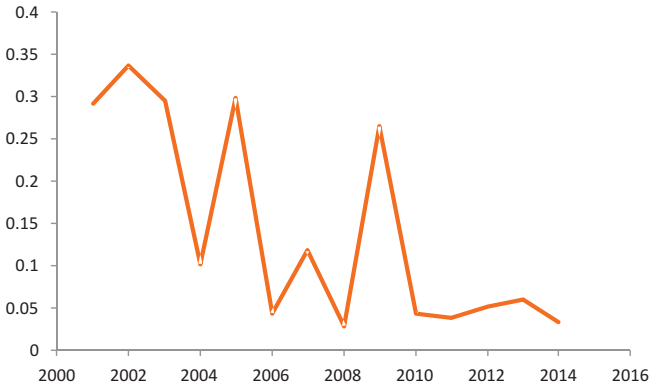
No. of reportable injuries divided by million man-hrs worked

The Frequency Rate has decreased to 0.21 in the year 2014 as compared to 0.27 in the year 2013.

Severity Rate

No. of man-days lost man-days lost divided by million man-hrs worked

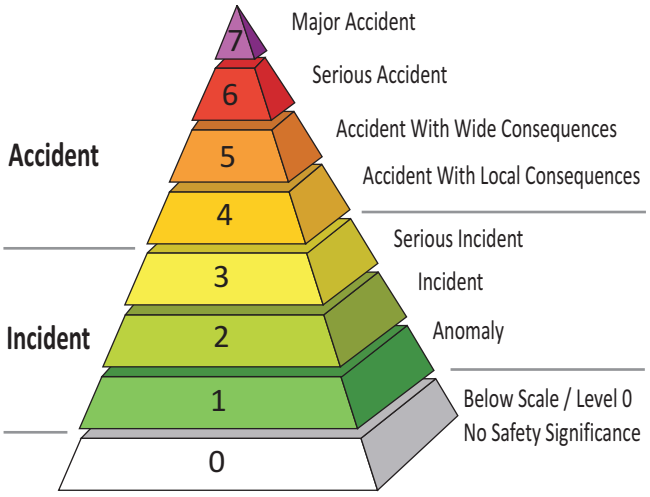
The Severity Rate was 160 in 2014 as compared to 219 in 2013.



Injury Index: Product of Frequency Rate and Severity Rate

SAFETY STATISTICS
SIGNIFICANT EVENTS

AERB requires NPPs to submit detailed report for every significant event that takes place. The reporting criteria is provided in the Technical specification for operations. These reports are reviewed and categorized based on International Nuclear & Radiological Event Scale. The INES system of the International Atomic Energy Agency (IAEA) rates events at seven levels (1 to 7) depending on their safety significance.



Out of 35 significant events in 2014, 34 significant events were rated at level 0 on INES while one significant event related to transfer of canister containing irradiated neutron detectors at TAPS-4 which led to over radiation exposure of a temporary worker.

The event was reviewed in detail in AERB. Further transfer of irradiated neutron detectors was permitted only after satisfactory implementation of the necessary corrective actions by the plant to prevent occurrence of such event in future.

INES Levels	2010	2011	2012	2013	2014
0	33	36	30	32	34
1	1	1	2	1	1
2	0	1	0	0	0
3	0	0	0	0	0
>3	0	0	0	0	0
Total	34	38	32	33	35

INES Rating of Significant Events in NPPs during the last five years

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. These accidents involved core meltdown with the consequences of off-site radioactivity release to environment.

DEVELOPMENT OF REGULATORY SAFETY DOCUMENTS

This year AERB published 8 Regulatory Safety Documents, of which contents of 3 important Documents are briefly described here.

Safety Code on 'Design of Light Water Reactor Based Nuclear Power Plants' (AERB/NPP-LWR/SC/D) presents the mandatory requirements for the design of light water based Nuclear Power Plants (NPP) and is intended to ensure the highest level of safety that can reasonably be achieved for the protection of workers, the public and the environment from harmful effects of ionizing radiation arising from nuclear power plants. It expands the well-established concept of plant states and defense in depth by introducing Design extension conditions including severe accidents, systems to mitigate them and requirements for practical elimination of the certain accident sequences, thereby bringing clarity in regulation for accident conditions beyond design basis accident. It also specifies provisions for additional provisions supporting the accident management infrastructure that might be needed to handle extreme events, along with unexpected failure of existing safety features/systems.

