Website: http://www.aerb.gov.in

ISO - 9001 : 2008 Organisation
Vol. 23, No. 1
January - June, 2010

AERB Newsletter

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.

CONTENTS

From the Chairman's Desk

AERB witnessed a change in the leadership during this reporting period. I am pleased to share some of my thoughts after taking over from Shri S. K. Sharma who laid down the office of Chairman, AERB on January 14, 2010. Shri Sharma laid the groundwork and guided this organization through many challenges with profound care and affection using his immense experience and wisdom. Through his efforts he has raised the stature of AERB by several notches in the true professional sense where stability and delivery are being achieved. We, at AERB express our sincere gratitude to him for the yeoman service rendered to this Institution.

This period saw the unfortunate incident involving high radiation exposures in metal scrap market at Mayapuri, Delhi that was reported to AERB on April 7, 2010. A team of officials from AERB, DAE, BARC, BRIT, and National Disaster Response Force (NDRF) visited the spot, contained the exposure and successfully recovered the radioactive sources responsible for the above exposure. Following this incident, AERB has initiated several actions to prevent such occurrences. A brief report covering the incident and corrective actions initiated is given in this Newsletter.

During this reporting period as a part of regulatory activities of AERB, various clearances for nuclear power projects were given. Heralding the beginning of site work for new generation of PHWRs of 700 MWe rating, 'Siting Consent' for Rajasthan Atomic Power Project units of 7 & 8 (RAPP-7&8) and 'Clearance for Site Excavation' for Kakrapar Atomic Power Project (KAPP-3 & 4) were given.

Clearances were also given for commissioning for Rajasthan Atomic Power Project unit of 6 (RAPP-6) in various stages covering Heavy Water filling to PHT system, Bulk Addition of Heavy Water to Moderator System, First Approach to Criticality, Low Power Phase-B Physics Tests, Phase-C Commissioning (Synchronization of TG set and operation of Plant up to 50% of Full Power) and raising reactor power up to 90% Full Power.

Licence was granted for operation of Electron LINAC in Industrial and Medical Accelerator (IMA) Building at Raja Ramanna Centre for Advanced Technology (RRCAT) upto 10 MeV energy and 10 kW Power. Licenses for Heavy Water Board's diverse activities included Renewal of Operation of Heavy Water Plant at Thal, Authorizations for Commissioning & Operation of "Versatile Solvent Production Plant (VSPP)" at Heavy Water Plant, Talcher, Commissioning and Operation of "Elemental Boron Facility" at Heavy Water Plant, Manuguru, Commissioning of Heavy Water Clean-Up Facility (HEWAC) at HWP, Kota and Commissioning of Tri-Butyl Phosphate Facility at Heavy Water Plant, Baroda.

Over the years, AERB has been pursuing with various State Governments to set up State-Level Radiation Safety Authorities such that an effective control on medical diagnostic X-ray installations could be realized. During this period, AERB signed a Memorandum of understanding (MoU) with the Government of Mizoram on March 25, 2010 and with the Government of Madhya Pradesh on May 25, 2010 for setting up Radiation Safety Agency and Directorate of Radiation Safety respectively.

As a part of safety promotional activities, the Industrial and Fire Safety Award Function for the year 2009 was held on April 19, 2010 in AERB and the awards were distributed to the winning units. A report is included in this Newsletter.

Shri. S. E. Kannan, Director, Safety Research Institute (SRI), Kalpakkam retired on superannuation on May 31, 2010. Shri V. Balasubramaniyan, Scientific Officer (H) from IGCAR and Mechanical Engineer from 28th batch of BARC Training School, Mumbai took over as Head, Safety Research Institute with effect from June 1, 2010.

Dr. Om Pal Singh, Secretary, AERB and Director, Information and Technical Services Division retired on superannuation on July 31, 2010. Shri. R. Bhattacharya, Director, Industrial Plants Safety Division (IPSD) of AERB took over charge from Dr. Om Pal Singh as Secretary, AERB and Director, ITSD. He will continue as Director, IPSD. We, at AERB express our sincere gratitude to Shri Kannan and Dr. Singh for their outstanding services to AERB.

Three feature articles, one on "ICRP 60 and ICRP 103: A Bird's Eye View", second on "Beach Sand Minerals Facilities: the dawn of regulation" and the third on "Revision of Effluent Discharge Limits for NPPs" are included in this issue of AERB Newsletter.

