



AERB

Newsletter

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ATOMIC ENERGY REGULATORY BOARD

Mission: The mission of Atomic Energy Regulatory Board is to ensure that the use of ionizing radiation and nuclear energy in India does not cause unacceptable impact on the health of workers and the members of the public and on the environment.

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From the Chairman's Desk

Season's Greetings to all our Readers! In the aftermath of Fukushima accident, the world's Nuclear Power Plants are being subject to re-evaluation of their safety. Focus is on ensuring that the designs are adequate to safely withstand external events like earthquakes and floods and that even if the magnitude of these events exceed the design basis values there are adequate margins and provisions to ensure safety. India has also undertaken a similar rigorous evaluation of its nuclear power plants and concluded that the prevailing siting and design practices of NPPs ensure adequate safety against anticipated external events. The periodic safety review and resulting upgradation of plant safety systems and operation by highly qualified operators have further ensured continuing safety.



While this outcome reinforces confidence in the Indian nuclear power program, further enhancement in safety by way of additional safety provisions have been proposed. Summary of the recommendations and conclusions of the AERB high level committee constituted in the wake of Fukushima accident is included in the current issue.

The accident at Fukushima has also brought to the fore, the global commitment to enhance safety of nuclear power. In this regard, AERB participated in various interactions organized by International Atomic Energy Agency (IAEA) and Nuclear Energy Agency (NEA) of OECD as well as with other regulatory bodies such as United States Nuclear Regulatory Commission (USNRC), and Korea Institute of Nuclear Safety (KINS). India is also likely to soon become a member of an expert network of different regulatory bodies of the world, the Multinational Design Evaluation Programme (MDEP). For AERB, MDEP could be a helpful platform to share knowledge and review experience with other regulators.

Another important area that needs to be addressed is assuaging the public fears and misgivings regarding nuclear power. It is becoming increasingly clear that public is an important stakeholder and their confidence must be gained right from the start and not just during a crisis situation. The importance of confidence-building, emergency preparedness planning and emergency exercises in the public domain was amply demonstrated in the prompt evacuation of public in the vicinity of Fukushima. Because of the planned manner of evacuation, there were neither deaths due to radiation nor incidents of radiation sickness amongst the members of public.

In this context, AERB organised a discussion meet on "Review of Off-site Emergency Preparedness and Response Plan of Indian NPPs based on Experience of Fukushima Nuclear Accident" where in senior officials from NPCIL, National Disaster Management Authority, BARC and AERB interacted and discussed action plans to improve the emergency preparedness in the public domain. As a part of safety promotional activities, the 28th DAE Safety and Occupational Health Professionals Meet for the year 2011 was held on November 24-26, 2011 in Bhubaneswar and the AERB Green site awards were distributed. A report is included in this Newsletter.

Towards effective regulation of medical diagnostic X-ray installations in India, AERB issued the necessary authorization and delegation of power to Radiation Safety Agency, Mizoram, on October 12, 2011, along the lines of Kerala Directorate of Radiation Safety.

AERB accredits Low Level Counting Laboratories to carry out radionuclide measurement in packaged drinking water and commodities (mineral, ore, food, soil, sediment and water) and to issue the requisite certificate. The Environment Assessment Division of BARC, Mumbai and the Radio-Ecology Laboratory, University Science Instrumentation Centre, Mangalore University are two laboratories accredited in this period.

This issue of Newsletter has also an interesting article on "Use of Mobiles for Scientific Applications".

(S. S. Bajaj)

AERB Board Meeting

The 105th meeting of the Board of AERB was held on September 9, 2011. Chairman, AERB accorded warm welcome to the new members of the Board, Prof Devang V. Khakhar, Director, Indian Institute of Technology, Bombay and Prof. Harsh Gupta, Raja Ramanna Fellow at National Geophysical Research Institute, Hyderabad.

Shri R. Bhattacharya, Secretary, AERB presented to the new members of the Board, responsibilities and functions of AERB. Shri S. K. Chande, Chairman, SARCOP briefed the Board about the operational safety review, significant events and major highlights during the last six months of various DAE Units. Specifically, this included renewal of licenses, with limited validity, for MAPS 1&2 and TAPS 1&2.

The Board members were updated on the Fukushima accident and measures taken by AERB and NPCIL in its wake. The recommendations and conclusions of high level committee, set up by AERB to review safety of Indian NPPs, were put forth to the members. Board noted that key aspects of the review of AERB constituted high level committee were: a) assessment of the available margins and b) measures required for strengthening of the defenses to deal with external / natural events of magnitudes beyond the design basis. The Board also noted that as per the observations of this committee, PHWR based NPPs in India, have inherent strengths to deal with natural events and their consequences and the Periodic Safety Reviews by AERB have substantially enhanced the safety of the nuclear power plants including capability to withstand natural events.

Apart from this, AERB had carried out special inspections of TAPS-1&2, RAPS-1&2, RAPS-3&4, RAPS-5&6, with a check-list incorporating all requirements with the background of Fukushima accident. AERB also participated in the emergency preparedness workshops and off-site emergency exercises organized by National Disaster Management Authority (NDMA) at all the Nuclear Power Plants. AERB also coordinated the training program for National Disaster Response Force at NPPs.

Board was informed that NPCIL had also carried preliminary safety assessments by all NPPs and identified areas for further improvements while assuring of the adequate safety margin against flood.

Board appreciated the efforts made by AERB and NPCIL to assess the safety of Indian NPPs against external events and expressed the need for expediting actions for implementation of the provisions identified for strengthening the safety of NPPs, in a time bound manner.

Regulatory Inspections (July - December 2011)

Unit	No. of Inspection conducted
Nuclear Projects	
RAPP-7&8, DFRP, FRFCF	1 each
PFBR, KAPP-3&4, IFSB	2 each
Nuclear Facilities	
MAPS, IGCAR-CORAL/FRTG, RAPS-3&4, KGS-1&2, KGS-3&4, KAPS, TAPS-1&2, TAPS-3&4, RAPS-5&6 RAPS-1&2	1 each
Nuclear Fuel Cycle Facilities	
AMD - West zone, South zone, Central zone, South-Central zone, IRE -Udyogamandal, OSCOM, HWP-Hazira, Baroda, Kota, Thal, Manuguru, NFC- Hyderabad, UCIL-Jaduguda, Gogi	1 each
VECC, RRCAT	1 each
ECIL, ZC- Pazhyakayal	2 each
Non -DAE Beach Sand Mineral & NORM Facilities	4
Special Inspections	
MAPS, RAPS-3&4, KGS-1&2, KGS-3&4, NAPS, KAPS, RAPS-1&2, RAPS-5 & 6	1 each
KKNPP 1&2, RAPP 7&8, KAPP 3&4, PFBR, DFRP UCIL-Tummalapalle, VECC-Medical Cyclotron (Special inspections on Industrial Safety)	27
Industrial Radiation Facilities	
Industrial facilities (Industrial Radiography, Nucleonic Gauges WL and SS)	113
Gamma chamber facilities	4
Gamma Irradiators	6
Medical Radiation Facilities	
Nuclear Medicine	23
Diagnostic X-rays	72
Radiotherapy Facilities	98

Licences / Authorisations Issued (July - December 2011)

- Consent for Siting of Uranium Ore Processing Plant and Tailings Management Facilities of UCIL at Gogi, District, Yadgir, Karnataka (March 31, 2011).
- Consent for Construction of Tummalapalle Tailings Pond and Tailings Dam including check dam of UCIL (March 31, 2011).
- Licence for enhancement of uranium ore production capacity from 2400 TPD to 3500 TPD at Banduhurang mine of Uranium Corporation of India Limited (UCIL) (July 8, 2011).
- License for Operation of Tri-Butyl Phosphate Facility at Heavy Water Plant, Baroda (July 8, 2011).
- Consent for Siting & Construction of Versatile Solvent Synthesis Pilot Plant (VSSP) at HWP (Tuticorin) (July 8, 2011).
- Clearance for First Pour of Concrete for Rajasthan Atomic Power Project-7&8 (July 16, 2011).
- License renewal of Tarapur Atomic Power Station 1&2 and MAPS 1&2 (July 25, 2011).