Safety Code titled 'Site evaluation of Nuclear Facilities' [AERB/SC/S (Rev.1)] scope has been extended to cover a more comprehensive range of land based nuclear facilities: nuclear power plants and research reactors, as well as nuclear fuel cycle facilities.

The revised safety code prescribes requirements for considerations during site evaluation for limiting the radiological impact for all nuclear facilities. It includes assessment of site characteristics, natural events and human-induced events specific to the site, which may have a bearing on the safety of the nuclear facility and the radiological impact on the environment & population during normal operation and accident conditions. The Code lays down requirements for assessing the suitability of a site from these considerations.

The safety code specifies limits on radiation dose, in form of quantitative values, to the member of public under accidental conditions such as Design Basis Accidents (DBA) and Design Extension Conditions (DEC). The dose limits specified in the safety code are in line with the emerging concept of no disturbances in public domain.

Regulatory Safety Documents published during 2014-15

- Safety Code 'Site Evaluation of Nuclear Facilities'
- Safety Guide 'Evaluation of Design Basis for External Human-induced Events for Nuclear Power Plants'
- Safety Guidelines 'Life Management of Heavy Water Plants'
- Safety Code 'Design of Light Water Reactor Based Nuclear Power Plants'
- Safety Guide 'Commissioning of Pressurized Water Reactor Based Nuclear Power Plants'
- Safety Manual 'Regulatory Inspection for Radiation Facilities'
- Safety Guidelines 'Criteria for Planning, Preparedness and Response for Nuclear or Radiological Emergency'
- Safety Guidelines 'Safety Aspects in Design and Operation of Heavy Water Plants'

> More than **150** regulatory safety documents have been published by AERB

Safety Guidelines titled "Criteria for Planning, Preparedness and Response for Nuclear or Radiological Emergency" (AERB/SG/EP-5) supersedes the AERB safety guide titled "Intervention Levels and Derived Intervention Levels for Off-Site Radiological Emergency" (AERB/SG /HS-1).

The revised Safety Guidelines provides criteria for establishing an emergency preparedness and response plan for nuclear and radiation facilities to deal with nuclear and radiological emergency. The criteria provided in this guidelines is to undertake protective actions and other response actions in precautionary action zone (PAZ), urgent protective action planning zone (UPZ), extended planning distance (EPD) and ingestion and commodities planning distance (ICPD) and replaces the existing Space-Time Domains.

It provides reference levels, generic criteria, emergency action levels, operational intervention levels including numerical values for these criteria for protective actions and other response actions in the event of a nuclear or radiological emergency. In addition to the above, it also provides guidance dose value for protection of emergency workers and the public in the event of a nuclear or radiological emergency.