(S. S. Bajaj)

Safety Review and Regulation

AERB Board Meetings

The 100th and 101st meetings of AERB Board were held on January 7 and April 23, 2010 at AERB, Niyamak Bhavan, Mumbai. In the 100th meeting, the Board gave clearance for first approach to criticality of RAPP-6. The Board was briefed about the salient design and safety features of 700 MWe PHWRs (KAPP-3&4) which is scaled up version of 540 MWe PHWR (TAPS-3&4). To commemorate the 100th meeting of the Board, Secretary, AERB presented the history of the constitution of the Board and the important decisions taken by the Board during the last 25 years. This meeting being the last meeting of the Chairman, Shri S. K. Sharma, the members bid a fond farewell to the Chairman and honoured him for his outstanding services to AERB. The meeting was also attended by Shri S. S. Bajaj, Chairman designate of AERB. The Board members took this opportunity to welcome Shri S. S. Bajaj.

In 101st meeting, the Board gave clearance for siting of RAPP-7&8. The Board also approved the amendment to the Para 4.4.1(a) and 4.5.1 of AERB Safety Code on Industrial Radiography (AERB/SC/IR-1/2001) in respect of minimum eligibility qualification for trainee industrial radiographers.

In this meeting, the Board was also briefed about the recent incident of radioactive material discovered in scrap dealers' shops in New Delhi.

AERB Board Meeting in Progress in Niyamak Bhavan-A
(L to R: Dr. Om Pal Singh, Shri S. K. Chande, Shri S. K. Sharma, Prof. J. B. Joshi, Dr. K. V. Raghavan, and Dr. K. A. Dinshaw)

Shri S. K. Sharma, Outgoing Chairman, AERB receiving a Silver Plaque on the occasion of his Farewell organized by AERB Staff
(L to R: Shri S. K. Chande, Vice-Chairman, AERB, Dr. S. Banerjee, Chairman, AEC, Shri S. S. Bajaj, Chairman, AERB and Shri S. K. Sharma, Outgoing Chairman, AERB)

Consents Issued
(January – June 2010)

- Renewal of licence for Operation of Electron LINAC at IMA Building in RRCAT up to 10 MeV energy and 10 kW Power. (January 8, 2010).
- Authorisation for Commissioning of 'Technology Demonstration Plant (TDP)' at RCF, Chembur, Mumbai. (January 12, 2010).
- Licence renewal of Heavy Water Plant, Thal (January 14, 2010).
- Approval for Commissioning and Operation of "Elemental Boron Facility" at Heavy Water Plant, Manuguru (January 18, 2010).
- Authorisation for Commissioning of Heavy Water Clean-Up Facility (HEWAC) at HWP, Kota (January 20, 2010).
- Authorisation for Commissioning of 'Oxide Production Facility & Sponge Production Facility' of Zirconium Complex (ZC), Pazhayakayal (February 10, 2010).
- Renewal of Authorisation of KAPS upto December 2010 (March 30, 2010).
- Consent for Commissioning & Operation of "Versatile Solvent Production Plant (VSPP)" at Heavy Water Plant, Talcher (March 30, 2010).
- Consent for Commissioning of Tri-Butyl Phosphate Facility at Heavy Water Plant, Baroda (March 31, 2010).
- Clearance for raising reactor power up to 90% FP, and subsequently up to 100% Full Power for RAPP-5.
- Clearance for Heavy Water filling to PHT system, Bulk Addition of HW to Moderator System, First Approach to Criticality, Low Power Phase-B Physics Tests, Phase-C Commissioning (Synchronization of TG set and operation of Plant up to 50% of Full Power), and raising reactor power up to 90% Full Power for RAPP-6.
- Clearance for Site Excavation for KAPP-3&4 (January 15, 2010).
- Siting Consent for RAPP-7&8 (May 24, 2010).

Safety Review and Regulation

Regulatory Inspections (January – June 2010)	
Unit	No. of Inspections
Nuclear Facilities	
RAPP 7&8, KAPP 3&4, KKNPP, DFRP, IFSB	1 each
PFBR, RAPP 5&6	2
MAPS-1&2, RAPS-1&2, RAPS-3&4, NAPS-1&2, KAPS-1&2, TAPS-1&2, TAPS-3&4, KGS-1&2, KGS-3, FBTR, KAMINI, ITG	1 each
UCIL, NFC-Hyderabad, NFC (ZC)-Pazhayakayal, TDP-Chembur, VECC, ECIL	1 each
IREL-Udyogamandal, Manavalakurichi & OSCOM	1 each
Non-DAE Beach Sand Minerals Facilities	6
HWPs-Thal, Manuguru, Baroda, Hazira, Tuticorin	1 each
Special Inspections	
RAPS-6, RAPS-5&6, KGS-2 & TAPS-4	1 each
KKNPP, PFBR, DFRP, FRFCF, UCIL (TMP), VECC Medical Cyclotron, RRCAT (Special inspections on Industrial Safety)	16
Industrial Radiation Facilities	
Industrial Radiography facilities	20
Gamma Irradiators	2
Nucleonic Gauges	9
Medical Radiation Facilities	
Nuclear Medicine	17
Diagnostic X Rays	28
Radiotherapy Facilities	5

