

# 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

In the month of March this year, we witnessed one of the worst nuclear accidents triggered by the East Japan Great Earthquake and Tsunami at Fukushima nuclear plant in Japan. This accident dampened the global nuclear ambitions and aspirations for a while and raised several questions about the safety and reliability of nuclear power stations under severe accident conditions.

AERB constituted a High Level Committee to review the safety of Nuclear Power Plants in India in view of the lessons learnt from Fukushima accident. The accident and its implications were also reviewed by the Board of AERB, as well as by various plant/project-specific Safety Committees. A monitoring cell was created to continuously follow the developments in Fukushima and to keep a close vigil on the radiation and contamination levels in and around Fukushima and in India. AERB interacted with the media proactively and issued several press releases on the subject and took several steps to keep the public informed on the situation.

AERB participated in the Nuclear Energy Agency (NEA) Forum on the Fukushima Accident: Insights and Approaches on June 8, 2011 in Paris, France and the IAEA Ministerial Conference on Nuclear Safety in Vienna, Austria from June 20 -24, 2011. A report on "National Assessment & Impact of the accident on Regulatory Requirements in India" was presented.

India presented the safety status of its nuclear power plants, and its regulatory and safety review system to an international gathering of experts in the 5th Review Meeting of the Convention on Nuclear Safety held at the Headquarters of the IAEA in Vienna from 4-14 April 2011. India is a Contracting Party to the Convention.

Regulatory control on medical diagnostic X-ray installations in India requires strengthening. Towards this end, AERB has been pursuing with various State Governments to set up State level Directorate of Radiation Safety. In this regard, AERB signed a Memorandum of Understanding (MoU) with the Government of Punjab on March 31, 2011 for establishing Directorate of Radiation Safety.

A special Discussion Meet was organised in AERB on 'Application of the Concepts of Exclusion, Exemption and Clearance in Nuclear Fuel Cycle and Radiation Facilities' to provide an opportunity to all the participants to have a firsthand discussion on various aspects related to Exclusion, Exemption and Clearance and also an insight into the application of these concepts in day to day plant operation.

In-house Orientation Course for Regulatory Processes (OCRP-2011) was conducted during January 10 to March 03, 2011 for the Scientists/Engineers newly inducted in AERB and the same was separately conducted in Safety Research Institute (SRI) at Kalpakkam. Several awareness programmes and technical talks were conducted on a spectrum of activities in radiological and nuclear safety arena.

AERB continued the Industrial & Fire Safety Award Schemes in order to promote industrial and fire safety in the units of DAE by organizing an Industrial and Fire Safety Award Function for the year 2010 on April 19, 2011 in AERB. Shri G.M.E.K. Raj, Director General, Directorate General Factory Advice, Service and Labour Institutes and the Chief Guest of the function distributed the Industrial & Fire Safety Awards to the winners of DAE units and released the compendium on Industrial and Fire Safety Statistics.

AERB started incorporating state of the art technologies in carrying out its regulatory functions. AERB has taken an initiative to implement state-of art AERB-RSD Information System (ARIS), a web-based ICT (Information and Communication Technology) application for the automation and real time management of "Consenting Process" i.e. issue of Licenses and regulatory clearances to various Radiation Facilities across the country. Corporate Human Asset Resource Management System (CHARMS) has also been implemented in AERB.

AERB being an ISO certified organisation, the Bureau of Indian Standards (BIS) carried out Surveillance Audit of AERB with respect to ISO 9001:2008 Quality Management System (QMS) during December 28-29, 2010.

An article on 'Fukushima Nuclear Accident: Brief Overview of actions taken', the additional information on activities mentioned above and others are included in this issue of AERB Newsletter.



(S. S. Bajaj)

### AERB Board Meetings

The 104th Board meeting was convened on March 23, 2011 for discussion on "Fukushima-Daiichi Incident of Japan" and to review the status of Nuclear Power Plants with respect to earthquake and tsunami effect.

Detailed presentations were made before the Board Members on the magnitude of earthquake and the subsequent tsunami that hit the Japan coast on March 11, 2011 triggering a set of cascading events at some nuclear power plants at Fukushima Daiichi and Daini, the impact of earthquake and tsunami effect on nuclear power plants at Fukushima, Japan vis-à-vis Indian nuclear power plants and the characteristics of the event and its impact on the NPPs in the area vis-à-vis the design basis phenomena and parameters considered for Indian NPPs.

Board noted that there were two stations: (i) Daiichi and (ii) Daini (10 km apart) at Fukushima prefecture which have six and four nuclear power reactors respectively. The combined effect of earthquake and tsunami led to a serious accident at the Fukushima Daiichi NPPs, resulting in severe damage to four out of six nuclear reactors located at the Fukushima Daiichi site. The operating NPPs (Units-1, 2, 3) at Fukushima-Daiichi got automatically shut down following the earthquake. The units-4, 5 & 6 were already in shutdown and defueled state at the time of the event. It was also informed that the Japan has given this event INES reading as 5 (provisional). Shri S.S.Bajaj, Chairman, AERB informed that AERB is



**The Board Members discussing the Fukushima Accident at the Board Meeting**

closely following up the events after the unprecedented earthquake and tsunami in Japan. Reports of IAEA, NISA and TEPCO etc. are being continuously monitored.

#### AERB Actions Related to Fukushima

- The Indian Environmental Radiation Monitoring Network (IERMON) data were being monitored and no increases in the background radiation levels have been noted. AERB gave several statements in the media, press. The radiation levels at nine locations encompassing whole of India was updated on a daily basis on AERB's website.
- One High Level Committee was constituted under the Chairmanship of Shri S. K. Sharma, Former Chairman, AERB to review safety of Indian NPPs in the light of the lessons from Fukushima. The Committee would review the capability of Indian Nuclear Power Plants to withstand earthquakes and other external events such as tsunamis, cyclones, floods, etc and the adequacy of provisions available to ensure safety in case of such events, both within and beyond design basis.
- AERB would continuously follow the developments in Fukushima and to keep a close vigil on the radiation and contamination levels in/around Fukushima and in India.
- With respect to screening of passengers coming from Japan, AERB advised the Government that there was no such requirement.
- AERB also advised the Food Safety and Standards Authority of India (FSSAI) laboratories in India which have been identified for testing of food items for contamination.

### Regulatory Inspections

(January - June 2011)

Unit	No. of Inspection conducted
<b>Nuclear Facilities</b>	
DFRP, PFBR, KK NPP-1&2, KK NPP-3&4, KAPP3&4	1 each
RAPP-7&8	2
MAPS-1&2, FBTR, KAMINI, PFBR, RAPS-3&4, KGS-1&2, KGS-3&4, NAPS-1&2, KAPS-1&2, TAPS-1&2 and TAPS-3&4	1 each
AMD (North & East zones), UCIL-Jharkhand, NFC-Hyderabad, IREL-Manavalakurichi, Chavara, OSCOM, Udyogamandal, HWP-Kota, Baroda, Tuticorin, Hazira, Thal, Manuguru, Talcher	1 each
VECC, RRCAT	1 each
TDP- Chembur	2
Non-DAE Beach Sand Minerals Facilities	19
<b>Special Inspections</b>	
RAPS-7&8	2
KAPP 3&4, RAPP 7&8, KKNPP, PFBR, DFRP, UCIL-Tummalapalle, VECC-Medical Cyclotron (Special inspections on Industrial Safety)	25
<b>Industrial Radiation Facilities</b>	
Industrial facilities (Industrial Radiography, Nucleonic Gauges WL and SS)	88
Gamma chamber facilities	36
Gamma Irradiators	11
<b>Medical Radiation Facilities</b>	
Nuclear Medicine	37
Diagnostic X-rays	32
Radiotherapy Facilities	41

### Consents / Clearances issued (January - June 2011)

- 1) Clearance for Synchronization of TG Set and operation of Plant up to 50 % FP for KGS-4 (January 10, 2011)
- 2) Clearance for Raising Reactor Power up to 90 % FP for KGS-4 (January 28, 2011)
- 3) Siting Consent for KK NPP 3 to 6 (February 9, 2011)
- 4) Clearance for raising Reactor Power to 100 % FP for KGS-4 (March 01, 2011)
- 5) Clearance for Hot Run of KKNPP UNIT-1 (June 30, 2011)

## Human Resource Development

### AERB Training Activity

The Orientation Course for Regulatory Processes (OCR-2011) was conducted during January 10 to March 03, 2011 for the Scientists/Engineers newly inducted in AERB. Lectures were delivered by staff from various divisions of AERB. Thirty-six participants from AERB and 2 from BARC Safety Council attended the course. A total of 53 lectures were delivered on topics related to functions of AERB, nuclear and radiation safety, Atomic Energy Acts and Rules, etc.