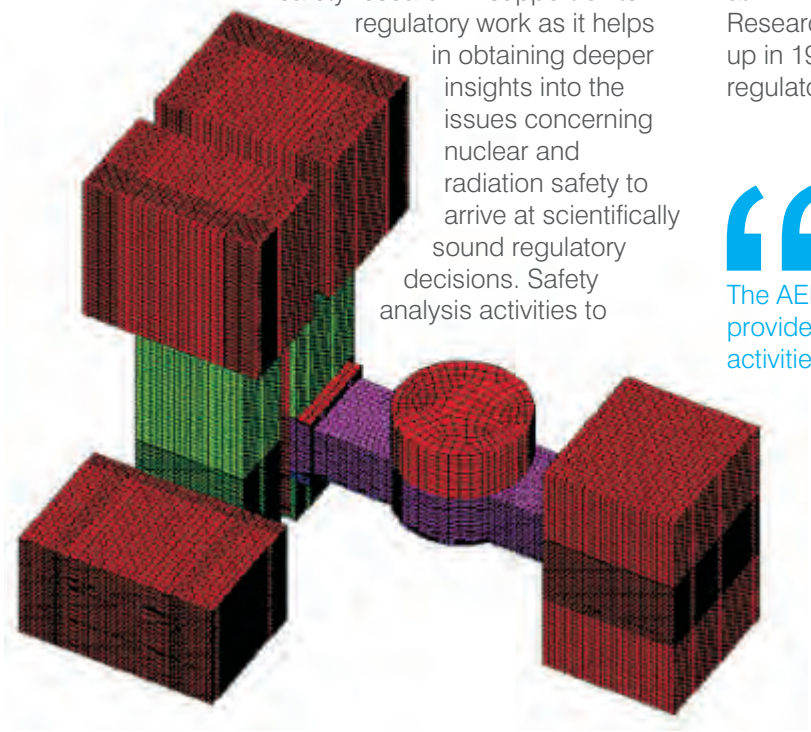
Twelve Regulatory Safety Documents were translated and published in Hindi by AERB

Experts in AERB reviewed 7 Draft Documents and 12 Document Preparation Profiles of IAEA and offered valuable suggestions to IAEA

Experimental test chamber at IIT Madras

SAFETY STUDIES & RESEARCH ACTIVITIES

AERB recognizes the importance of safety research in support of its regulatory work as it helps in obtaining deeper insights into the issues concerning nuclear and radiation safety to arrive at scientifically sound regulatory decisions. Safety analysis activities to support the regulatory decisions are being carried out at AERB headquarters in Mumbai as well as in Safety Research Institute, Kalpakkam which was primarily set up in 1999 to carry out safety research studies of regulatory interests.



IRRS Team's observation

The AERB's research and development infrastructure provides strong regulatory review and assessment activities.

Safety studies and R&D activities at SRI, Kalpakkam and Mumbai Headquarters

Several important developmental studies in the areas of severe accident analysis, hydrogen distribution & mitigation, probabilistic safety assessment, reactor physics, radiochemistry, thermal hydraulics, fire safety, seismic safety, geo-technical, structural safety assessment etc were taken up and completed during the year.

Safety studies with National & International Collaboration

AERB has been participating in several national and international collaborative problem exercises in severe accident analysis, thermal hydraulics, hazard assessment, structural integrity assessment etc.