New Minimum Eligibility Qualification for Trainee Industrial Radiographer

The AERB Safety Code on Industrial Radiography (AERB/SC/IR-1/2001) has been amended relating to minimum eligibility qualification for Training programme for industrial radiographers.

The new approved requirement is "10+2 pass in science subject with mathematics in 10th standard or equivalent" in place of "10+2 pass in science stream with physics and mathematics". The amendment has been approved considering that the nature of job of Industrial Radiographer, does not require knowledge of mathematics at plus 2 level and the proposed qualification is adequate as per present standards and contents of the course for the trainees. This modification will also improve the availability of the qualified Industrial Radiographers.

New Safety Documents Published

The following new documents were published by AERB.

1. Revised Safety Code on 'Design of Pressurised Heavy Water Reactor Based Nuclear Power Plants' (AERB/NPP-PHWR/ SC/D (Rev. 1))
2. Revised Safety Standard on 'Fire Protection Systems for Nuclear Facilities' (AERB/NF/SS/FPS (Rev. 1))
3. Safety Guide on 'Seismic Qualification of Structures, Systems and Components of Pressurised Heavy Water Reactors' (AERB/NPP-PHWR/SG/D-23)
4. Safety Guide on 'Computer Based Systems of Pressurised Heavy Water Reactors' (AERB/NPP-PHWR/SG/D-25)
5. Safety Guide on 'Decommissioning of Nuclear Power Plants and Research Reactors' (AERB/NPP&RR/SG/RW-8)
6. Safety Guidelines on 'Uranium Oxide Fuel Fabrication Facilities' (AERB/FE-FCF/SG-3)

Press Releases

During the period between January and June 2010, a total of six press releases were issued; five were on the incident of radiation exposure in scrap dealer shops at Mayapuri industrial area in New Delhi. More information on these press releases can be found at AERB website. (http://www.aerb.gov.in/cgi-bin/prsrel/prsrel.asp)

Human Resource Development

Recruitment

As part of the XI Plan Expansion Project, one hundred and three Scientific & Technical posts have been sanctioned for AERB. Amongst the applications received in response to AERB advertisement issued in 2009, the short-listed candidates were interviewed and 41 candidates from various streams of Science and Engineering were empaneled for appointment to the post of SO (D)/SO (E) and TO (D)/TO (E). Some of them have already joined and some are in the process of joining AERB. Apart from these, two officers in the grade of SO (D) joined AERB on transfer from BARC/IGCAR. These appointments were made against the newly sanctioned posts.

A special recruitment drive to clear backlog vacancies reserved for SC/ST/OBC/Physically Handicapped candidates was also conducted during the period. A total of five candidates belonging to OBC/SC/PH joined AERB in the grade of SO(C) during the period.

Annual Training Calendar

AERB Annual Calendar for the Training Activity (April 2010-March 2011) was finalized and issued. The Training Activities during 2010-11 would include Orientation Course for Regulatory Processes (OCRP-2010) for the newly inducted Scientific and Technical Staff, Refresher Courses to all AERB staff on selected topics, Technical Talks by In-house officers, Orientation Course for DAE Fellows (OCDF), Courses on Continued Education Programme (CEP) and deputation of AERB officers to NPC units for On-the-Job Training (OJT). The technical talks are being organized on regular interval.

AERB Technical Talks

Technical talks were arranged on the following topics.

A) Fuel Management Aspects of Pressurized Water Reactors (PWR) by Shri A. Ramakrishna, ITSD, AERB on March 4, 2010.

B) ASME Sec. IX-Welding Qualifications by Shri P.K. John, Technology Development Group, NPCIL on May 19, 2010.

Safety Research Programme (SRP)

The Committee on Safety Research Programme (CSRP) held its 45th meeting during the period. Eleven new project proposals were considered for funding. The Committee after detailed deliberations recommended approval of grant-in-aid for 5 project proposals (Table-1) Two on-going projects were approved for renewal (Table-2).