Site visits were organized to TAPS-3&4, Dhruva reactor at BARC and Advanced Centre for Treatment, Research and Education in Cancer (ACTREC) at Kharghar, Navi Mumbai. Trainees were familiarized with the systems of PHWR, research reactor and radiation facilities through these visits. The safety measures provided in these units were explained to the Trainees. The valedictory function for the Course was held on 22nd March 2011, in which the certificates were distributed to the trainees.

For the benefit of SRI staff, OCR- SRI-2011 schedules have been worked out to conduct the programme during June to August 2011 at SRI-Kalpakkam.

### Technical Talks

- A technical talk on "Effect of Earthquake and Tsunami on NPPs at Fukushima, Japan vis-à-vis safety review of Indian NPPs" by Shri A. D. Roshan, SSED was organized. The talk presented technical details related to earthquake and tsunami during the incident in Fukushima, Japan.

- A technical talk by Shri A. P. Garg, OPSD was organized on "Events after Earthquake and Tsunami in NPPs at Fukushima, Japan.". The talk gave an overview of the events that had taken place following earthquake and tsunami incident in Fukushima, Japan.



**Shri S. K. Chande, Vice-Chairman, AERB presenting the certificate to one of the AERB trainees (left).  
Shri A. Ramakrishna, Course Coordinator is seen at the center**

- A technical talk on "Analysis of Experimental Scenarios during Phase B Physics Commissioning of VVER KK Unit 1 using Indigenous code system" by Dr. V. Jagannathan, Head, LWRPS, RPDD, BARC was organized. The presentation brought out the results of theoretical analysis on the activities during Phase B physics commissioning of VVER KK Unit 1 using indigenous code system EXCEL-TRIHExFA-HEXPIN.

## Safety Research Programme (SRP)

CSR held its 46th meeting during the period. Six new project proposals were considered for funding. The Committee after detailed deliberations recommended approval of grant-in-aid for 2 project

proposals. The details are given in Table 1. The details of 2 on-going projects that were approved renewal are given in Table 2.

**Table 1: New Projects Sanctioned**

Sr. No.	Project Title	Principal Investigator / Organization	Principal Coordinators / Collaborators
1.	Lysimeter based Subsurface Investigations to assess the Transport Behaviour of Containments in the Vadoze zone near Surface Disposal Facility at Kalpakkam	Dr. Sudhakar Rao, Indian Inst. Of Science, Bangalore	Dr. P. Sasidhar, SRI-AERB, Kalpakkam Shri Soumen Sinha, IPSD, AERB Dr. D. Datta, NPCIL, Mumbai
2.	Studies on the Thermal Hazards of Reactive Red Oil forming Substances in Fuel	Dr. M. Surianarayanan, Central Leather Research Institute, Chennai	Shri Lakshman N. Valiveti, IPSD, AERB Shri H. Seshadri SRI-AERB, Kalpakkam

**Table 2: Renewal of On-going Projects**

Sr. No.	Project Title	Principal Investigator / Organization	Organization
1.	Retrospective Assessment of Indoor Radon Exposure in Garhwal Homes by Measurements of <sup>210</sup> Po Implanted on Glass Surface	Dr. R.C. Ramola	H.N.B. Garhwal University, Tehri Garhwal
2.	Reliability assessment of large and complex computer codes	Prof. R.B. Misra	IIT-Kharagpur
3.	Hydrogeochemical modeling of Coastal aquifers in and around Kalpakkam - an integrated approach	Dr. S. Chidambaram,	Department of Earth Sciences, Annamalai University
4.	Development of a TLD base on Borate Glass: Implication to Clinical Dosimetry	Dr. A. Nabachandra Singh	Thoubal College, Thoubal

## Awareness Programmes / Workshops

### 1.0 One day Workshop on "Radiation Safety in Teaching and Research" at Banaras Hindu University (BHU)

One day workshop on "Radiation Safety in teaching and research" was conducted jointly by the Radiation Safety Committee, BHU and AERB on January 12, 2010 at the K.N. Uddappa Auditorium of BHU. The objective of the workshop was to bring awareness and educate the concerned professionals following the radiological incident at Mayapuri Industrial Area, Delhi in April 2010. AERB and BARC officials delivered lectures during the workshop that include a spectrum of topics ranging from fundamentals of ionizing radiation to the national legislation and regulatory requirements in handling radioisotopes used in research applications and planning of research laboratories. About 225 participants from BHU comprising of Professors, Associate Professors, Lecturers, Technical Officers and students attended the workshop. An information bulletin on "Introduction to ionizing Radiation and Safe Practices" and a poster on "Dos and Don'ts for safe handling of radioactive material" were released by the Rector, BHU. The programme ended with a panel discussion on radiation safety.

### 2.0 AERB's Participation in Engineering Export Promotion Council (EEPC) Programmes

AERB has initiated several proactive measures to bring awareness on the issue of radioactive contamination in the scrap metal recycling steel industries. The issue of radioactive contamination in scrap metal and steel products is a great concern for both AERB and Engineering Export Promotion Council (EEPC) of India. Currently, EEPC has a mandate to promote foreign trade and investment in the Indian engineering sector. It was felt that AERB's participation in EEPC's seminars would benefit the audience (engineering industries). AERB is thus regularly invited to give talks on the radioactive contamination in scrap metal and steel products. So far, AERB had delivered three talks in their programmes conducted at Kolhapur, Mumbai and Kolkata.

### 3.0 One day Awareness Programme on radioactive contamination in steel products for the steel manufacturers/suppliers in the southern region

In the last four years, there have been cases of radioactive contamination in steel products exported by Indian steel manufacturers to some countries. Such cases of contamination of material exported from India to foreign countries have been either reported to AERB by the affected Indian suppliers or the concerned officials from the overseas. On investigation it was found that the steel products were made out of steel produced in foundries where radioactively contaminated imported metal scrap was used. Though the radiological impact of such incidents is too low to cause any significant hazard, such incidents are undesirable and need to be prevented. A number of measures were taken by AERB to prevent recurrence of such incidents. These include holding meetings with the concerned associations of exporters and

organizations to improve radiation safety awareness among the manufacturers and exporters.

As a follow-up, RSD, AERB, conducted a one-day awareness programme on radioactive contamination in steel products for the steel manufacturers/suppliers in the southern region on February 4, 2011, at SRI Guest House Auditorium, Anupuram, Kalpakkam. There were 29 participants representing major steel manufacturers/suppliers and two participants from SRI attended the programme. The programme had lectures, like '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 (MRAI) and a leading steel manufacturing private company at Coimbatore. This was followed by feed-back session and discussions.

### 4.0 One Day Awareness Programme on "Safe Transport of Radioactive Material by Air"

It has come to the notice of AERB that many of the air carriers do not accept consignments containing radioactive material for export. It is also noted that most of the foreign airlines carry the radioactive material in one way i.e. they bring the radioactive material into the country; but reluctant to transport the decayed sources back to the country of origin on flimsy grounds. The import of the radioactive material into the country heavily outnumbers the export though AERB has the policy that all imported sources should be sent back to the original supplier abroad after the useful life of the source.



(L to R: Shri R.K. Singh, AERB; Shri M.C.Dinakaran, BRIT; Shri M.S.Ansari, Manager, Cargo Division, Air India; Shri Shubhanya Ghosh, Chief Instructor, GGR Training, DGCA)

It was also learnt that most of the airlines offices in India have a wrong perception about the transport of radioactive material with the fear of risk involved in handling packages containing radioactive material under normal and accident conditions. It is also observed that most of the shippers are not well conversant with the procedural requirements as per IATA DG Regulations while booking a radioactive consignment. Inadequate facilities at the cargo terminals of some major airports in the country are also another factor compounding the denials of shipments of radioactive material.

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In view of the above that a one day awareness programme on the safe transport of radioactive material for the shippers/consignors (Radiological Safety officers) managerial levels of the airlines, airport operators (Mumbai International Airport Pvt. Ltd), source suppliers, freight forwarders and private cargo service providers in the country was conducted on March 18, 2011 at AERB Auditorium. The objective of the program was to allay fear of risk in handling packages containing radioactive material, which in turn would help in reducing the number of denial of shipment by carriers. The number of participants for the programme was 68. 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 DGR, global view on denial and delay of shipments, economic prospect of transporting radioactive material by air, firsthand experience on the export of disused sources by a supplier, a short video film on the safe transport of radioactive material by air, feed-back session and discussions.