Human Resource Development

AERB Training Activity

After the successful completion of Orientation Course for Regulatory Processes (OCR - 2011) at AERB, Mumbai, OCRP-SRI-2011 was conducted at SRI, Kalpakkam during June 23 to August 8, 2011. Forty-seven participants from various DAE units (SRI, IGCAR, BARC, MAPS and BHAVINI) attended the training programme. In-house Faculty delivered a series of 42 lectures in the Course. Seven examinations were conducted. The lectures were delivered on Thursdays and Fridays and examinations were conducted on following Mondays. The topics included: Functions and Responsibilities of AERB, Regulatory Inspections of NPPs, Reactor Concepts and Systems, Accident Analysis, Basic & Operational Reactor Physics, Radiological Safety, Operational Health Physics, Industrial Plant Safety Topics, Atomic Energy Act and Rules, Environment Protection Act and Rules, Civil Engineering Safety Aspects, Nuclear Security, QA Requirements of NPPs, Operation Experience Feedback (OEF) and Event Reporting. The feedback was obtained and participants were appreciative of the Course. A valedictory function was organised on January 2, 2012 in which Chairman, AERB distributed certificates to successful Participants.

Training Programme on "Effective Communication"

A two day training programme on "Effective Communication" by Smt. Malvika Mookherjee, management faculty, professional corporate trainer and image consultant was organized in Niyamak Bhavan-B, AERB during October 14-15, 2011. The programme was inaugurated by Shri R. Bhattacharya and twenty-five AERB participants attended the programme.



AERB trainees at the "Effective Communication" training programme.

Safety Research Programme

Safety Research Programme (SRP)

The forty-eighth meeting of Committee for Safety Research Programmes (CSR) was held at SRI, Kalpakkam in the presence of AERB project co-ordinators and principal investigators, to review the progress of on-going projects, and consider funding new project proposals. The Committee approved three new project proposals, recommended revision for five new project proposals, renewed three on-going projects and approved funding of one seminar.

Table 1: New Projects Sanctioned

Sr. No.	Project Title	Principal Investigator / Organisation	Principal Coordinators / Collaborators
1.	Non-contact strain measurement of Zircaloy using digital image correlation (DIC) under high temperature ambience	Dr. M. Ramji, IIT-Hyderabad, Hyderabad	Smt. Ritu Singh, SADD, AERB and Shri V. V. Reddy, RS&A Directorate, NPCIL
2.	Seismic fragility of the primary containment considering structural integrity and leakage through the damaged containment	Dr. Siddhartha Ghosh, IIT-Bombay, Mumbai	Shri Ajai S. Pisharady, SSED, AERB and Shri G. Srinivas, RSAD, NPCIL

Table 2: Renewal of On-going Projects

Sr. No.	Project Title	Principal Investigator / Organization	Principal Coordinators
1.	Microbial biofilm formation and corrosion of firewater pipelines in NPPs	Prof. K. Prashanth Pondicherry University	Dr. T.S. Rao, IGCAR and Dr. P. Muraleedharan, IGCAR
2.	Studies of the transport of Hydrogen-Air-Steam Mixture within a confinement	Dr. S. K. Das, IIT-Madras, Chennai	Shri Nilesh Agarwal, SRI-AERB
3.	Evaluation of burst criterion of Zircaloy Clad	Dr. Mohd. Kaleem Khan, IIT-Patna	Smt. Ritu Singh, SADD, AERB

AERB Colloquium

An AERB colloquium was organized on 'Integrated Decision-Making Using INSAG-25, US Safety Goals' by Shri Ashok Thadani, Chairman, Scientific Committee of the French Nuclear Safety Authority, ASN and Senior Advisor, US-NRC during the period on July 18, 2011. During presentation, Shri Thadani described the value of safety goals in integrated risk-informed safety decisions from US perspective and also discussed on the views of an international ad hoc group on actions that should be considered as a result of the nuclear accident at Fukushima Daiichi.

AERB Theme Meeting

A theme meeting on 'Status of LWR Analysis' was organized on November 22, 2011 in AERB. The meeting contained talks on reactor physics codes and thermal hydraulics coupling codes developed in BARC, NPC and AERB.



Participants from BARC, NPC and AERB at the theme meeting on 'Status of LWR Analysis'



Dignitaries at the theme meeting on 'Status of LWR Analysis'

Shri S. S. Bajaj, Chairman, AERB in his inaugural address expressed that it is an opportune time for experts from AERB, BARC, NPC, SRI-AERB and IGCAR to come to a common platform for (a) reactor physics code development and analysis of Light Water Reactors (b) exchange of expertise in validation and benchmarking exercises

on these codes, (c) steady state lattice and core physics analysis of VVER and (d) operational reactor physics aspects of Kudankulam.

Nuclear Medicine Conference

Chairman, AERB inaugurated the 43rd Annual Conference of Society of Nuclear Medicine, held at Chennai, from December 8-12, 2011. In his inaugural speech; Chairman AERB observed that the last decade has witnessed tremendous advancements in the field of Nuclear Medicine. While the 170 Nuclear medicine centers in the country are effectively regulated by AERB with regard to occupational worker, public and environment, more needs to be done with regard to patient safety.



Shri S. S. Bajaj, Chairman, AERB at the 43rd Annual Conference of Society of Nuclear Medicine

Chairman, AERB expressed that AERB participates in the over-all Quality Management Systems of a nuclear medicine centre by carrying out pre-commissioning inspections, performance checks of radiation-specific equipments used at the centre, verifying protocols of emergency preparedness and periodic interactions with the institute's Local Safety Committee.

Chairman AERB further expressed that as the Local Safety committee is the ideal interface between the regulatory body and the institute, with an established incident reporting system, the scope of this incident reporting system should be enhanced to include incidents of misadministration (i.e. incorrect radiopharmaceutical, patient, anatomy or procedure) if any. The Society of Nuclear Medicines can play a very important role in setting up a national level 'incident reporting system' with objective of OEF (Operation Experience Feedback) for corrective actions and improving procedures to avoid recurrence of incidents.

Chairman AERB informed the audience about the recently issued revision of the AERB Safety Code on Nuclear Medicine Facilities (AERB/RF-MED/SC-2 (Rev. 2), 2011, which includes the latest developments in the field. Chairman also informed that AERB is in the process of installing a state-of-the-art web-based computerized system where in consenting applications of all the radiation facilities would be processed faster and more effectively.

One Day Awareness Programme on Radioactive Contamination in Steel Products for the Steel Manufacturers/Suppliers in the Delhi Region

In continuation of series of awareness programmes, which are part of various preventive measures taken up by AERB, a one-day awareness programme on radioactive contamination in steel products for the steel manufacturers/suppliers in the Delhi region was conducted on September 23, 2011 in New Delhi. The participants representing major steel manufacturers/suppliers attended the programme. The programme had a series of lectures by AERB officials on 'Radioactive Contamination in Steel Products - An Overview', 'Effective Monitoring for Detection of Radioactive Contamination in Scrap Metal and Steel Products; and Emergency Management' followed by presentations from Metal Recycling Association of India and steel manufacturing companies. This was followed by feed-back session and discussions.

One Day Awareness Programme on Safe Handling of Packages containing Radioactive Material at the Airport

AERB received the feedback from earlier such forums that for most of the cargo handling staff of airlines operating in India have fears of risk involved in handling packages containing radioactive material.

In view of the above a one day awareness programme to allay the fear in handling packages containing radioactive material was conducted on November 9, 2011 at Import Cargo Terminal, Indira Gandhi International Airport, New Delhi, for about 30 representatives from the airlines (carrying class 7 cargo), freight forwarders, cargo handlers etc. The programme was arranged in association with M/s Celebi Delhi Cargo Terminal Management India Pvt. Ltd., New Delhi.