Safety studies Funded by AERB

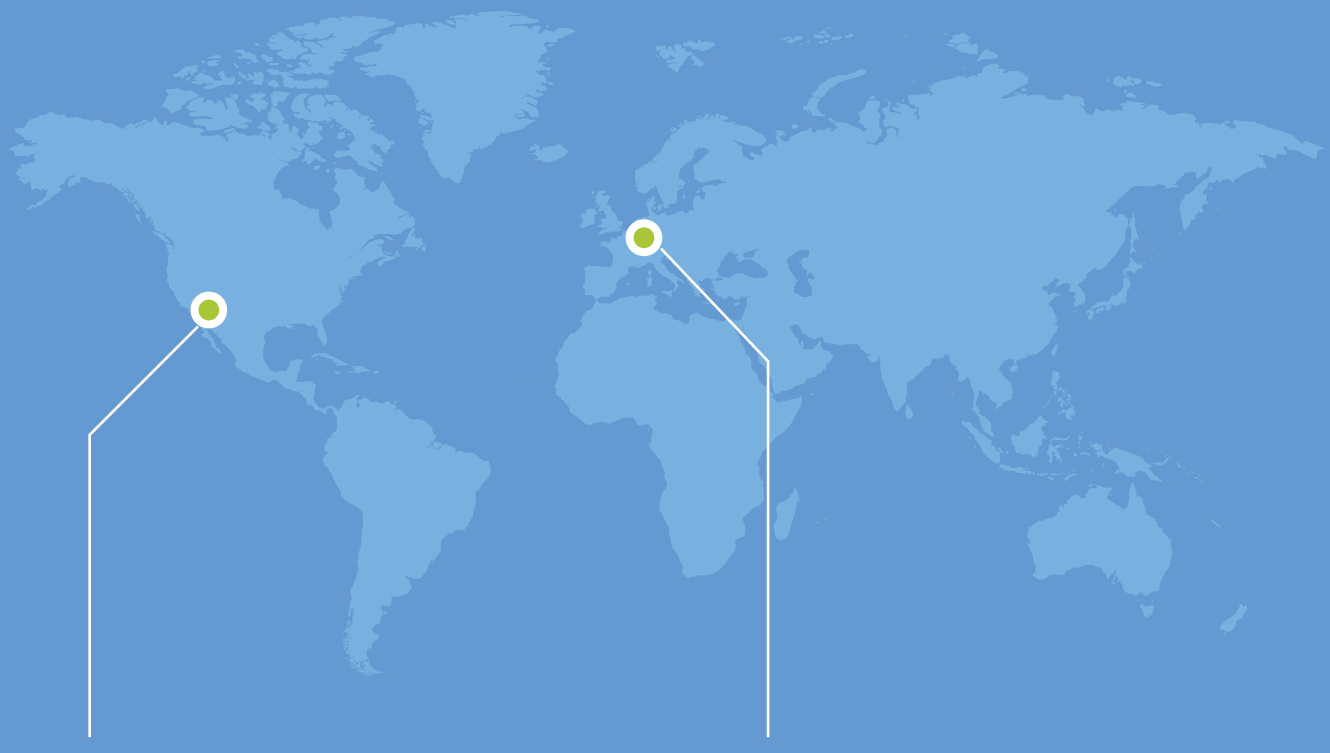
AERB continued to fund project proposals from academic and research institutions for research in nuclear and radiological safety. This year AERB sponsored 4 new research projects.

A need was felt to undertake experimental work on enclosure fires to augment the already existing numerical analysis capability and to have a comprehensive research program on fire safety. Towards this, SRI has set up a state of the art Compartment Fire Test Facility (CFTF) for basic research in enclosure fires, investigation of mitigation methodologies & techniques, and to provide inputs for regulatory activities in the area of fire safety.

Currently, pool fire experiments with hydrocarbons are being carried out.

A pool fire experiment in progress at CFTF, SRI

INTERNATIONAL CO-OPERATION



North America

US-NRC

Europe

IAEA
OECD-NEA
ASN-FRANCE
IRSN-FRANCE
CNCAN-ROMANIA
STUK-FINLAND
SNRIU-UKRAINE
ROSTECHNADZOR-RUSSIA

BILATERAL MEETING BETWEEN US-NRC AND AERB

USNRC & Indian delegation visits to North Anna Power Station, USA

As a part of continued technical cooperation, a bilateral meeting with USNRC was held during September 10-11, 2014 at Rockville, Maryland USA. The purpose of the meeting was to continue bilateral cooperation between AERB and NRC in the areas of nuclear regulatory safety, regulatory safety research including severe accident prevention and lessons learned from Fukushima nuclear accident.

ANNUAL CANDU SENIOR REGULATORS GROUP MEETING

CANDU Senior Regulators Group Meeting, Mumbai

The Annual Meeting for the year 2014 was hosted by AERB at Mumbai during November 10 - 14, 2014. The areas of common interest such as Instrumentation & Controls (I&C) aspects of CANDU reactors, source term assessment methodology, radiological impact assessment, possible measures for avoidance of long term offsite contamination etc. were discussed.

ANNUAL MEETING OF WWER REGULATORS FORUM

WWER Regulators Forum at Helsinki, Finland

The 21st Annual Meeting of WWER Forum was held during June 16 - 18, 2014 at Helsinki, Finland. Issues of nuclear and radiation safety regulation and events of safety significance that have occurred at the WWER NPPs in other countries were discussed.

DIPLOMATIC CONFERENCE OF THE CONVENTION ON NUCLEAR SAFETY

AERB was a key player in the formulation of the Vienna Declaration. the Indian Delegation extended its full support to the approval of the Declaration by consensus and highlighted the efforts it has taken to enhance safety of the nuclear power plants in India. AERB has already put in place the measures for fulfilling the obligations of The Vienna Declaration.