### 5.0 Awareness Programme on "Safety in handling of Radiation Sources in Oil Well Logging"

On request by the management of Oil and Natural Gas Corporation (ONGC), Mumbai, which is the leading operator in oil industry and possessing large number of oil well has requested for an awareness programme on "Safety in handling of Radiation Sources in Oil Well Logging (OWL)". The one day awareness programme was conducted by S/Shri D. M. Rane and Pravin J. Patil of RSD, AERB at ONGC Head office, Sion, Mumbai on January 24, 2011. The following lectures were delivered in the programme:

- Basic Nuclear Physics, Radiation Quantities and Units
- Radiation Hazard Evaluation and Control
- Biological Effects of Radiation
- Emergency Response Plans and Preparedness
- Regulatory Aspects for OWL

About 24 engineers and technicians from various ONGC well logging sites viz. Mumbai High, Ankleshwar, Mehasana, Ahmedabad, Karaikal and Assam Asset participated in the awareness programme.

### 6.0 Awareness Programme on use of radiation sources for nucleonic gauging applications

One-day special meeting on Nucleonic Gauge was held on Wednesday March 16, 2011 at AERB, Niyamak Bhavan, Anushaktinagar, Mumbai for users of nucleonic gauges in coal washeries in the country. The main objective of the meeting was to discuss regulatory issues pertaining to streamlining the inventory of category 3 and 4 sources used in coal washeries, status of the nucleonic gauges at their institutions, review existing inventory,

update inventory of sources, safety and security of radiation sources and initiate action for disposal of disused sources.

A total of eighteen participants consisting of senior representatives from central office and personnel from various coal washeries sites viz. Bharat Coking Coal Limited (BCCL), Central Coalfields Ltd., Central Mine Planning & Design Institute Ltd., (CMPDI), Global Coal & Mining (P) Ltd., Orissa Mining Corp., Aryan Coal Beneficiation Ltd., attended the meeting.

Presentations were made mainly to provide updated information to the participants pertaining to regulatory requirements, regulatory forms, and disposal procedures. The sources used in coal washeries are of very long half life (Cs-137, Am-241), and there is potential radiological risk, if not safely handled and securely stored. Hence, participants were made aware of the importance of maintaining the source inventory by users, submission of periodic status report to the regulatory body, availability of trained manpower and basic infrastructure such as radiation survey meter, exclusive storage room for the gauges which are not in use.

### 7.0 One day Awareness Programme for Medical Cyclotron Facilities

In order to generate awareness among the Institutions having Medical Cyclotron facility and to enhance good safety practice for effective implementation of regulatory measures, the Nuclear Medicine group of RSD conducted an awareness programme on the February 18, 2011. At AERB, Mumbai Forty-eight delegates from different cyclotron facilities in the country participated in the programme.

The programme commenced with the welcome address by Shri S.A. Hussain, Head, RSD, AERB. He pointed out that as per NCRP report, the recent increase in ionizing radiation exposure is mostly due to the growth in the use of medical imaging procedures such as Nuclear Medicine and CT. So he emphasized on the need of adopting a safety culture in the clinical use of radiation in order to reduce exposure to patients as well as public. The inaugural address was given by Shri R. Bhattacharya, Director-ITSD, Director-IPSD, Secretary, AERB. In his speech, he emphasized on the importance of conducting such awareness programmes for



(L to R: Dr. Pankaj Tandon, RSD, AERB; Shri R. Bhattacharya, Secretary, AERB and Shri S.A. Hussain, Head, RSD, AERB)

## Awareness Programmes / Workshops

ensuring safety while operating cyclotrons. He also mentioned about the new developments in medical research such as production of Tc-99m using cyclotrons. Vote of thanks was proposed by Dr. Pankaj Tandon.

The programme covered discussions on following topics:

1. Legislation and Regulatory Requirements for Medical Cyclotron Facilities in India.
2. Radiological Safety Aspects during the Synthesis of Radiopharmaceuticals in a Medical Cyclotron Facility.
3. Role of Radiological Safety Officer in a Medical Cyclotron Facility.
4. Regulatory and Radiological Safety Aspects during the Shipment of Radioisotopes
5. An overview on various models of Medical Cyclotron presently dealt by IBA Molecular Imaging and their Radiological Safety Aspects during the repair and maintenance
6. An overview on various models of Medical Cyclotron presently dealt by Wipro GE Healthcare and their Radiological Safety Aspects during the repair and maintenance
7. An overview on various models of Medical Cyclotron presently dealt by Siemens Ltd. and their Radiological Safety Aspects during the repair and maintenance

The programme concluded with a feedback session.

### 8.0 One day Awareness Programme on "Radiation Safety and Regulatory Aspects of Nucleonic Gauges/Industrial Radiography"

M/s Tata Steel Limited (TSL), Jamshedpur has requested for organizing one day workshop on "Operational and Safety Aspects of Nucleonic Gauges". M/s TSL is in the possession of around 170 nucleonic gauges which are located at various departments under the M/s TSL. The programme was organized on Friday, June 17, 2011 at M/s Tata Steel Limited, Jamshedpur. The above programme was conducted by Dr. A.U. Sonawane and Shri Dinesh M. Rane, RSD, AERB. Mr. S Mark Bernard Denys, Chief of R&D and Scientific Services Division, M/s TSL inaugurated the programme. M/s TSL has developed a 'website' providing information about all the nucleonic gauges in the possession of M/s TSL, Jamshedpur along with AERB safety rules, regulatory aspects & safe disposal of nucleonic gauges. This website was also inaugurated on the day of the workshop.

Mr. S Mark during his inaugural talk remarked that the workshop was aimed at generating awareness on safe operation of Nucleonic Gauges and Industrial application of Radiation for concerned personnel of M/s TSL.

The programme included presentations on topics such as applications of radiation sources; basic working principle and types of nucleonic gauges; radiological safety, security and

regulatory aspects of nucleonic gauges, radiation hazard evaluation & control and biological effects of radiation.



AERB and TSL Officials at the Awareness Programme

Forty-one engineers from various units of TSL viz. Blast Furnaces, Sinter Plant, LD#1, LD#2, LD#3, Cold Rolling Mill (CRM), Rapid Analysis Centers (Scientific Services), West Bokaro Collieries and Tinplate India Limited (TCIL) participated in the workshop. Participants submitted written feedback of usefulness of the programme. Participants expressed satisfaction and appreciated the knowledge gained during the programme. They also expressed that such programmes should be arranged periodically for their benefits.

### 9.0 AERB Discussion Meet on Application of the Concepts of Exclusion, Exemption and Clearance in Nuclear Fuel Cycle and Radiation Facilities

A Discussion Meet on "Application of the Concepts of Exclusion, Exemption and Clearance in Nuclear Fuel Cycle and Radiation Facilities" was organised in AERB, Niyamak Bhavan on January 10, 2011. Faculty members and nominated participants from NPP units, BARC, IGCAR and AERB participated in the meet.

Shri.S.K.Chande, Vice-Chairman AERB and Chairman SARCOP, in his Presidential address, highlighted the conceptual difference between Exclusion, Exemption and Clearance in regulation. He anticipated generation of a large amount of contaminated and activated materials in the future when nuclear facilities are decommissioned at the end of their useful life and a case by case approach will not be sufficient to handle the associated volumes of waste. To minimise the radioactive waste that needs to be disposed of and to facilitate clearance of slightly radioactive/ contaminated materials international organisations have drafted their regulations and guidance allowing for a rational system of release of materials from the regulatory control.

Shri Kanwar Raj, Head, Waste Management Division, BARC, in his keynote address emphasised the need to minimise the volume of radioactive solid waste per unit of electricity produced as the number of nuclear facilities are increasing day by day resulting in consumption of large area for its disposal. The increasing number of nuclear facilities undergoing decommissioning in the world has

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also brought recognition of the need to have well-established and internationally accepted policies. These policies should guide the release of materials from decommissioned nuclear facilities for subsequent reuse, recycle or disposal. He emphasized the concept of internal as well as external recycling of radioactive waste by quoting the example of recovery of useful materials such as nitric acid and solvents from the waste at Waste Immobilization Plant (WIP), Tarapur.