The key note address was delivered by a senior official from AERB and the faculty comprised of officers from AERB and Director General of Civil Aviation (DGCA). The Chief Dangerous Goods Instructor was the faculty from DGCA. The programme comprised of lectures on safe transport of radioactive material relevant to the shippers and carriers, radiation protection techniques, standards and dose limits, procedures for accepting the consignment containing radioactive material in line with IATA Dangerous Goods Regulations (DGR), firsthand experience on regulating transport of radioactive material by air and a short video film on the safe transport of radioactive material by air. The attempt proved fruitful with active participation of the members in the feedback session and discussions.

Awareness programs in Diagnostic Radiology

The extensive use of Diagnostic Radiology equipment, with minimal awareness about the radiation safety and AERB regulatory requirements involved in its use has prompted AERB to conduct/participate in awareness programs, across a spectrum of stake holders. The programs familiarize the participants with the

requirements of The AERB Safety Code on Medical Diagnostic X-ray equipment and Installations (AERB/SC/Med-2 (Rev-1), 2001). The AERB safety code addresses mandatory requirements for (a) Manufacturers of X-ray equipment to ensure safety in design, (b) Suppliers of X-ray equipment to ensure radiation safety in installation, maintenance and periodic Quality Assurance tests, (c) utilities owning the X-ray installations, to obtain Licence/Registration for operation of X-ray facility and (d) Safety precautions to be implemented by the utility for general public.

An important role is played by the X-ray radiographers/X-ray technologists in ensuring safety in operation of the equipment. They also need to keep themselves updated with the latest protocols available with the newer versions of diagnostic X-ray equipment, to ensure minimal dose to patient with maximum diagnostic information. AERB members re-emphasize radiation safety in all forums of radiographers, such that radiation safety is ingrained in the day to day functioning of radiographers.

The various programs, in which AERB members participated from July 2011-December 2011, are as follows:

- i) Symposium on Radiation Safety in Computed Tomography & Diagnostic Radiology held at Tata memorial hospital, Parel, Mumbai on July 31, 2011. The program was attended by 150 Radiologists, X-ray technologists, manufacturers of X-ray equipment, and services engineer. Dr. A. U. Sonawane, RSD, AERB and the other speakers from AERB were the faculty members. The highlights included regulatory requirements and Radiation safety aspects in advanced technologies such as Computed Tomography.
- ii) National Conference of Society of Indian Radiographers (SIR) - A newer solution in Radiological Technology for 21st century was held at Goa during November 5-6, 2011. The program was attended by 700 radiologists, non-radiological physicians, X-ray technologists, manufacturers/suppliers of X-ray equipment and service engineers. Dr. A. U. Sonawane and the speakers from AERB delivered lectures on regulatory requirements, a special lecture on responsibilities of Radiation Safety Officer (RSO) in the diagnostic Installations and presentations on current technologies such as digital imaging



Dr. A. U. Sonawane at the National Conference of Society of Indian Radiographers (SIR).

Colloquium / Theme Meeting / Awareness Programmes

technology, recent advances in reduction of patient doses in CT scanning, radiation safety, 3D-CT interventional radiology, etc.

- iii) Workshop on radiation safety in Diagnostic Radiology practice was held at Northern Coalfields Limited, Nehru Shatabdi Chikitsalaya, Singrauli, Madhya Pradesh on November 20, 2011 and was attended by thirty X-ray technologists of different subsidiary of Coal India Limited and nearby hospitals. The speakers included senior officers from AERB. The highlights included an invited Talk on clinical aspects of diagnostic radiology by Dr. Prakash of NTPC, Shakthinagar. A Panel discussion with AERB members was conducted, where in various queries by X-ray technologists regarding safety aspects and risk associated with operation of diagnostic X-ray equipments were addressed.

Awareness programs in Industrial Radiation Facilities

Radioactive sources are used extensively in industry for various purposes such as Radiography, as Gauges, for Oil well logging etc. With increasing use of radioactive sources in the country, the concern about safety and security of radioactive sources is also growing. Hence, AERB ensures stringent regulatory control over the handling of the sources and their security aspects.

Apart from Regulatory control, AERB carries out periodic awareness programs to refresh the safe operating practices amongst the operators in various industrial practices using radioactive sources. The participants are apprised of different regulatory issues pertaining to safety of various Categories of sources such as a) Source inventory management b) Review of existing inventory c) Safety and security of radiation sources d) Disposal of disused sources.

The awareness programs include presentations on various topics such as applications of radiation sources; basic working principle

and types of equipment; radiological safety, security, regulatory aspects, radiation hazard evaluation & control and biological effects of radiation.

The various programs, in which AERB members conducted / participated from July 2011 - December 2011 and are as follows:

- i) Safety & Security of industrial radiography sources at IOCL, Paradip conducted by AERB on 18th November 2011. This program was conducted as a follow up action to avoid recurrence of loss of source incident that occurred on October 10, 2011, at M/s Indian Oil Corporation Ltd. (IOCL) site at Paradip, Orissa. Earlier, AERB was informed of the theft of Industrial Gamma Radiography Exposure Device (IGRED) containing about 3.1 TBq (84 Ci) ¹⁹²Ir radiography source belonging to one of the industrial radiography agency. The program was attended by 107 participants belonging to thirty contract awarding parties apart from all the radiography agencies working at IOCL, Paradip. The participants comprised of Regional Construction Managers, QA/QC Managers, Engineers and Projects Managers. AERB officials acted as faculty for the above programme.
- ii) Safety and Security of Industrial radiography Source held at BPCL, Kochi on July 22-23, 2011. Seventy officers from various departments and security officers of M/s BPCL, Kochi attended the programme. AERB officials played key roles as faculty for the above programme.

Safety Aspects in handling of Nucleonic Gauges and Industrial Radiography Practices held at M/s KIOCL, Mangalore on July 21, 2011. Thirty-five officers from various departments attended the programme. AERB officials played key roles as faculty for the above programme.

Press Releases

In this reporting period, five press releases were issued:

July 21, 2011	Granting Clearance for Starting of Construction of two more Nuclear Power Plants AERB grants clearance of 'First Pour of Concrete' for Rajasthan Atomic Power Station (RAPP 7&8) of 700MW (e) design.
August 10, 2011	Radiation Safety Concerns at Lok Nayak Hospital, Delhi. Issued in response to a news item in the press regarding "unsafe practices" in handling radioactive material at this hospital
September 5, 2011	Report of AERB Committee to Review Safety of Indian Nuclear Power Plants against External Events of Natural Origin.
November 17, 2011	USNRC Delegation visits India The USNRC team, led by Chairman USNRC visited India during November 12-18, 2011 to discuss on regulatory aspects related to Fukushima accident, with Chairman AERB amongst other visits.
December 9, 2011	Incident of Fire at Advanced Medicare and Research Institute (AMRI) & Hospital, Kolkata - Radiological Status: This was to inform the public that there was no radiological safety concern due to the fire at the hospital because of the Brachytherapy unit (housing a radioactive source).

The details of these press releases are available at the AERB's official website (<http://www.aerb.gov.in/cgi-bin/prsrel/prsrel.asp>).

AERB-NEA Meeting



Senior AERB officials and NEA delegates at the AERB-NEA meeting.

A meeting was held between Nuclear Energy Agency (NEA) officials, Mr. Luis E. Echavarri, Director-General, OECD and Mr. Javier Reig, Head Nuclear Safety Division, OECD and AERB officials in AERB on November 4, 2011.

Presentations were made by AERB officials on topics such as "Immediate Actions by AERB - Post-Fukushima" and "Highlights on Recent Regulatory Activities and Indian Participation to NEA". General concern was regarding the availability of operating staff in multi-unit sites to simultaneously handle emergency situations in different units, which is a challenge. AERB explained that in India, the operating staffs are identified for each twin unit. Emergency operating procedures, are in place with defined roles for the operating personnel of the second unit, should there be any emergency in one of the twin units.

Mr. Echavarri informed that NEA has expressed its interest in opening new areas of cooperation. In this connection, actions to make India a full member of Multinational Design Evaluation Programme (MDEP) are in progress. Mr. Echavarri further informed that a VVER design specific group could then be formed with Russia, China, India, Vietnam and Turkey. India could also join the already existing EPR and AP1000 design groups. Mr. Echavarri invited Chairman, AERB to attend the MDEP policy group meeting which is scheduled early next year in Paris.