A five member Delegation from India led by Shri R. Bhattacharya, then Secretary, Atomic Energy Regulatory Board (AERB) represented India in the Diplomatic Conference of the Convention on Nuclear Safety (CNS), held at International Atomic Energy Agency (IAEA) in Vienna on February 9, 2015. The diplomatic conference was convened as decided by the 6th review meeting of CNS held during March-April, 2014, for considering the proposal for amendment to article 18 of the CNS. The diplomatic conference proposed to come out with the consensus formulation involving Vienna Declaration on Nuclear Safety. The Indian delegation supported the consensus on the Vienna Declaration on Nuclear Safety. The Declaration seeks to achieve significant safety enhancements in the nuclear power plants all over the world, both new as well as the existing ones. The diplomatic conference was attended by 71 member states. In its statement to the Diplomatic Conference, the Indian Delegation extended its full support to the Declaration by consensus and highlighted the efforts it has taken to enhance safety of the nuclear power plants in India.

The Vienna Declaration calls for enhancements in the design, siting and construction of nuclear power plants, with the objectives of preventing accidents as well as mitigating possible radioactivity releases, should an accident occur and avoiding early and large radioactivity releases. It also calls for systematic and periodic safety assessments of existing plants, throughout its lifetime, for implementing reasonably practicable safety enhancements. These principles are being integrated in the review process of the CNS with immediate effect, with the requirement of reporting on the measures by the individual Contracting Parties and its peer review, from the next CNS Review Meeting in 2017.

This declaration came on the back of extensive discussions extending over many weeks and months, among the Contracting Parties of the CNS, on the issue of voting on a proposal for change in the text of CNS vis-à-vis a consensus. Right from the time the proposal for amending the text of the CNS was mooted, India has been expressing the view that the CNS processes have enough in-built mechanisms to keep the Convention up to date and contemporary without necessarily going in for any amendment to the text of the Convention. In fact soon after the 2nd Extraordinary Meeting of CNS in 2012, AERB has started the work of reviewing the regulatory requirements for the nuclear power plants, in the light of the lessons from the Fukushima accident. The new Codes issued recently by AERB, on 'Siting of Nuclear Facilities' and 'Design of LWR based NPPs' incorporate the requirements arising out of the lessons learned from the Fukushima accident. The regulatory practices of AERB, with the enhanced safety requirements would help enormously in addressing the objectives of the present Vienna Declaration on Nuclear Safety.

SAFETY PROMOTIONAL EVENTS & ACTIVITIES

DAE Safety & Occupational Health Professionals Meet

AERB organizes DAE Safety and Occupational Health Professionals Meet every year which provides a platform to the safety professionals of DAE for sharing of experiences on safety related matters.

Awareness Programs For Stakeholders

AERB conducts radiation safety awareness programs to a wide target audience for dissemination of information's to prevent radioactive contamination in metal recycle industries, security of radioactive material at radiation facilities and during transport etc. This year AERB conducted 6 such awareness programmes.

Theme meetings

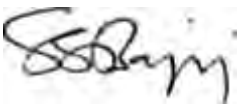
During the process of regulatory review, several important topics emerged out which require consultation with the experts in order to have a better understanding of the subject. AERB organises theme specific discussion meet wherein experts, representatives from utilities and concerned officials from AERB participates. Two theme meetings were conducted this year.

The 31st Meet was jointly organized by Atomic Energy Regulatory Board, Mumbai and BHAVINI at Kalpakkam, Tamilnadu during October 15-17, 2014. The themes for the meet were "safety & Emergency Management At Coastal Sites and Diabetes Mellitus & Metabolic Syndromes". A monograph on these themes was released during the meet.

Dr. Baldev Raj, Director, National Institute of Advanced Science, Bengaluru & Former Director, IGCAR, Kalpakkam delivered the Dr. S.S. Ramaswamy Memorial Endowment Lecture on "Tsunami Management at Kalpakkam Nuclear Site.