(L to R: Shri P. R. Krishnamurthy, AERB; Shri S.K. Chande, Vice-Chairman, AERB and Shri Kanwar Raj, Head, WMD, BARC)

In the technical session of the Discussion Meet, the current IAEA strategy of Exclusion, Exemption and Clearance of radioactive solid materials and application of the same in radiation practices and use of sources was discussed. Exclusion is the deliberate exclusion of a particular category of exposure from the scope of regulatory control on the grounds that it is not considered amenable to control through the regulatory instrument in question; e.g.; K - 40 in the body, cosmic radiation on the surface of the earth. Exemption is the determination by a regulatory body that a source or practice need not be subject to some or all aspects of regulatory control on the basis that the exposure (including potential exposure) due to the source or practice is too small to warrant the application of those aspects. The IAEA recommends an exposure of 10  $\mu\text{Sv}$  in a year for such exemption cases. Clearance is the removal of radioactive materials or radioactive objects within authorized practices from any further regulatory control by the regulatory body.

Technical talks were delivered on the following topics: (i) IAEA concepts of Exclusion, Exemption and Clearance of radioactive solid materials (ii) Application of the Concept of Exclusion, Exemption and Clearance in Use of Radiation sources and Practices (iii) Monitoring of low level contamination in solid materials for compliance with clearance criteria (iv) Application of exemption and clearance of radioactive scrap material generated from nuclear facilities (v) Application of the concept of exemption and clearance in management of radioactive waste generated from nuclear fuel cycle and radiation facilities and (vi) scope for re-cycle and re-use of radioactive solid materials.

This discussion meet provided an opportunity to all the participants to have a first hand discussion on various aspects related to Exclusion, Exemption and Clearance and also an insight into the application of these concepts in day to day plant operation. The feedback of participants emerged at the end of interactive discussion meet was fruitful and positive.

## IRRS and AERB's Preparedness

The integrated regulatory review service (IRRS) is a peer review service of IAEA which is designed to strengthen and enhance the effectiveness of the national regulatory infrastructure of States for nuclear, radiation, radioactive waste and transport safety and security of radioactive sources. The IRRS regulatory review process compares the nuclear and radiation regulatory infrastructure in a State against international standards and where appropriate, good practice elsewhere.

The IRRS is performed by an international team that includes senior regulatory experts with broad knowledge of the regulation of nuclear and radiation safety and extensive related experience, often in specialized areas. The IRRS team is led by a senior regulator from a Member State designated as the IRRS Team Leader and in general, the team comprises both designated IAEA staff and experienced international reviewers.

AERB is considering to initiate IRRS through a formal Governmental request to the IAEA. AERB is in the process of carrying out a self assessment based on methodology and procedure used for IRRS. In this regard, a committee has been constituted for internal assessment of AERB preparedness for IRRS and the assessment work has been started.

## NEA Meet on Fukushima and IAEA Ministerial Conference

The Nuclear Energy Agency (NEA) organised a Forum on Fukushima Accident: Insights & Approaches on June 8, 2011 in Paris, for which has formed an important part of the international effort being undertaken to learn from, to share and to implement the lessons learnt as a result of the Fukushima Daiichi accident. It aimed at preparing future discussions at the international level, in particular the IAEA Ministerial Conference of 20 June, by providing recommendations on nuclear safety in light of the Fukushima event, as shared by the regulatory authorities of NEA member and associated countries. Shri S.S.Bajaj, Chairman, AERB represented India and served as one of the session panelists in this Forum. Shri Bajaj presented a report on "National Assessment & Impact of the accident on Regulatory Requirements in India".

India also participated in the IAEA Ministerial Conference on Nuclear Safety that was held in Vienna, Austria from June 20 -24, 2011. The Indian delegation was led by Dr. Srikumar Banerjee, Chairman, AEC. The overall objective of the Conference was to identify lessons learned from the nuclear accident at the Fukushima Daiichi Nuclear Power Station. The Conference adopted a Ministerial Declaration that called for improvements in global nuclear safety. The Ministers asked the Director General to prepare a draft Action Plan to address issues related to nuclear safety, emergency preparedness and response and radiation protection of people and the environment, as well as the international legal framework. The conference ended with the Conference President's concluding remarks on a wide range of practical ideas for improving global nuclear safety in the wake of the Fukushima Daiichi accident.

## Safety Research Institute Activities, Kalpakkam

### Training Program on RELAP at Safety Research Institute (SRI)

A training program on the nuclear reactor safety analysis code RELAP5 was organized by Safety Research Institute (SRI) under the auspices of the Indian Society of Radiation Physics, Kalpakkam Chapter during April 19 to May 13, 2011.

The RELAP5 code has been developed for best-estimate transient simulation of light water reactor coolant systems during postulated accidents. The code models the coupled behavior of the reactor coolant system and the core for loss-of-coolant accidents and operational transients such as anticipated transient without scram, loss of offsite power, loss of feed-water, and loss of flow. A generic modeling approach is used that permits simulating a variety of thermal hydraulic systems. Control system and secondary system components are included to permit modeling of plant controls, turbines, condensers, and secondary feed-water systems.



**The Faculty Members and the Participants at the RELAP training course**

Six young officers from SRI and four from Reactor Engineering Group of IGCAR participated in the training program. The course was directed by Dr. S. K. Gupta, Director, SADD and five officers from the division delivered lectures on the capabilities of RELAP5 and also gave hands on training to the participants. During the rigorous training program, each participant analyzed a specific design basis accident scenario for a typical 540 MWe PHWR.

The valedictory function of the RELAP training course organized at SRI was graced by Shri S. S. Bajaj, Chairman, AERB. Dr. S. K. Gupta highlighted the objectives of the training program. Other dignitaries who were present during the function are, Dr. P. Chellapandi, Director NSEG, IGCAR; Dr. B. Venkatraman, Associate Director RS&EG, IGCAR; Dr. C. P. Reddy, President ISRP (K) and Dr. S. M. Lee, Raja Ramanna Fellow of AERB.

During his address, Chairman, AERB highlighted the role of RELAP code in accident analyses and stressed that with the training imparted to the young engineers and scientists, SRI could contribute significantly towards the safety review and accident analysis of the nuclear reactors under review by AERB

### Inaugural Function of Orientation Course for Regulatory Process (OCRP-SRI-2011) at SRI, Kalpakkam

The inauguration of OCRP-SRI-2011 was held on June 23, 2011 at the RSD Seminar Hall of IGCAR, Kalpakkam. The number of participants was forty-seven, with twenty-seven participants from SRI, five from IGCAR, eight from BARC facilities at Kalpakkam, one from MAPS and six from BHAVINI.

The programme was inaugurated by Dr. S. M. Lee, Rajaramanna



**Inaugural Function of OCRP-SRI-2011 at SRI, Kalpakkam**

Fellow and Member of SARCOP, AERB. Other dignitaries on the dais who addressed the gathering were, Shri G. Srinivasan, Director ROMG, IGCAR; Dr. B. Venkataraman, AD, RS&EG, REG, IGCAR; Shri V. Balasubramanian, Head, SRI and Shri A. Ramakrishna of ITSD, AERB.

At the outset, Dr. D. K. Mohapatra gave a brief introduction about the participants highlighting their educational and professional backgrounds. Subsequently, Shri A. Ramakrishna briefed the gathering about the OCRP-SRI-2011 and made a presentation on 'Functions and Responsibilities of AERB'.

After the inaugural session, lectures were delivered on Operational Reactor Physics Aspects of PHWR and BWR by Smt. Reeta Malhotra and Shri A. Ramakrishna.

## Internal Auditor Training as per ISO 9001:2008 Standard for AERB Officers

Atomic Energy Regulatory Board has opted for certification under ISO 9001 standard by Bureau of Indian Standards (BIS) for its consenting activities, regulatory inspection and preparation of regulatory documents since November 15, 2006. BIS Auditor carried out Surveillance Audit with respect to ISO 9001:2008 Quality Management System (QMS) at AERB during December 28-29, 2010. Based on the suggestion in the audit, an in-house internal auditor training cum certification programme by BIS faculties was organised for 25 officers of AERB during April 27-28, 2011.



**BIS Faculty Member and AERB trainees at the Internal Auditor Training cum Certification Programme**



## Industrial & Fire Safety Award Function for the Year 2010

In order to promote industrial and fire safety in the units of Department of Atomic Energy (DAE), AERB constituted the Industrial & Fire Safety Award Scheme in 1992 and 1993 respectively. The Industrial and Fire Safety Award Function for the year 2010 was held on April 19, 2011 at Niyamak Bhavan, AERB.