NEA invited AERB's participation on activities of its different committees, in addition to Committee for Nuclear Regulatory Activities (CNRA) in which AERB is participating presently. NEA also invited Indian participation in joint research projects. Mr. Echavarri expressed that AERB's participation has been excellent during the previous years and emphasized on the active participation of AERB. The meeting concluded with re-affirming co-operation between the two organisations.

AERB-USNRC meeting

A meeting was held between AERB officials and USNRC delegation on November 15, 2011 in AERB. The USNRC team was led by Mr. Gregory B. Jaczko, Chairman USNRC. A series of presentations were made by AERB officials on topics such as "Nuclear Safety Regulation in India", "Post Fukushima Actions" and "AERB-NRC Nuclear Safety Co-operation". It was conveyed that post Fukushima accident, AERB setup a high level committee to take a more

comprehensive review of capability of Indian NPPs to deal with external events of severe magnitude within and beyond design basis. While noting inherent strengths of the design, practices and regulation followed in India, further enhancements or re-confirmation in safety have been recommended in a few areas like capability to cope with Station Black Out (SBO) or loss of heat sink for extended duration, hydrogen management, availability of key parameters for monitoring even under most extreme condition, severe accident management guidelines (SAMGs), up-gradation of Emergency Operating Procedures / SAMGs, Emergency planning in public domain, etc.



Senior AERB officials and USNRC delegates at the AERB-USNRC meeting

Chairman, USNRC explained that in NRC also, post-Fukushima review has revealed strengthening a few areas viz. Seismic design basis, Re-evaluation of NPPs for seismic and Tsunamis every ten years, make up of coolant to Reactor core and SFSB, more operating procedures to cover additional scenarios like dealing with containment damage in case of explosion, etc., Emergency preparedness and staffing requirement to deal with multi unit problems, etc. He informed that all the upgrades recommended post Fukushima would be implemented in a time span of 5 years.

With regard to AERB-USNRC bilateral agreement, Chairman AERB informed that the draft agreement is under review. The meeting concluded with re-affirming co-operation between the two organizations.

Discussion Meeting on Co-operation between Atomic Energy Regulatory Board and Korea Institute of Nuclear Safety

A five member delegation team led by Mr Han Poong Woo, Minister Counselor of the Embassy of the Republic of Korea, New Delhi visited AERB on December 23, 2011 to hold discussions on cooperation among the safety regulation agencies of Korea and India.

Dr S. K. Gupta, Director, Safety Analysis and Documentation Division, AERB, welcomed all the participants and briefed about the specific issues for which co-operation is mutually sought: (a) Licensing procedures of Prototype Fast Breeder Reactor (PFBR), (b) Licensing issues identified for PFBR and their resolutions, (c) Development of safety requirements and guides for Sodium cooled Fast Reactors (SFR), (d) Development of computer code systems of safety and Regulatory importance for SFR, (e) Test



AERB officials and the five member Korean delegation team at the Co-operation meeting between AERB and Institute of Nuclear Safety.

programs of safety and regulatory importance for PFBR, and (f) Operating experience of Fast Breeder Test Reactor (FBTR).

Senior officials from AERB delivered talks on overview of AERB activities Safety Regulatory framework and Safety documents, Safety review of PFBR and Safety review of operating plants including FBTR.

Mr. Lee Jeong Kong, Head, International Co-operation Team, KAERI (Korean Atomic Energy Regulatory Institute) presented highlights of Nuclear facilities in Korea. There are a total of 21 Nuclear Power Plants (NPPs) in operation, in Korea, generating 18,716 MWe (36% of total electricity generation). Korea is equipped with Light Water Reactors (LWRs), Heavy Water Reactors (HWRs), fabrication facilities for LWRs, HWRs and Research Reactors, spent fuel research & storage facility.

The Korean delegation informed that Post-Fukushima, the safety regulatory framework was reorganized with more independence to the regulator. A new organization named Nuclear Safety and Security Commission (NSSC) was established on October 26, 2011. It is an independent, stand-alone and minister-level government agency reporting directly to the President. It is responsible for nuclear safety, security and safeguards. Korea Institute of Nuclear Safety (KINS) and Korea Institute of Nuclear Nonproliferation and Control (KINAC) are supporting organization of NSSC.

This meet is a precursor for planned discussions on status of regulatory research on Sodium Cooled Fast Reactors (SFRs) in KINS and licensing experience on SFRs in AERB, proposed to be held during February 2012.

Chairman, AERB address in MDEP conference

Shri S. S. Bajaj, Chairman, AERB, India was invited to participate in the second Multinational Design Evaluation Programme (MDEP) Conference held between September 15-16, 2011 at the OECD Conference Center in Paris. MDEP is a multinational initiative taken by national safety authorities of various countries to develop innovative approaches to leverage the resources and knowledge of the national regulatory authorities who are currently or will be tasked with the review of new reactor power plant designs. Mr. Luis Echávarri, Director-General, OECD Nuclear Energy Agency (NEA)

MDEP Policy Group (PG) Chaired the session. In this Conference, Mr. Bajaj, Chairman, AERB presented "Regulatory Authority perspective". Some of the salient features highlighted in his presentation are given as below:

- MDEP is a revolutionary initiative of bringing together regulators from different countries, and in efforts towards harmonization of safety requirements of NPPs. The deliberations in this conference provided ample evidence that the initiative is a success and the efforts have begun to achieve positive results including in important work towards harmonization of Codes and Standards.
- It needs to be recognized that while aiming for harmonization, national regulators would have a final say since safety is finally a national responsibility. And there would always be local factors - not only those related to natural external events, but others, including technical and man-made ones such as cultural and infrastructural differences, security environment, vulnerability to aircraft crash, differences in Reliability of off-site power supplies etc.
- To the extent that the requirements are science based, it should be easier to harmonize. However, many requirements having basis in history and culture, and well ingrained practices should be recognized. Also, harmonisation should accommodate prevailing local good practices. The definition of standardization in MDEP framework such as "As similar as possible" could be elaborated with "to the extent that individual regulatory systems and country circumstances will allow".
- India has long-standing experience in regulatory review of different designs of NPPs which include PHWRs, FBRs and VVERs.
- Beyond the existing generation capacity of around 4700 MWe from 20 reactor units, there are plans for setting up substantial additional nuclear capacity based on Indian PHWRs as well as imported LWRs, to meet the growing demand for electricity. Currently, two units of 1000 MWe VVERs are under commissioning and should start generating electricity in the next few months. Further four PHWR units of 700 MWe each, as well as one FBR of 500 MWe are under construction. Future planned construction includes multiple units of LWRs of imported designs, including EPRs and AP 1000.
- With a large number of facilities with diverse designs to be regulated, it is imperative that AERB optimizes its resources. In this context, MDEP could be a very helpful platform to share knowledge and review experience with other regulators. Further, in areas where the national requirements are similar to the criteria used in MDEP review, the review results could be adopted directly. Thus, India can look forward to a very fruitful participation in the activities of MDEP.

In the end, Chairman AERB put forward a few suggestions to enhance the scope of MDEP that include (i) Addressing Fukushima for new builds (ii) Extending the programme to operating NPPs - especially in area of review against current standards as part of Periodic Safety Reviews, and handling resulting 'upgrades' in safety, (iii) Sharing of construction experience, would be a very useful activity for all concerned and (iv) Involvement of vendors and utilities in some form in MDEP activities may be useful to get a broader perspective.

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DAE Safety & Occupational Health Professional Meet

28th DAE Safety & Occupational Health Professionals Meet

The 28th DAE Safety & Occupational Health Professionals Meet was jointly organized by Atomic Energy Regulatory Board, Mumbai and Indian Rare Earths Ltd. (OSCOM), during November 24 - 26, 2011 at Hotel Hindusthan International, Bhubaneswar. The themes for the Meet were "Emerging Trend in Environment Protection" for Industrial Safety and Life Style Diseases for Occupational Health Safety.