"

AERB is neither for nuclear power nor against it; or for that matter for any other application of nuclear energy or radiation application. As a regulator, AERB's mandate is to ensure that activities involving ionising radiation are conducted safely.



S. S. Bajaj
Former Chairman, AERB

AERB for the first time in several years organized 'Health Physics Professional Meet' in similar lines with ongoing Industrial Safety Professionals Meet

Considering the crucial role of health physicist and to familiarize them with ongoing development in radiation protection, AERB organized a one day 'Health Physics Professional Meet' on November 20, 2014 in Mumbai. The objective of the meet was to achieve high standards in radiological safety by constantly perusing techniques, update & enrich the knowledge and create opportunities for continual improvement.

AERB Safety Awards

AERB has instituted three Annual safety award schemes. These are Industrial Safety Award, Fire Safety Award and Environment Protection Award. The required data for these awards is collected in standard format every year from all the DAE units for assessment purpose. The committee with members from NPCIL, HWB, BARC, IRE, NFC etc. decides the winner units for these awards based on assessment of data provided by various units.

The Industrial Safety Award scheme was started in 1991. The Fire Safety Award scheme was started in 1992. The Environment Protection Award scheme was started since 2011 in place of Green Site Award scheme of AERB. The Green Site Award scheme was started in 1993 by AERB.

Safety Award Winners for 2014

Industrial Safety Award:
NAPS and MAPS (production group-I)
ZC Tamilnadu & IREL Udyogamandal in Kerala (production group-II)

Fire Safety Award:
KGS 1&2 (high risk group)

Environment Protection Award:
NAPS & IRE-OSCOM (operating units and mines group)
RAPP 7&8 (projects & under development mines group)

Indian Science Congress

DAE Safety and Occupational Health Professionals Meet

India Nuclear Energy Expo

ISMAA Conference

Indo-Japan IJAA Conference

ANNUAL REPORT
Once every year.

AERB BULLETIN
Once every year.

NEWSLETTERS
Once in every six months.

PRESS RELEASES
Six press releases issued.

PARLIAMENT QUERIES
Fifty one Parliament questions received & replied.

RTI
104 RTI queries answered.

PRESS CONFERENCE
One press briefing held.

WEBSITE
Periodical updates.

EXHIBITIONS

PUBLIC COMMUNICATION & OUTREACH

AERB has been maintaining a website with all relevant and updated information, issuing press releases on contemporary issues, publishing Annual Reports and newsletters once in every six months. These contain information on various activities carried out by AERB as well as the nuclear and radiological safety status of regulated plants and activities. AERB continued its recent initiative of publishing AERB Bulletin, which is the popular version of Annual report.

AERB enhanced its participation in science and technology fairs and displayed exhibits to create awareness among the school and college children and general public on the nitty-gritty of nuclear and radiation safety aspects, the robustness of regulatory regime followed by AERB and the basis of regulatory decision making process. These interactions have been very encouraging and helped in dispelling several myths about the regulatory set up and framework.

AERB organized a press briefing on March 31, 2015 soon after the conclusion of the Integrated Regulatory Review Service (IRRS) mission of the International Atomic Energy Agency (IAEA) to AERB, the first international peer review it hosted. The media was appraised of the highlights of IRRS Mission, its findings and its relevance for AERB by Shri S. S. Bajaj, Chairman, AERB. During the press meet, Chairman, AERB responded to a number of questions posted by the journalists.

Press briefing at AERB, Mumbai after IRRS Mission

Team Leader Mr. Ramzi Jammal handing over draft IRRS Mission Report to Shri S.S. Bajaj, Chairman AERB

SPECIAL FEATURE: IRRS MISSION TO INDIA

"The IRRS team is satisfied with the practice of founding regulatory decisions on well-established and communicated regulatory documents coupled with the multi-tier safety review. This ensures that AERB's regulatory control maintains the necessary reliability and consistency in its approach and implementation. The multi-tier safety committee approach, management controls and adherence to procedure with the regulatory body's operating sections ensure the quality of the decision-making process and helps avoid inconsistencies."