Shri G.M.E.K. Raj, Director General, Directorate General Factory Advice, Service and Labour Institutes (DGFASLI) was the Chief Guest of the function. Chief Executive of NFC, Chairman & Chief Executive of HWB, Director (Operations), NPCIL, senior officers from BARC, NPCIL, HWB, IREL, VECC and other DAE units, Chairman, Vice Chairman & Directors/Heads of Divisions of AERB were also present along with the staff of AERB.

Shri R. Bhattacharya, Secretary, AERB & Director, IPSD & ITSD welcomed the gathering. He briefed the audience on the categorization of the units depending on the hazards involved and presented the computational criteria for evaluating the winners of the

Industrial and Fire Safety Award. In a brief presentation, he highlighted the industrial and fire safety statistics of the various DAE units.

Shri S.S. Bajaj, Chairman AERB in his presidential address expressed concern over the serious accidents taking place at the construction sites of DAE. He informed the audience on some of the useful suggestions made during the last month's Discussion Meet on 'Challenges and Strategies in Industrial Safety at DAE Construction Sites' which include training and certification of workers, consideration during design stage w.r.t execution of construction jobs, regular supervision and commitment of line management, effective coordination between mega contractor/sub contractor with departmental staff, effectiveness of job hazard analysis and imposing penalty. He then announced the winners of the Industrial and Fire Safety Awards for the year 2010.

Industrial Safety Award		
Group	Group Title	Winner Units
I	Construction Units	No Award
II	Production Units (NPPs & HWPs)	Heavy Water Plant-Manuguru Tarapur Atomic Power Station 3&4
III	Production Units (Others)	Nuclear Fuel Complex (radioactive plants), Hyderabad
IV	Research Units / Other Low Risk Units	Indian Rare Earths Ltd. (OSCOM - Thorium Plant)
Fire Safety Award		
I	Operating NPPs & High Risk Units	Heavy Water Plant (Kota) Madras Atomic Power Station
II	Construction Projects & Low Risk Units	Variable Energy Cyclotron Centre (Kolkata)



(L to R: Shri S.S. Bajaj, Chairman, AERB; Shri G.M.E.K. Raj, Director General, Directorate General Factory Advice, Service and Labour Institutes (DGFASLI) and Shri R. Bhattacharya, Director, ITSD & IPSD and Secretary, AERB)

Shri G.M.E.K. Raj, Chief Guest of the function distributed the Industrial & Fire Safety Awards to the winners and released the compendium on Industrial and Fire Safety Statistics. In his address Shri Raj applauded the computation criteria of the awards

adopted by AERB and the detailed analysis carried out in the compendium. He informed about the National Safety Policy, declared by Hon'ble Finance Minister of India, in 2009 and the formation of National Innovation Cell by Secretary, Ministry of Labour wherein all industries can share their safe practices. He also re-emphasized on the importance of supervision and bringing to the notice of top management of any unsafe condition prevailing at the site, reporting of near misses and risk assessment in industries. Shri Raj once again congratulated the winners and stressed that continuous and sustained efforts as well as rigorous and vigilant approach is required to maintain the high safety performance. He also urged other units to compete so as to get awards in the coming years.

There were presentations from the award winning units on the measures adopted for improving the industrial safety in their units. The function concluded with a vote of thanks by Shri K. Ramprasad, Scientific Officer of Industrial Plants Safety Division of AERB.

## Official Language Implementation

AERB continued its efforts to ensure effective implementation of Official Language Policy and to increase use of Hindi in official work. AERB conducted a three day Hindi workshop from February 08-10, 2011 at V.S.Bhavan under the auspices of Joint Official Language Co-ordination Committee. Employees of DAE units (AERB, HWB, DCS&EM and DPS) located in Anushaktinagar actively participated.

World Hindi Day was organized on January 10<sup>th</sup>, 2011 at conference hall of Training School Hostel under the auspices of Joint Official Language Co-ordination Committee. Dr. S. P. Kale, Scientific Officer (H), BARC delivered a talk on "Sustainability of Mother Earth" in Hindi.



(L to R: Shri Zahir Hussain, AD(OL), AERB;  
Dr. R. K. Bajpai, TDD, BARC;  
Shri A. Ramkarishna, Chairman, OLIC, AERB;  
Shri V.M. Thomas, AERB and Shri S.M. Gaikwad, AERB)

Hindi talks were organized by Official Language Implementation Committee (OLIC) in AERB. First speaker, Dr. Anjali Kulkarni, Head, Medical OPD of BARC Hospital delivered a talk on "Diabetics - Symptoms & Prevention". The speaker highlighted on various aspects of Diabetes and provided tips to keep Diabetes in control. Second speaker Dr. R.K.Bajpai, Scientific Officer (F), Technology Development Division, Nuclear Recycle Group of BARC, Mumbai highlighted various aspects of "Permanent Disposal of Nuclear Wastes in the context of India". He also mentioned various techniques of "Permanent Disposal of Nuclear Wastes" in detail and informed the audience about the latest developments in this field. The talks received overwhelming response from DAE employees.

A total of thirty-five Safety Codes, Standards, Guides and Manuals have been published in Hindi as on March 31<sup>st</sup>, 2011.

## Discussion Meet on 'Review of Systems for Operating Experience Feedback'

A discussion meet on 'Review of Systems for Operating Experience Feedback' was organized during March 10 - 11, 2011. in AERB. The objective of this meet was to share the experience with the existing event reporting system, working of OEF system at NPPs established in accordance with AERB safety guide AERB/SG/O-13, review of external operating experience, low-level & near miss events. The meet was also aimed at obtaining experience with development and review of technical specifications for different type of NPPs and safety related experience during long shutdowns for en-masse coolant channel and primary heat transport feeder replacements, which will be helpful in similar activities in future. Establishment of formal experience feedback system for NPP projects was also discussed.

The meet was attended by eighty delegates from NPPs, NPCIL, BHAVINI, BARC, IGCAR, Heavy Water Board and AERB. Shri S.K.Chande, Vice-Chairman, AERB delivered the inaugural address. He stressed the need for establishing a system for continual assessment of the existing operating experience feedback programme at operating NPPs. Shri G.Nageshwara Rao, Director (Operations), NPCIL delivered the keynote address. He highlighted the systems established at NPCIL and its NPPs for proper utilization of internal and external operating experience and the resulting improvements in NPCIL plants. A total of thirty-three presentations were made by the various participants on the OEF practices being followed at various plants / organizations.

The discussion meet brought out that the operating experience feedback system has been working satisfactorily at all operating NPPs. The meet made suggestions for further improvements in event reporting for operating NPPs and establishment of formal system for feedback on events during construction, manufacturing and commissioning.

Operational experience is a valuable source of information for learning and improving the safety and reliability of nuclear installations. Safety significance of the deviations from normal operating conditions, events and significant events need to be assessed for taking remedial measures. Implementation of appropriate measures prevents re-occurrence of events and also reduces their consequences if they reoccur.

AERB guide SG/O-13 deals with the subject of 'Operating Experience Feedback System' that needs to be established at the operating Nuclear Power Plants (NPPs). The event reporting system for NPPs was formally established in 1991. In order to strengthen the operational experience feedback system, a new two-tier event reporting system was established in 2002. This system evolved based on the discussion meet organized in December 1999. During the fourth review meeting of the 'Convention on Nuclear Safety' held in 2008, review of the operational experience was recognized as one of the good practices in India.

Also, a presentation was made by Shri R.P. Gupta, Scientific Officer (F), NPSD on a proposal highlighting the need for establishing safety significant event reporting for the Nuclear Power Projects (SERP) based on the observations made during regulatory inspections and experience of projects safety review during construction and commissioning stages. The SERP proposal of AERB is being reviewed by the concerned agencies.

## AERB-RSD Information System (ARIS)

### AERB-RSD Information System (ARIS)

Anand Pinjarkar and S.A.Hussain, Radiological Safety Division, AERB

AERB has undertaken an e-Governance project to implement AERB-RSD Information System (ARIS), a web-based ICT (Information and Communication Technology) application for the automation and real time management of regulatory processes for various types of Radiation Facilities located across the country. The objective of the project is to enhance efficiency and transparency in the regulatory processes dealt by Radiological Safety Division (RSD) of AERB.

The ARIS is broadly constituted of two layers, namely Portal and Application. The ARIS Portal or Website shall cater to all the information and documents related to regulatory functions of the AERB for public viewing, whereas the ARIS Application will provide a medium for exchange of information among AERB and regulated entities. The ARIS Application will have two modules, namely Internet Interface Module (IIM) and Back Office Module (BOM) for providing Information Processing services to the users of Radiation Facility and AERB respectively.