Dignitaries on the Dais at the 28th DAE Safety & Occupational Health Professionals Meet.

Dr. R. N. Patra, CMD, IREL welcomed all the delegates and expressed his gratitude towards AERB's Role in Industrial Safety & Environment Protection. Shri R. Bhattacharya, Secretary AERB and Director, IPSD & ITSD, AERB, briefed about the genesis of the Meet. He assured to strengthen the commitment towards the cause of environment protection. Shri S. K. Chande, Vice Chairman AERB and Chairman SARCOP distributed a prize for the safety logo competition. In his introductory address, Shri Chande emphasised the need of sustainable development in nation's progress and highlighted the regulatory measures in place to prevent adverse impact on environment from operating Nuclear Power Plants. This was followed by AERB Green site awards presentations by Shri S.S. Bajaj, Chairman, AERB to the winning units; Nuclear Fuel Complex, Hyderabad and Narora Atomic Power Station, Narora. He also

released the compendium of the Technical Proceedings of the 28th DAE Safety & Occupational Health Professionals Meet. Shri S.S. Bajaj in his inaugural address explained the national & international efforts taken to prevent environment degradation and also the relevant legislation. While mentioning the AERB's role in environment protection he informed that AERB has developed several Codes, Standards and Guides and carries out the regulations as per these regulatory documents.

Shri R. K. Garg, Former Chairman & Managing Director, Indian Rare Earths Limited (IREL) released the booklet on "Environment Protection" prepared by Shri Soumen Sinha, IPSP, AERB. He delivered Dr. Ramaswamy Memorial endowment lecture on "Emerging Trends in Environment Protection". In his talk he briefed on the proper balance between development and environment. Shri D. Mohanty, Head, Orissa Sands Complex, Indian Rare Earths Ltd. & Chairman, Local Organising Committee proposed the vote of thanks. The dignitaries then visited the stalls installed by various exhibitors. Shri S.S. Bajaj, Chairman AERB inaugurated the exhibition.

The inaugural session was followed by three Technical Sessions in which two sessions on "Environment Protection" and one on "Lifestyle Diseases". Each of these technical sessions had three invited lectures delivered by renowned experts from DAE as well non-DAE facilities.

On the second day, there were presentations from various participants on Injury and Occupational Health Statistics, Serious and Near Miss Accident cases and fatal cases that occurred during the year 2011. Also the contributory papers on "Environment Management Systems & Performance", "Risk Analysis & Emergency Preparedness", "Environment Protection - Emerging trends" and "Life Style Diseases & Occupational Health" were presented. On the third day, there were presentations on 'Training & Safety Culture' from AERB, NPCIL, IGCAR and IREL.

The meet was concluded by a valedictory session wherein prizes for Posters, Cartoon, and Slogan Competition among DAE Employees were distributed and the feedbacks received from various participants were reviewed. The Meet had been a great success. It was decided to hold the next year's meet at Kakrapar Atomic Power Station, NPCIL on "Emergency Preparedness" as one of its theme.

Cont. from Pg. No. 8 **International Co-operation**

11th Sustainable Energy Meet in New Delhi

Shri S. S. Bajaj, Chairman, AERB, while chairing the Plenary session on "Future of Nuclear Power Plants" at the 11th Sustainable Energy Summit Organized by India Energy Forum on November 23, 2011 at New Delhi, emphasized that it is increasingly clear that nuclear power is acceptable only if it is not only safe but perceived to be safe for the public and the environment. The catastrophe at Fukushima has accentuated this imperative. Highlighting the proactive measures taken by AERB in the wake of Fukushima accident, Shri Bajaj stressed that it is essential that all the possible lessons drawn from the Fukushima accident are incorporated in design and operation of nuclear power plants, and in management of nuclear

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Shri S. S. Bajaj, Chairman, AERB at the eleventh Sustainable Energy Meet.

Radiation Safety Agency in Mizoram

AERB Authorizes Radiation Safety Agency in Mizoram

Currently, there are more than 50000 X-ray installations in our country. It is recognized that an effective control on such a widely used diagnostic tool is possible only if the regulatory responsibility is decentralized. The first Directorate of Radiation Safety was established in Kerala under the Department of Health & family Welfare, which has been functioning since 1999. Following the Kerala Model, the Govt. of Mizoram signed an MoU with AERB on March 25, 2010 to set up an independent Radiation Safety Agency (RSA) under the Health & Family Welfare Department, Government of Mizoram.

After formation of RSA and compliance with the safety requirements, the Govt. of Mizoram requested AERB to issue necessary authorization and to delegate adequate power to the Head, RSA to carry out the functions of the Agency. On October 12, 2011, in response to the request and in exercise of the powers conferred by the relevant Rules of the Atomic Energy (Radiation Protection) Rules 2004, Chairman, Atomic Energy Regulatory Board, the Competent Authority to enforce the Radiation Protection Rules 2004 authorized the Head, RSA, Department of Health & Family Welfare, Government of Mizoram to carry out inspection of medical diagnostic X-ray installations in Mizoram State to verify compliance with the relevant safety requirements and stipulations specified by AERB from time to time. This is the second State to have established an independent Radiation Safety Agency after Kerala to enforce X-ray radiation safety in the State.

Discussion Meeting between AERB and Radiation Safety Agency

On December 19, 2011, a meeting was held between officials of AERB and Radiation Safety Agency (RSA) at Aizawl in Mizoram State. Dr. Lalrinliana Sailo, Director, Hospital and Medical Education, Mizoram, Shri Khamsuanpauva, Head, RSA, Shri R. Bhattacharya, Secretary, AERB, Shri S. A. Hussain and Dr. R. M. Nehru were present in the meeting. Dr. Sailo thanked AERB's support in the establishment of RSA in the State of Mizoram and indicated that RSA would play a major role in the regulation of medical X-ray facilities in the State and bring out positive benefits to the patients. Shri R. Bhattacharya gave a brief background and understanding on AERB and RSA's functions and its responsibilities. He recalled the

historical regulation of medical X-ray facilities in the country and the AERB's initiatives in the decentralization of regulation of such facilities in the country by quoting Kerala as an example. Also, he appreciated that RSA, Mizoram is first State among the other eight States in the North Eastern Council to form the RSA in a shortest period time. He informed that Head, RSA, one Radiation Safety Inspector and two Technical Assistants had already undergone training successfully at AERB and RP&AD in the month of December 2010. He stated that many other States such as Madhya Pradesh, Tamil Nadu and Punjab have already signed the MoU and in the process of notification for establishing the Radiations Safety Agencies in their States. He stated that the activities of RSA would benefit the public and the radiation workers.



AERB and Mizoram RSA officials at the meeting.

Shri S. A. Hussain gave an introduction to regulation of radiation facilities and emphasised that the technical support and training



Shri Khamsuanpauva
Head, RSA Mizoram

would be extended to RSA as and when needed. He volunteered that the faculty would be provided if the RSA is conducting any awareness programme on radiation safety. Shri Khamsuanpauva, Head, RSA briefed on the recent activities of RSA and presented the report on inspection of a few facilities in Aizawl. Dr. Nehru made a brief presentation on AERB's regulatory mechanisms for radiation facilities and elaborated the responsibilities, function and jurisdiction of RSA and liaison with AERB as stipulated in the MoU.

Cont. from Pg. No. 9 International Co-operation

safety. Such reviews have been undertaken by AERB through a high level committee, as well as by the utility NPCIL and work is on to implement the recommendation arising from these reviews.

Talking about effectiveness of the nuclear regulatory process in India, Shri Bajaj brought out that whenever required enforcement actions have been taken by AERB, including ordering of safety

improvements and even stoppage of work or operation. Transparency and public information is ensured through various means, including regular updates on AERB website, issue of Annual Report, Newsletters, press releases, awareness programmes and discussion meets with stakeholders.

AERB's initiative in Medical Physics Internship Programme

AERB has recently published the revised Code AERB/RF-SC/Med-1 (Rev-1), 2011. As per the revised Code, in order to be recognized as Medical Physicist/ Radiation Physicist/ Radiological Physicist, a candidate shall have along with the requisite basic and professional qualification, a minimum of one year internship programme at a well equipped radiation therapy department. The objective of the internship programme is to strengthen safety issues arising in the curriculum of Medical Physics domain and improve the existing ongoing radiation safety training in radiation oncology facilities.