Integrated Regulatory Review Service (IRRS) mission of IAEA is an international peer review carried out by a team having domain experts from all over the world which aims to benchmark a country's legal and regulatory framework for nuclear and radiation safety against the globally accepted IAEA safety standards.

Government of India made a formal invitation for hosting the 'Integrated Regulatory Review Service' (IRRS) mission in January 2014 with respect to regulation of Nuclear Power Plants.

The first and most significant prerequisite of the mission was to carry out a self-assessment of the country's legal and regulatory framework vis-à-vis IAEA's elaborate questionnaires. The responses to these questionnaires went through a very elaborate quality check by way of review and harmonization, analysis of the responses under the supervision of an apex committee of AERB. Final submission made to IAEA comprised of some 1000 odd pages.

The twelve day long IRRS mission was conducted during March 16-27, 2015 by a team consisting of 18 members. During the mission, the team reviewed and verified the submissions through interactions with the officials and senior management of AERB as well as examination of documents. The Mission also interacted with the Chiefs of AEC, BARC and NPCIL. A few team members witnessed conduct of AERB's regulatory inspection of Kakrapar Atomic Power Station.

The team concluded that AERB is an experienced, knowledgeable and dedicated regulatory body for the protection of the public and the environment. It continues to enhance its regulatory programme to face the current and future challenges in regulating nuclear safety, such as reinforcing the safety of existing nuclear facilities, monitoring ageing and decommissioning, as well as providing oversight of the construction, commissioning and operation of new nuclear power plants.

The team identified several good practices related to competence of the personnel, the recruitment and training of personnel, operating experience feedback, research and development infrastructure related to regulatory activities and the use of systematic database for tacking the recommendations from emergency exercises. The team also identified few areas for improvement such as embedding in law the regulatory independence of AERB, governmental policy on safety and strategy for waste management, enhancing the frequency of routine on-site inspections of NPPs, development and implementation of its own internal emergency arrangements.

A press briefing was arranged on March 31, 2015 in AERB to brief the media about the outcome of the IRRS Mission.

IRRS Mission team members - AERB officials during Exit Meeting

SPECIAL FEATURE: SKOCH SMART GOVERNANCE AWARD FOR E-LORA

Skoch Smart Governance Award is an initiative recognising top performing government organisations and organisations working with the government, operating at local, state and national level in the area of Health, Education, Rural Development/Panchayati Raj, Urban Development, Finance, and Security. It is a step towards recognising the best practices and models of governance for excellent and efficient implementation of programmes and services delivery.

AERB received prestigious SKOCH Smart Governance Award - 2015 for successful implementation of state-of-art e-licensing Radiation Applications (eLORA) in the country at 41st SKOCH summit on Transformative Governance hosted at Indian Habitat Centre, Delhi during 22-23 September, 2015. After a rigorous evaluation process about 300 Government implemented projects were shortlisted for the SKOCH Order of Merit Award - 2015 and out of them, 30 projects were selected for the SKOCH Smart Governance Award - 2015 and eLORA is one among them.

eLORA is a major initiative taken by AERB for computerisation of regulatory processes associated with the use of ionising radiation in India. e-LORA system is built on web based technology to ensure its accessibility to the stakeholders through internet. The objective is to ensure that procedures for application submission by the utility and application processing by AERB are simplified and fast. The other objective is to achieve higher efficiency and provide enhanced transparency in its exchanges with the stakeholders.

The success of eLORA can be gauged by the following facts:

- More than 9,000 institutes are registered in eLORA.
- More than 10,000 radiation professionals are registered in eLORA.
- The major achievement of eLORA is in the regulatory activities of diagnostic X-rays where in just a period 1.5 years, more than 21,000 x-ray equipments are declared through the system and more than 12,500 equipments are already licensed. (Before eLORA, only about 5,000 licenses were given for X-ray equipment in around 10 years).
- eLORA has a database of over 24,000 employees working in radiation facilities and it is utilized for spreading safety awareness.

AERB officials receiving SKOCH Smart Governance Award

www.aerb.gov.in

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