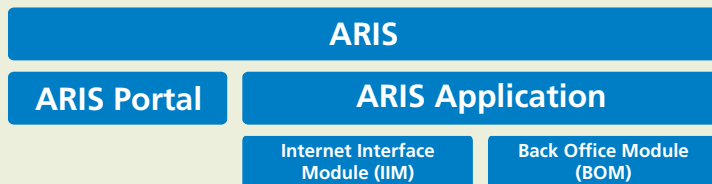


Figure 1: Overview of ARIS layers

### ARIS Portal

The website of AERB is not only accessed by the regulated entities (radiation facilities) under its purview but by the general public and other stakeholders such as other GOI organizations, PSUs and Private sectors for information. Keeping in view of the above, the ARIS will provide a web-link to its Portal through AERB's website and facilitate the following:

1. Access to regulatory documents such as Codes, Guides, Manuals and Public Notifications related to regulatory requirements of AERB
2. Enhance public awareness through ARIS portal, which will have easy navigation, guidelines with illustrations, information on Safety Awareness program, feedback reporting, FAQs and search mechanism for better information dissemination
3. From ARIS portal, the validity of AERB consent shall be verified through unique Consent Number given by AERB

### Internet Interface Module (IIM)

The IIM of ARIS will establish the medium for exchanging information among AERB and the users of Radiation Facility. This module will be accessible only by the registered users of Radiation Facilities through internet. These users will be given with username and password for secure access to IIM. The IIM will facilitate the following:

1. Submission of on-line application through e-forms for getting regulatory clearances
2. e-forms for online submission of safety status reports and other information as per the regulatory requirements
3. Track the processing status of their submitted applications
4. Obtaining auto-notification through email/SMS for acknowledgement of application, issuance of Licence or regulatory clearance and issuance of any letter by AERB

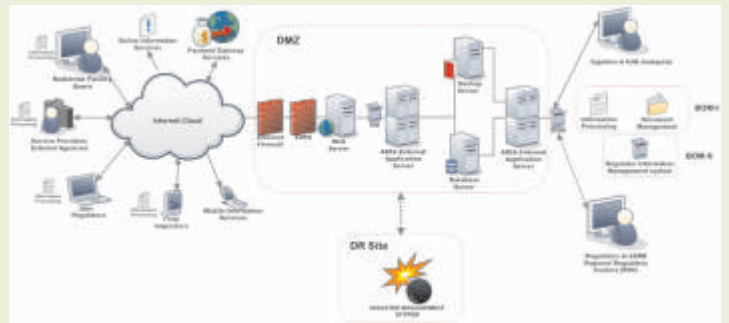
5. Create user profile and manage master data for quick and easy filling of e-forms
6. Manage the history of on-line applications and safety status reports submitted to AERB
7. Incident Reporting for any unusual occurrence related to radiological safety
8. Make payment of Licence fee (as proposed in future) through secure payment gateway

### Back Office Module (BOM)

The BOM of ARIS will provide platform for AERB personnel to carryout core regulatory activities with the capability to bring complete automation in entire regulatory process. This module will be accessible to the users of AERB and facilitate the following:

1. Improve regulatory information collection through e-forms
2. Improve data validation and authentication process through on-line checks
3. Ensuring data consistency and reliability at time of scrutiny and helping in review process time reduction
4. Improve internal office operational efficiency through tracking mechanism, discussion forum, auto-alerts and reminders for pending tasks and dashboards for higher management to keep eye on operational performance of AERB personnel
5. Enable faster and efficient interactions with radiation facilities while dealing with users and public at large with transparency perceived at all levels
6. Manage centralized data repository and generate standard and ad-hoc report from database for better decision making
7. Manage life cycle of various documents generated in regulatory process through Document Management System (DMS)
8. Established interoperable and easy contact with Regional Regulatory Centre (RRCs) of AERB and other regional regulatory agencies such as Directorate of Radiation Safety (DRS) for active exercise of regulations
9. Provide access to regulatory information from the site of inspection through internet

The ARIS will be equipped with hardware infrastructure placed at AERB datacenter to provide 24x7 data continuity operation. AERB is also establishing disaster recovery data centre for this project. The information security of the system shall be ensured through layered and diverse protection mechanism (Defense in Depth). The overview of the typical structure of ARIS is shown in the indicative diagram below:



The work order for implementation of ARIS was placed on 08/08/2011. The project is expected to be implemented over a period of 12 months from the date of acceptance of work order.

## Motivation for Radiation Protection

### Motivation for Radiation Protection

P.S.Nair, Operating Plants Safety Division, AERB

#### 1. Introduction

The success of radiation protection programme in a nuclear facility rests on the organizational culture and the attitude of its people at all levels. The quality, honesty and authenticity in all aspects of the utility's safety management are vital to it. The organization of the nuclear facility that provides its workers with services, tools and devices that satisfy their safety requirements should more importantly offer knowledge and motivation for safety on a continuous basis.

The effectiveness of Radiation Protection programme at nuclear facilities can be enhanced through Motivation Management with practically no additional expenses. The fundamental policy of Motivation for Radiation Protection should be to abolish the "I work, you protect" attitude commonly found in the radiation work. Infusing radiation safety awareness, culture and discipline should be an essential part of work force development in a nuclear facility. The workers are allowed to perform in an enriched and empowered role. The management should aim at reducing the dependence on the traditional policy of surveillance and routine compliance checks leaving this responsibility entirely to the concerned work force and individuals.

#### 2. Motivation for Radiation Protection (MRP)

MRP is a concept that encompasses all levels of the organization. The significant features of MRP are zeal for continuous improvement, ALARA accomplishment, prompt response, action based on facts, employee participation, safety culture and top management support. MRP has a safety-first orientation. The consideration for safety of workers and the general public living around the plant takes priority over the operational targets and constraints. The organization values worker confidence and public confidence in the production and the plant management above other priorities.

MRP is an approach for occupational radiation exposure control with everyone's participation and is a strategy inspired by the following principles:

- Total removal /enclosure of sources of radiation in the plant
- Meticulous planning to prevent incidents resulting in breach of system integrity
- Elimination of potential exposures
- Empowerment of workers with sense of ownership and safety consciousness
- Involvement of all departments and sharing of responsibility
- Involvement of all employees from top managers to front line workers
- Encouraging Radiation Protection through motivation

#### 3. Main Features of MRP

MRP is efficiency driven. Total control of exposures is realized with utmost efficiency for radiation protection services, procedures and infrastructure. The existing radiation protection facilities, design provisions, information and operating experience are fully utilized to maximize the radiation safety. The protection includes prevention, control of source, environment and improvement of conditions.

MRP is a culture. It has to be introduced, nurtured and led directly by the top management. Indeed, it should not be introduced out of compulsion, but by genuine desire for excellence. The system envisages total participation of all individuals, all departments and hierarchical levels. The workers are allowed to perform in a free and empowered role characterized by

- Requisite authorization and permit to perform the radioactive job
- Clear concept of the job sequence, associated hazards and protective measures gained through discussion, briefing, training or mock up exercise
- A vigilant and careful approach
- A sense of observation, consultation and reporting

#### 4. MRP Implementation

Implementation of MRP in a nuclear plant is not a onetime task. Its implementation is a step-by-step process and requires commitment, dedication and sense of belonging at all levels on a continuous basis. All personnel of the organization from top management to the lowest level should receive appropriate training. The training module should be carefully designed for all the hierarchical levels. An organization with MRP culture is more likely to be responsive to knowledge and learning process. Committed and well trained work force that participates fully in dose reduction activities constitute the successful MRP environment. Refresher training programmes and ongoing informal training sessions motivate the workers to control their doses and dose to others. Employees are encouraged to take more responsibility to handle incidents, take protective measures, communicate and make observations. An open cooperative culture has to be created by the management for introduction of MRP. Employees need to be made to feel that they are an important part in the organization, by including them in work planning and ALARA strategies. Management should create and maintain the internal environment in which people can become fully involved in achieving the dose targets.

A blue print for continuous improvement in all spheres of Radiation Protection function in the plant needs to be prepared based on objective data, root cause analysis of events, trend analysis and benchmarking through industry associations. Continuous improvement should be aimed at in the quality of services, materials used, decisions taken, procedures and tools used.

The results of MRP introduction can be monitored in terms of tangible parameters such as housekeeping, procedure adherence, unplanned exposures, unusual radiation conditions, collective dose, speed of response, number of events occurring, waste generation etc Ideally the exposure involved in any work should be zero. Every bit of dose received needs to be justified adequately.