In this regard, an assessment was made by sending a questionnaire to seek willingness of radiotherapy facilities equipped with minimum required equipments (i.e. Accelerator, HDR Brachytherapy unit, Simulator/ CT simulator, and Treatment planning system) to participate in the internship program. Also, a meeting was conducted on December 5, 2011 with all the stake holders such as RP&AD, Bhabha Atomic Research Centre, Universities /Institutions conducting the medical physics/radiation physics programs and finalized details such as topics to be covered during the internship, role of the university/ institution in facilitating the candidate to undergo internship etc.

This proposal was further discussed in AERB's apex Safety Committee i.e., Safety Review Committee on Applications of Radiation (SARCAR) and the internship program is approved to be implemented to students passing the qualifying exam in the year 2013. This arrangement is expected to bring a win-win situation for both the student and the radiotherapy centre. The student would be acquiring the precious hands-on experience along with a stipend and the centre could suitably use his knowledge and services.

Accreditation of Low Level Radioactivity Counting Laboratories

AERB has accredited Low Level Counting Laboratory at Environment Assessment Division (EAD) of Bhabha Atomic Research Centre (BARC), Mumbai for undertaking measurement of radionuclide content in packaged drinking water and commodities (mineral, ore, food, soil, sediment and water) and issue requisite certificates. The laboratory has facility to measure low level of alpha, beta and gamma emitters of both natural and manmade origin in environmental, biological and processed samples. This validity of accreditation certificate is till December 31, 2014.

Also, the Radioecology Laboratory of University Science Instrumentation Centre, Mangalore University was granted accreditation by AERB for undertaking measurement of radionuclide contents in packaged drinking water and commodities (mineral, ore food, soil, sediment and water). The laboratory has facility to measure low level of alpha, beta and gamma emitters of both natural and manmade origin in environmental, biological and processed samples. The validity of this accreditation certificate is till December 31, 2014.

First Prize awarded in the 'Hindi Essay Competition'

Shri S. V. Chavan, Assistant Personnel Officer (E), AERB received the First Prize in the 'Hindi Essay Competition' at 'All India DAE Official Language Seminar' held at IOP, Bhubaneswar, Orissa during November 2-3, 2011. Also, he represented DAE Team in the 41st All India Inter Institutional Table Tennis Tournament, a national level tournament held at Asansol-Burnpur, Calcutta during August 17-22, 2011.



NSRA, 2011 Bill introduced in the Parliament

The existing Atomic Energy Regulatory Board (AERB) was established in 1983 by Government of India by exercising the powers conferred on by Section 27 of the Atomic Energy Act 1962 through a gazette notification. It is entrusted with the responsibility of regulating activities related to nuclear power generation, nuclear fuel cycle facilities, and research, industrial and medical uses of radiation. In addition, AERB was also assigned the responsibility to enforce industrial safety as per the provision of Factories Act 1948 and the Atomic Energy (Factories) Rules 1996, for the plants and facilities managed by Department of Atomic Energy.

To substantiate the legal status of AERB, it has been decided to establish an autonomous and independent regulatory authority under the proposed 'The Nuclear safety Regulatory Authority of India Bill, 2011'. The existing AERB will be subsumed by the newly formed Nuclear Safety Regulatory Authority (NSRA). Unlike the present AERB, which reports to the Atomic Energy Commission, NSRA will be directly reporting to parliament. The Bill was placed in Parliament during Monsoon Session of 2011 and is under review by Parliamentary Standing Committee.

Report of AERB Committee to Review Safety of Indian Nuclear Power Plants against External Events of Natural Origin

In the light of the Fukushima accident, Chairman, AERB constituted a committee on March 19, 2011 to review the safety of Indian NPPs against external events of natural origin. Members of the committee include experts from Central Water and Power Research Station (CWPRS), Pune, Indian Institute of Technology (IIT), Madras and Indian Institute of Tropical Meteorology (IITM), Pune in addition to the experts from BARC, NPCIL and AERB. The committee submitted its report on August 31, 2011. It observed that the design, practices and regulations followed in India have inherent strengths as mentioned below, particularly in case of pressurized heavy water reactors (PHWR) that account for 18 out of the 20 currently operational NPP units in India, to deal with the external natural events and their consequential events safely.

- a) In PHWR design, cooling of the reactor core, with the plant in hot shut down state, is achieved by natural convection flow of reactor coolant through steam generators. With the design provision for charging water to the secondary side of the steam generators using diesel engine driven pumps, this mode of core cooling can be maintained even under extended Station Block Out (SBO). The efficacy of this design feature got amply demonstrated during the 17 hours long SBO caused by the turbine hall fire incident at Narora unit-1 in 1993.
- b) The heat load from irradiated fuel stored to design capacity in the spent fuel storage pools is much less and the inventory of water in the pools is much larger at Indian NPPs in comparison to the corresponding heat load and water inventory in the spent fuel storage pools at Fukushima NPP. Consequently, for the Indian NPPs, submergence of the fuel in the pool water is assured for a time period of at least one week under SBO, even with the most conservative assumptions on the quantum of decay heat from the stored fuel and without any credit for operator action.
- c) All NPPs in India undergo Periodic Safety Reviews (PSR), which comprise of a detailed design and operational safety review conducted every 10 years and a brief but comprehensive review every 5 years. A large number of safety upgrades have been implemented over the years, especially in the old units, based on the outcome of the various safety reviews including augmenting seismic resistance and flood protection. These safety upgrades have substantially enhanced the safety of Indian NPPs including their capability to withstand natural events.
- d) The submarine faults capable of generating tsunamis are located at very large distances of more than 800km from the Indian coast. Thus, unlike in the Fukushima case, the possibility of simultaneous occurrence of an earthquake and a tsunami at our NPPs, is almost non-existent.

The committee observed that occasionally the magnitude of natural events can be higher than what is considered in design as seen in case of the Fukushima accident. It is therefore prudent to make

additional design provisions such that at least the basic safety functions for the NPPs are not impaired even under beyond design basis (extreme) natural events. Important recommendations of the committee in this regard are given below:

- a) The magnitude of postulated design basis natural events and the related requirements for siting and design of NPPs, as specified in AERB safety regulations, are found to be appropriate and sufficiently conservative. However in the light of Fukushima experience it is considered prudent to further enhance this conservatism and also postulate the magnitude of beyond design basis natural events.
- b) Detailed analyses were undertaken to estimate the maximum tsunami wave heights that can possibly be generated from the sub-sea faults around the Indian coasts after validation of the methodology using the data from the 2004 Indian Ocean tsunami. The work done so far indicates that the maximum postulated flood level at Kalpakkam coast is likely to get revised upwards and consequently the corresponding design improvements for MAPS will have to be considered. The Prototype Fast Breeder Reactor at this site is likely to remain unaffected due to this revision as its grade level is sufficiently high. For all other coastal NPP locations there will be no change in the maximum postulated flood level.
- c) Design provisions should be made to ensure safety even for the conservatively estimated magnitude of extreme events without any unreasonable demand on operator actions. For example, provision of air cooled diesel generators (DGs) capable of remaining operational even under extreme events, and, portable power packs that could be easily hooked up at pre-identified points, to supply back up power for performing essential safety functions and obtaining information on important safety parameters, could be considered as a further measure of defense in depth.
- d) A beyond design basis external event may disable the facilities available at the NPP site for monitoring and control of important reactor parameters. It may also result in physical isolation of the site such that it may not be possible to receive outside help for a considerable period of time. Creation of an emergency facility at each NPP site which will remain functional under such conditions is therefore recommended.
- e) As stated earlier, PHWR based NPPs have core cooling capability under SBO by natural convection flow of the reactor coolant through Steam Generators (SGs). To ensure natural convection flow of the reactor coolant through SGs, any significant voiding in the reactor coolant system should be prevented by providing a reliable back-up for PHT make-up during extended SBO.
- f) In the case of the boiling water reactors of TAPS-1&2, core cooling under SBO can be maintained for about 8 hours by natural convection cooling of reactor coolant by the water present on secondary side of the emergency condenser. To ensure reactor cooling in this mode beyond 8 hours, back up provisions should be made for replenishing loss of inventory by

injection of water to the reactor coolant system as well as to the secondary side of the emergency condenser. In this connection, it was noted that NPCIL has already made interim arrangements to inject water into the secondary side of the emergency condenser and to the reactor coolant system.