#### 5. Health Physics Role

The Health Physics Unit (HPU) entrusted with the task of radiation protection monitoring and services have a very important role to play in installing MRP at the plant. It should be very sensitive and proactive to the worker protection and radioactive waste control. HPU should satisfy each functional section and each individual of their radiation safety requirements, services, information and ALARA measures and just-in time operating experience. The HPU should understand current and future needs of the workers meet the requirements and strive to exceed their expectations.

The radiological sampling should produce representative samples and monitoring accuracy should be up to the standard, preemptive surveys should be thorough. Any abnormal condition should be traced to its root cause to decide on the corrective action. Radiological condition beyond the normal levels is often a good sensor that indicates a process, equipment or system failure. Operating experience, knowledge of instrument behavior and effect of environmental factors should be considered in interpreting the radiological data. The person using the instrument should calibrate it and get the feel of it. View every job as a new job and involve from the planning to the post job review. Anticipate the worst and hope for the best.

## Fukushima Nuclear Accident: Brief overview of actions taken

### Fukushima Nuclear Accident: Brief overview of actions taken

Soumen Sinha<sup>1</sup> and Pariskhat Bansal<sup>2</sup>

<sup>1</sup>Industrial Plants Safety Division and <sup>2</sup>Operating Plants Safety Division, AERB

#### Overview of the incident

A massive earth quake and Tsunami hit Japan on March 11, 2011. The combined effect of earthquake and Tsunami led to a serious accident at the Fukushima Daiichi NPPs, resulting in severe damage to four out of six nuclear reactors located at the Fukushima Daiichi site. The operating NPPs (Units-1, 2, 3) at Fukushima-Daiichi got automatically shut down following the earthquake. The units-4, 5 & 6 were already in shutdown at the time of the event. The tsunami that followed about half an hour after the earthquake resulted in loss of off-site power and damage to the emergency power supply systems. Thus there was a complete loss of onsite and offsite power. The power could not be restored for a long duration and hence the plant operators could not achieve the essential safety function of maintaining adequate cooling of the radioactive fuel in the reactors and spent fuel storage pools. Inadequate cooling of the radioactive fuel led to overheating, resulting in series of developments including release of radioactivity and generation of significant amount of hydrogen from metal-water reaction. The hydrogen generated through metal water reaction exploded in the secondary containments of units-1&3. An explosion took place in the suppression chamber of unit-2. The loss of cooling to spent bay of unit-4 led to fire, damage to stored fuel & building and release of radioactivity.

#### Mitigation measures taken within the plant premises

In order to take control of the situation, the following mitigation actions were taken by Japanese officials:

1. Venting of containment to avoid hydrogen explosion in primary containment.
2. Measures were taken to cool the reactor by injecting borated sea water to core and containment.
3. Sea water spray from helicopter over the damaged containment.
4. Sea water injection to containment using special concrete trucks.
5. Efforts were made to restore offsite power at the affected units.
6. Subsequently borated freshwater injection to core and Spent Fuel Storage Pool was made using offsite power and separate pump.
7. Containment re-inerting with nitrogen was carried out for Unit no. 1
8. Controlled discharge of low active water to the sea was carried out and in parallel, scheme was management of high active water was formulated.
9. The removal of debris spread due to explosion was also initiated using remote tools.

### Emergency Measures taken in Japan

In view of the release of radioactivity from these NPPs, Japanese government, as part of emergency response, ordered evacuation of the population residing within 20 km radius of the plant and a 'stay indoors' advice for the population residing between 20 & 30 km radius of the plant. In addition, the following actions were taken:

1. Administration of stable iodine was carried out.
2. Continuous monitoring of the environment radiation levels and activity levels in the drinking water, milk and other food stuff was carried out for all prefectures.
3. Restriction on consumption of water, food, milk and leafy vegetables was applied whenever required.
4. Restriction on the export of the processed and un-processed food material was applied so as to stop spread of the contamination.
5. Public were subjected to thyroid monitoring and screening.
6. Enhancement of the emergency dose reference values from 100 mSv to 250 mSv in a graded manner for the occupational workers working at the affected site.
7. Measurements of radionuclide concentration at various depths in sea water and air were done

### Immediate actions taken by Atomic Energy Regulatory Board (AERB)

Post Fukushima Nuclear Accident in Japan, AERB has taken several proactive measures, which are as follows:

- A High Level Committee under the Chairmanship of Shri S. K. Sharma, Former Chairman, AERB consisting of experts from Central Water and Power Research Station, Indian Institute of Tropical Meteorology & IIT (Madras) apart from BARC, NPCIL & AERB was constituted to review
  - The capability of Indian Nuclear Power Plants to withstand severe earthquakes and other external events such as tsunamis, cyclones, floods, etc.
  - Adequacy of provisions available/to be made available to ensure safety in case of such events, both within and beyond design basis.

The Committee has sought plant specific details from the utility including available safety provisions to handle the Fukushima type scenario as well as other possible accident scenarios that could be initiated during external events. These details are undergoing critical review by working groups constituted by the Committee for specific areas of safety and for specific plant types. The findings of these groups will be discussed in the Committee to arrive at final recommendations.

Some of the areas identified for action or further investigation are brought out below:

- Adequacy of our current requirements and methods for specifying design basis external events.
- Re-assessment of individual plants to ascertain their capability to withstand currently defined design basis external events. Results of such exercises conducted during periodic safety reviews, will be revisited.

## Fukushima Nuclear Accident: Brief overview of actions taken

- Assessments for existing plants to understand the available margins beyond design basis flood and design basis earthquake, at which safety functions can still be performed.
- Experts have been asked to examine if we can also evolve guidelines for suggested margins or magnitudes to be considered for such beyond design basis external events.
- Mitigation measures for extended periods of station blackout and loss of UHS, hookup schemes using external mobile power packs and pumping systems which are being worked out by NPCIL will be examined by AERB for their adequacy.
- Review of severe accident management provisions and guidelines are also included in the scope of this Committee.
- The Apex Safety Review Committee of AERB, SARCOP convened an immediate meeting to take stock of the safety measures available at all the operating nuclear power plants to deal with such accidental conditions.
- Special inspections of nuclear power plants were carried out to review and assess the systems in light of Fukushima nuclear accident.
- An in-house Monitoring Cell has been constituted to continuously follow the events at Fukushima and to keep a close vigil on the radiation/contamination levels in Japan and its effect, if any, in India.
- Daily updates on AERB website
  - on radiation levels recorded by Indian Environmental Radiation Monitoring Network (IERMON) for 9 locations encompassing whole of India, on safety status of the Fukushima units, the occupational exposure to workers and radiation and contamination levels at different prefectures of Japan.
- A series of press releases were issued to keep the public informed.
- AERB coordinated with and advised the Food Safety and Standards Authority of India (FSSAI) regarding testing of food items for contamination and for taking a decision related to import of Food items from Japan.
- With respect to screening of passengers coming from Japan, AERB informed National Disaster Management Authority (NDMA) that there was no such requirement.

### Further Actions planned/ in progress

- Continuation of review of our Nuclear Power Plants in the light of the Fukushima accident through the AERB High level Committee and SARCOP.
- Monitoring the progress of activities in and around Fukushima NPPs subsequent to earthquake & tsunami that hit the east coast of Japan on March 11, 2011.
- Monitoring of the actions taken at NPPs in various countries consequent to accident at Fukushima NPPs so as to compare and benchmark our actions.
- Regulatory Inspection of all Indian NPPs in view of accidents at Fukushima NPPs.

- To carry out safety assessment of the on-going nuclear power projects namely Kakrapar Atomic Power Project unit 3 & 4 and Rajasthan Atomic Power Project unit 7 & 8 (PHWRs, 700 MWe each), Kudankulam Nuclear Power Project unit 1 & 2 (VVERs, 1000 MWe each) and Prototype Fast Breeder reactor (PFBR, 500 MWe) in the wake of accidents at Fukushima NPPs, Japan and to identify suitable changes for implementation, in short term and long term, in these plants.
- To carry out safety assessments, of spent fuel storage facilities of on-going projects (KAPP-3&4, RAPP- 7&8, KKNPP-1 & 2 and PFBR) in the light of Fukushima event.

### Environmental Impact on radiation leak in Japan

As per the various international reports and press releases of Japan's nuclear regulatory authority (NISA), it is observed that initially, after the accident, radioactive fallout was noted in some of the neighbouring prefectures of Fukushima. However, presently, radiation levels in all the neighbouring prefectures are below 0.1 microGy/h (i.e. background level). Restrictions on consumption of food items have been removed in most of the prefectures except in certain locations in Fukushima and nearby Ibaraki prefecture. Thyroid monitoring of general public was carried out. All measurement results were below Japan's established criteria.

### Impact on India

- Radiation levels at various locations in India are continuously monitored. No increase in gamma dose rate above the normal background has been noticed.
- Air, water, vegetable and goat thyroid samples were collected from various locations in India and monitored. No detectable activity has been observed in any of these samples.

## International Women's Day Celebration

A cultural programme was organized by lady employees of AERB on International Women's Day on March 8, 2011. This year was the centenary year, i.e., the 100th Women's Day Celebration. The Chief Guest of the programme was Smt. Suzie Bajaj and other invitees present were:



**AERB Women Staff and the invited Guests at the International Women's Day Programme**

Smt. Surekha Chande, Smt. Seema Gupta, Smt. Swati Gujrathi, Smt. Lakshmi Ramakrishna and Smt. Padma Srivasista. All the ladies actively participated in various competitions and games. Prizes were distributed to the winners. The success of the programme was in the team spirit shown by all the ladies who worked collectively to make it a memorable event.

## Fifth Review Meeting of Convention on Nuclear Safety

The Convention on Nuclear Safety (CNS) was adopted in Vienna on June 17, 1994 by a Diplomatic Conference convened by the International Atomic Energy Agency (IAEA). India ratified the Convention on March 31, 2005. Presently there are 72 Contracting Parties to the convention. India submitted second national report in August 2010 for the fifth review meeting of the convention to be held in April 2011. India received a total of 122 questions / comments from the various contracting parties. India reviewed the national reports of 15 countries and raised a total of 107 questions.

A thirteen member Indian delegation led by Shri S.S.Bajaj, Chairman, AERB, participated in the 5th Review Meeting of CNS from April 4-14, 2011, held at the IAEA Headquarters, Vienna, Austria. The delegation consisted of senior officers from AERB, Bhabha Atomic Research Centre (BARC), Indira Gandhi Centre for Atomic Research (IGCAR), Nuclear Power Corporation of India Ltd (NPCIL) and Permanent Mission of India in Vienna. 60 countries participated in the review meeting. India's presentation

was scheduled on 6th April and was well attended. India presented updates on nuclear safety regulation, advances in safety research including experimental programmes, safety status of nuclear power plants in India, safety aspects of the reactors under construction and commissioning including the Prototype Fast Breeder Reactor. The presentation also included our initial response to Fukushima nuclear accident in Japan and formation of a high level committee by AERB to see the capability of Indian NPPs to withstand external events and adequacy of provisions available to ensure safety in case of such events. Indian regulations and practices on issues thrown up by this accident, especially external events and severe accident mitigation were also presented.

The contracting parties appreciated the refurbishments, backfits & safety upgrades implemented in Indian NPPs as a result of Periodic Safety Reviews and operating experience feed back such as that following a tsunami in 2004.

## AERB Board Reconstituted

In exercise of the powers conferred by Section 27 of the Atomic Energy Act, 1962 (33 of 1962) and in supersession of this Department's Notification No. 18/1/7/2005-ER/1679 dated July 29, 2005, the Board of AERB was reconstituted on Aug. 9, 2011.

1.	Shri S.S. Bajaj	Chairman
2.	Shri S.K. Chande, Chairman, Safety Review Committee for Operating Plants (SARCOP)	Ex-Officio Member
3.	Dr. K.A. Dinshaw, Former Director, Tata Memorial Centre, Mumbai	Member
4.	Dr. K.V. Raghavan, Former Chairman, Recruitment & Assessment Centre, Defence Research & Development Organisation, Ministry of Defence, New Delhi	Member
5.	Prof. Devang V. Khakhar, Director, Indian Institute of Technology, Mumbai	Member
6.	Dr. Harsh K. Gupta, Panikkar Professor, National Geophysical Research Institute (NGRI), Hyderabad	Member
7.	Shri R. Bhattacharya, Director, Information & Technical Services Division & Industrial Plants Safety Division, AERB	Secretary

## Awards



Dr. Avinash U. Sonawane

Shri Avinash U. Sonawane, Scientific Officer (G), RSD, AERB has been awarded Ph.D.(Science) Degree in Physics for his thesis entitled, "Radiation Protection of Patients in X-ray Diagnostic Radiology in India" by the University of Mumbai, Maharashtra in July 2010. This work was done under the guidance of Dr. A.S.Pradhan, Former Head, Internal Dosimetry Division, Health Safety & Environment Group, BARC, Mumbai.



Dr. P. K. Dash Sharma

Shri P. K. Dash Sharma, Scientific Officer (F), RSD, AERB obtained Ph.D.(Science) Degree in Physics from University of Mumbai in September 2010, under the guidance of Dr. D.N.Sharma, Associate Director, Health Safety & Environment Group, BARC, Mumbai. The topic of his thesis was "Some Safety and Dosimetry Aspects of an Indigenously Developed Medical Linear Accelerator".

## New Appointment



Shri S. Krishnan

Shri S. Krishnan, Chief Administrative Officer has joined AERB on transfer from NFC, Hyderabad on June 27, 2011. Prior to his joining AERB, Shri Krishnan was working in various capacities in different DAE Units. He joined initially at MAPS, Kalpakkam on May 18, 1974. He has worked as Section Officer and Under Secretary (R&D) in DAE. He has also worked in Heavy Water Plant (HWP), Baroda, Heavy Water Board, HWP (Kota) and DPS, Mumbai.



Shri S. Duraisamy

Shri S. Duraisamy, an Electrical and Electronics Engineer from the 18th batch of BARC Training School, who was heading the Reactor Operations Division at BARC, has been appointed in AERB on transfer as Director, Operating Plants Safety Division on August 11, 2011. As Head ROD Shri Duraisamy was responsible for the safe and efficient operation of the research reactors at BARC Trombay. Shri Duraisamy is involved through various AERB committees in the design, commissioning and operational safety reviews of the PHWRs and PFBR for more than a decade.

### Personnel Joined (January - June, 2011)

Sr. No.	Name	Designation	Date of Appointment
1.	Shri Shyam Vyas	SO(E)	20/01/2011
2.	Smt. K.M. Shimja Bhanu	SO(D)	27/01/2011
3.	Shri Rakesh H. Jadhav	UDC	22/02/2011
4.	Smt. Rachna Sajesh	UDC	01/03/2011
5.	Shri K. Zahir Hussain	AD(OL)	14/03/2011
6.	Shri Shashi T. Dhunde	LDC	21/03/2011
7.	Shri V. Srinivasan	Assistant	07/04/2011
8.	Shri N.V. Adhinarayana Karibandi	SO(C)	06/06/2011
9.	Shri Gopal Grandhi	SO(C)	06/06/2011
10.	Smt. Shweta S.Sahasrabudhe	LDC	29/06/2011
11.	Shri Amiket P. Gupta	SO(C)	29/06/2011

### Personnel Retired (January - June, 2011)

Sr. No.	Name	Designation	Date of Retirement
1.	Shri R.K. Chugha,	SO(H), OPSPD	31/01/2011

## OBITUARY



(Late)

**Padmashri Dr. (Ms) K. A. Dinshaw**  
(Nov. 16, 1943 - Aug. 26, 2011)

Padmashri Dr. (Ms.) K. A. Dinshaw, the renowned Ex-Director, Tata Memorial Centre and Board member of Atomic Energy Regulatory Board, died on August 26, 2011 (Friday) at 0650 hrs. We, at AERB, deeply mourn the sudden demise of our esteemed Board Member.

Dr. Dinshaw was the Board Member of Atomic Energy Regulatory Board since July 2005. She was the recipient of Padmashri award from the Govt. of India in the year 2001. She was a pioneer in Oncology. Dr. Dinshaw will be remembered in AERB for her immense contribution in the deliberations of Board Meetings.

## Press Releases

In this period, six press releases were issued: one on the use of low strength radiation sources by Delhi University, four on the impact of Japan's Nuclear Sites in the aftermath of unprecedented earthquake and tsunami and one on the Industrial and Fire Safety Awards. These are available at the AERB's official website (<http://www.aerb.gov.in/cgi-bin/prsrel/prsrel.asp>).

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### Editor

Dr. R. M. Nehru, [nehru@aerb.gov.in](mailto:nehru@aerb.gov.in)

### Editorial Committee

Shri R. P. Gupta, Dr. C. Senthil Kumar,  
Smt. Manisha Inamdar, Shri Soumen Sinha,  
Shri K. Ravi, Smt. Sharmin, and Shri Zahir Hussain