- g) Some of the safety systems including class III power supply system in TAPS-1&2 are located below the revised reference flood level for the site and therefore external flooding at TAPS has the potential to cause SBO. A detailed study is hence necessary to identify the design improvements required to ensure availability of the above systems during external flooding and the requisite corrective actions should be implemented.
- h) In spite of all the safety features provided, the extremely remote possibility of an accident leading to partial or total melting of fuel in the reactor core due to unforeseen reasons, termed as severe accident, should still be deterministically taken into consideration. In the area of severe accident management significant progress has been made in our country in the recent past in terms of analysis and R&D work. Similarly, work on development of severe accident management guidelines has also been initiated. These should be expeditiously translated into design provisions together with related procedures for the operating as well as under construction NPPs.

The committee has also made some other recommendations for further enhancement of safety of Indian NPPs. These are available in the report, made public.

AERB Discussion Meet on "Review of Off-site Emergency Preparedness and Response Plan of Indian NPPs based on Experience of Fukushima Nuclear Accident"

AERB had organised a one day Discussion Meet on "Review of Off-site Emergency Preparedness and Response Plans of Indian NPPs based on the Experience of Fukushima Nuclear Accident" at AERB on November 30, 2011. About 100 delegates and invitees from AERB, NPCIL, BARC and NDMA participated in the Discussion Meet.

Shri S. Duraisamy, Director, Operating Plants Safety Division, in his welcome address expressed that this meet is a platform for all stakeholders for exchange of information in the background of Fukushima nuclear accident.

Shri S.K.Chande, Vice-Chairman, AERB & Chairman, SARCOP delivered a presentation on "Offsite Emergency Preparedness and Response Plan based on the Experience of Fukushima Nuclear Accident". In his presentation he explained the structure of Nuclear Emergency Response Plan in Japan and its legal basis, the chronology of the emergency situation, challenges faced during the accident and the manner in which it was handled. Vice Chairman expressed that the emergency management at Japan demonstrated the involvement of various agencies with delineated role and responsibilities. Considering the complexity of an off-site nuclear

and radiological emergency situation, he emphasised the need to reiterate the role and responsibilities of various agencies in Indian context, for effective management of such situations, should they arise.

Dr. Baldev Raj, Chairman, Advisory Committee on Nuclear Safety inaugurated the Discussion Meet. He opined that the possibility of a Fukushima type nuclear accident in India is very remote due to the low probability of a high intensity earthquake followed by tsunami at NPP sites. However, to deal with any unlikely radiological emergency situation, the emergency preparedness and response plans are in place at all NPPs prior to their commissioning. These plans are tested as per the stipulated frequency. However, it is prudent to revisit the emergency preparedness and response plans of NPPs for any further improvement in view of Fukushima nuclear accident.

He emphasized that the radiation dose to the public during operation of nuclear power plants is very low. However, these informations are not reaching the general public in the desired manner. The information about the nuclear industries including nuclear power plants and the knowledge of radiation safety aspects are very limited to the general public. Hence, there is a need to improve the awareness among the general public about the nuclear industries and radiation safety to allay the unfounded fear.

Shri S. S. Bajaj, Chairman, AERB in his remarks emphasised the need for defining the role and responsibilities of various agencies for management of nuclear and radiological emergencies. He stressed the importance of a document which enumerate the role and responsibilities of relevant agencies in line with the national nuclear and radiological emergency organization set-up. The development of such document should also consider the experience of Fukushima nuclear accident.

He opined that at present the source term evaluation and consequence analysis for most of the accident scenario like core melt with early/late containment failure are conservative and is appropriate for a safety case. However, for accident management and emergency response the best estimate of source term and the radiological consequences analysis are necessary. This will also help for developing an optimal off-site emergency preparedness and response plan. For this, he desired that the responsible agencies like AERB, BARC and NPCIL should work together for evolving the best estimate of source term considering various plant conditions and accident scenarios.

Shri B. Bhattacharjee, Honorable Member, NDMA (nuclear) appreciated the objective of the discussion meet and the relevance in the nuclear and radiological emergency management programme. He opined that the regulators, operators and stakeholders have shared responsibility for management of off-site nuclear and radiological emergency situation.

Dr. A. K. Ghosh, Director, Health Safety & Environment Group, BARC presented the "R&D Programmes of BARC for Supporting

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Official Language Implementation

A battery of events was organized all through the year in AERB with a view to ensure effective implementation of Rajbhasha and the popularization of Hindi language. In this reporting period, an internal inspection with regard to the usage of Official language in various divisions was conducted by the members of OLIC, AERB.

As part of the Hindi fortnight organized by the Joint Co-ordination Committee (of the four DAE units in Anushaktinagar (v.i.z DCS&EM, HWB, DPS & AERB), various competitions like Quiz, Self-composed Poetry Recitation, Debate & Extempore were conducted in V.S Bhavan.

On September 14, 2011, marking the occasion of Hindi Day, a talk was organized on 'Radiation leakage in Fukushima Daichi' by Mr. Sukheswala, ex-senior scientist, AERB. Addressing the gathering in simple and lucid manner, Mr. Sukheswala brought to the fore various angles of the Fukushima mishap. Also, the winners of Hindi competitions received their prizes on this occasion.

The year also saw AERB crossing a major milestone in terms of its Hindi activities on September 30, 2011 with the launch of its Hindi

website. "Niyamika", the House Magazine of AERB was also released on the same day. Another impressive programme was a special talk in Hindi by Smt.Rani Verma, Principal, AECS, Tarapur on 'Yoga for a healthy life'. Health being everyone's prime concern, the talk was a huge hit with one and all. This talk, in the Special Hindi Lecture series periodically organized by Hindi Section, AERB, had the audience completely lapping up the message of the day - "A bit of Yoga everyday keeps the doctor away". A total of 150 participants from AERB and other units of DAE were nominated for this programme.

The wrap up event for the year 2011 was the Hindi Workshop organized under the auspices of the Joint co- ordination committee. The three day workshop was held between December (20-23), 2011 and was attended by twenty-six participants from the four units. A variety of topics ranging from Rajbhasha, RTI, Accounts and DAE Activities were covered. The workshop was well-appreciated.



A cultural event during the Hindi programme.



Dignitaries on the Dais during a special Hindi programme.

Cont. from Pg. No. 13 **Special Report**

Nuclear Emergency Preparedness" such as (a) Development of Indian Real Time Online Decision Support System (IRODOS), (b) Indian Environmental Radiation Monitoring Network (IERMON), (c) GIS based Emergency Response System, (d) Aerial Gamma Spectrometry System (AGSS), (e) Compact Aerial Radiation Monitoring System (CARMS), (f) Mobile Radiological Impact Assessment Lab (M-RIAL), and (g) Portable Personal Decontamination Unit (PPDU) etc. He informed that the IRODOS is operational at NAPS, Narora since the last four years and is planned to establish these systems at all NPPs.

The technical session consisted of presentations from AERB, NPCIL and NDMA officials. The presentations brought out the influence of past nuclear events like TMI (1979) and Chernobyl (1986) for development of emergency preparedness and response plans. NPCIL presented site specific experiences, challenges and

constraints while conducting off-site emergency exercises at various NPP sites. NDMA official explained about the Nuclear Incident Response System (IRS) which could reduce the scope for ad-hoc measures while responding to an emergency situation. IRS, he explained, will greatly help in reducing chaos and confusion during the response phase, if put in place with clearly defined roles of stakeholders. AERB officials gave presentation on the observation of recent off-site emergency exercises conducted at Indian NPPs. While revising the emergency preparedness and response plan, the need for incorporating the new terminologies like operational criteria (EAL&OIL), Incident Response System, precautionary urgent protective actions, large area contamination monitoring etc. is emphasised.

The Discussion Meet was highly beneficial to the target audience. The feedback of participants emerged at the end of the meet was fruitful and positive.

Use of Mobiles for Scientific Applications

K. V. Subbaiah and C. Senthilkumar

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Mobile phones have become an indispensable tool and are very commonly available with every one of us. They are extensively used for communication, net browsing and many other business transactions and hence we felt that these mobiles can also be effectively used for professional purposes apart from being used as a simple communication device. Because of the growing use of these devices in our everyday life and in view of its easy portability, an attempt has been made to develop "RadSafe", a mobile application for professionals in the nuclear industry, radiation safety officials handling radiation sources and to regulatory inspectors to serve as an easy reference resource. The size of the mobile application is just 64 kB and can easily be attached with email or sent as an MMS. User-friendly features to view desired topics are provided for novice users of mobile. This application covers a wide variety of topics in radiation and nuclear reactor physics. Some of the salient features of the application are given below:

1. Radioactivity:

Brief information on radioactivity, radiation properties, decay law, radioactive equilibrium is given. Various modes of decay along with few examples of isotopes during the different decay process are provided. For example, for a Th-232 series decay, a list of daughter products that are generated from the parent Th-232 isotope are shown. The information provided is half-life($T_{1/2}$) and decay mode ($A=\text{Alpha}$, $B=\text{Beta}$, $G=\text{Gamma}$).

2. Natural Radiation Sources:

Natural radiation sources classified under different categories viz., Terrestrial, Cosmogenic, human body, man-made, etc. are displayed and on selection, a list of various isotopes for each source is shown.

3. Gamma Source Energies and Emission:

A list of nearly 300 isotopes that emit gamma rays are made available under this topic. By selecting an isotope, one can obtain its half-life($T_{1/2}$), no. of gammas emitted and the list with energy and emission probability. Further, spectral weighted average energy, total yield per decay and the Gamma Ray Constant which are important parameters for control of exposure and shielding design are also displayed.

4. Neutron sources:

Information on yield and dose rates of neutron sources such as (Alpha, n), (Gamma, n) and spontaneous fission sources are provided.

5. Radiation Measurements and Units:

Information on sources of radiation exposures, radiation units in use and their conversion from one to another both for quantifying radiation sources and fields, etc. are provided. The AERB prescribed dose limits for occupational workers are also made available.

6. Reactors:

Some information on reactors are provided for scientific users. For eg., the information on various terms of reference to criticality, fissile materials and approximate mass required to a system to become critical both for Pu-239 metal and its compounds. Further,

information on the limiting size, shape, mass parameters for a system to remain sub-critical are given. The list of Power reactors (PHWRs) generating power, the place, year of commissioning are provided in the form of tables. Similar tables exist for the power reactors under construction.

7. Shielding:

It is a known fact that excessive exposure to radiations results in undesirable health effects. Therefore, the principles of radiation protection are

- Time (Control time of working with radiation sources or radiation field)
- Distance (The radiation field strength decreases as inverse square law from the source. This cautions us to work away from radiation sources as far as possible and use tools such as tongs, etc to limit the exposure) and
- Shielding (Interpose a suitable material between the source and the worker). Often, this is the only choice frequently adopted.
- Among all kind of radiations, neutrons and gamma rays have highly penetrating power through materials. If the amount of dose rate to be reduced is known, one can make use TVLs (Tenth value Layer= The amount of thickness required to reduce dose rate to one-tenth($1/10$) of its original value). User can choose the material of interest and can easily arrive at shielding thicknesses.

8. Radioactive Waste:

Categorisation of solid, liquid and gas wastes based on their concentrations are displayed.

9. Beach Sand Mineral Industries:

Information on beach sand minerals and the radiological properties are briefly explained.



Some of the screenshots of the mobile application "RadSafe" are shown. The leftmost screen appears at the start of the application with a list of topics. The selection of Co-60 isotope under the topic 'Gamma Source Energy and Emission' and the subsequent display of data of the selected isotope and gamma ray constant (i.e. the dose rate due to a point isotropic source of strength 1 Ci at a distance of 1 metre) are shown in the remaining screens.

(Note: The mobile application "RadSafe" may be obtained from the authors on request.)

Personnel Joined (July - December, 2011)

Sr. No.	Name	Designation	Date of Appointment	Sr. No.	Name	Designation	Date of Appointment
1.	Shri Aniket P. Gupta	SO(C)	29/07/2011	13.	Shri Ramakrishna Pagoti	SO(C)	01/09/2011
2.	Shri Shailendra Kumar	SO(C)	29/07/2011	14.	Shri Avimanyu Banerjee	SO(C)	01/09/2011
3.	Shri S. Duraisamy	Outstanding Scientist	11/08/2011	15.	Shri M.M. Kulkarni	SO(G)	02/09/2011
4.	Shri P. Varadarajan	UDC, SRI	12/08/2011	16.	Shri H. Ansari	SO(G)	02/09/2011
5.	Shri Somnath Jha	SO(C)	01/09/2011	17.	Smt. Sini S. Kaimal	Steno Gr. II	21/09/2011
6.	Kum. Poorva P. Kaushik	SO(C)	01/09/2011	18.	Kum. Jayalaxmi Harikantra	Steno Gr.II,SRI	04/10/2011
7.	Shri Devendra Upadhyay	SO(C)	01/09/2011	19.	Smt. Rachna N. Pawar	Steno Gr.II	11/10/2011
8.	Shri Nishikant Tyagi	SO(C)	01/09/2011	20.	Smt. Rakhee P. Nair	Steno Gr.II	19/10/2011
9.	Shri Kuldeep Singh Sangwan	SO(C)	01/09/2011	21.	Dr. (Kum.) K. Madhavi	Sr. Hindi Translator	05/12/2011
10.	Shri Alok Kumar Yadav	SO(C)	01/09/2011	22.	Smt. Namitha Krishna Kumar	SO(D)	29/12/2011
11.	Shri Sumit Awasthi	SO(C)	01/09/2011	23.	Shri Ravikant N. Karda	SO(E)	29/12/2011
12.	Shri Mohammed Ilyas Lone	SO(C)	01/09/2011	24.	Smt. Swathy K. Nair	SO(D)	29/12/2011

Personnel Transferred /Retired (July - December, 2011)

Sl. No.	Name	Designation	Date of Transfer / Retirement
1.	Dr. D. S. Suryanarayana	SO(G)	Transferred to NFC, Hyderabad w.e.f 21/07/2011
2.	Shri R. I. Gujrathi	Outstanding Scientist & Director, NPSD	Retired from Govt. Service w.e.f. 31/12/2011

Awards



Shri Obaidurrahman K., Scientific Officer (E), SADD, AERB has been awarded Ph.D. Degree in Mechanical Engineering for his thesis entitled, "Spatial Instability Analysis in Large Light Water Reactors" by the IIT Bombay, Mumbai during institute's 49th convocation on August 05, 2011.

This work was done under the guidance of Professor J. B. Doshi of IIT Bombay and Dr. S. M. Lee, Former Director, SEG, IGCAR, Kalpakkam.

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New Director



Shri K. J. Vakharwala, Chemical Engineer from the 20th batch of BARC Training School, has been appointed as Director Nuclear Projects Safety Division (NPSD) on December 30, 2011. Since his transfer from Reactor Operations Division BARC to AERB in July 2005, he has been working in NPSD. Before his transfer to AERB, he was Assistant Reactor Superintendent of Cirus and was responsible for safe and efficient operations of

Cirus. Shri Vakharwala is involved through various AERB Committees in design, commissioning and operational safety reviews of PHWRs and Regulatory Inspections of NPPs for more than a decade.

Editor

Dr. R. M. Nehru, nehru@aerb.gov.in

Editorial Committee

Shri R. P. Gupta, Dr. C. Senthil Kumar,
Smt. Manisha Inamdar, Shri Soumen Sinha,
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