Table 1: New Projects Sanctioned

Sr. No.	Project Title	Principal Investigator	Organization
1.	Evaluation and Inter-Comparison of QA Measurements in Radiation Oncology	Shri C. Ramakrishna Rao	MNJ Institute of Oncology, Hyderabad
2.	A Study on Radioactivity in Phosphogypsum based Building and Construction Materials and Indoor Radon Inhalation Dose Estimate in Tamil Nadu	Dr. P. Shahul Hameed	J.J College of Engineering & Technology, Thirchy
3.	Numerical Stimulation of the Response of Nuclear Containment subjected to Aircraft Crash	Prof. Pradeep Bhargava	IIT-Roorkee, Roorkee
4.	Influence of Stiffness of the System and Heat Input Waveform on Transient CHF in Horizontal Channels under LPLF Conditions	Dr. S.V. Prabhu	IIT-Bombay, Mumbai
5.	Development of a 1-D Thermal Hydraulic Code for Computation of Unsteady Steam-Water Flow and Supercritical Water Flow in Horizontal and Vertical Channel Type Reactors	Prof. Man Mohan Pandey	IIT-Gandhi Nagar

Table 2 : Renewal of On-going Projects

Sr. No.	Project Title	Principal Investigator	Organization
1.	Evaluation of Patient Specific Dose for Optimised X-ray Diagnostic Imaging System in a Rural Setup	Dr. V. S. K. Vijaykumar	MGMMT, Bhimavaram, Andhra Pradesh
2.	Enhancement of Durability of Concrete Structures using Microbes	Prof. A. Mukherhjee	Thapar University, Patiala, Punjab

Reporting On ...

1.0 AERB signs two MoUs with the State Governments

Currently, there are more than 40000 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. Accordingly, AERB had earlier signed a Memorandum of Understanding (MoU) with the Government of Kerala and established the Directorate of Radiation Safety (DRS) so as to carry out inspection of medical diagnostic X-ray installations in Kerala.

In this regard, AERB has requested all the State Governments to set up DRS. Consequently, AERB signed a MoU with the Governments of Mizoram and the Government of Madhya Pradesh respectively.

(A) MoU between the Government of Mizoram and AERB

Memorandum of understanding was signed between the Mizoram Government and Atomic Energy Regulatory Board on March 25, 2010 at Aizawal, Mizoram. AERB was represented by Dr. Ompal Singh, Secretary, AERB while Shri Lalrotluanga, Joint Secretary, Health and Family Welfare Department, Government of Mizoram represented the State Government during the signing of the MoU. As per the MoU, the State government will set up Radiation Safety Agency (RSA) in Aizawal and will work as per the rules and procedures set up by AERB.

(B) MoU between the Government of Madhya Pradesh and AERB

Memorandum of Understanding was signed between the Government of Madhya Pradesh and Atomic Energy Regulatory Board on May 25, 2010 at Bhopal, Madhya Pradesh. AERB was represented by Shri V.S. Iyer and Shri Rajoo Kumar. Dr. Ompal Singh, Secretary, AERB signed the MoU on behalf of AERB while Shri Arun Tiwari, Secretary, Health and Family Welfare Department, Government of Madhya Pradesh represented the State Government during the signing of the MoU. The Directorate of Radiation Safety (DRS-MP) has already been formed with Shri J.P. Sharma, Medical Physicist and RSO, Gandhi Medical College, Bhopal as the Director. The constitution of the DRS is yet to be finalized.

2.0 One Day Meet on Regulatory Requirements in Layout Plan Approval for Radiotherapy Facilities

A "One Day meet on Regulatory Requirements in Layout Plan Approval for Radiotherapy Facilities" was conducted on March 4, 2010. Twenty-four participants comprising radiation shielding experts, architects and managers participated from various companies supplying Radiotherapy Units in the country. Most of these participants were involved in either guiding the user institution or designing of radiotherapy plans on behalf of the user institutions. It was noticed that the plans submitted to AERB for approval of the radiotherapy installations had inadequate inputs. This resulted in multiple submissions, increase in workload for AERB and delay in the project of the concerned institution. It was observed that more than 70% of the plans are prepared either in consultation or by the suppliers of the Radiotherapy Units. Thereby, it was decided to address the issues to the suppliers of the Radiotherapy Units.

Shri S.A. Hussain, Head, RSD, AERB delivered the introductory speech and Dr. Y.S. Mayya, Head, RPAD, BARC delivered the remarks about the workshop. Dr. Om Pal Singh, Secretary, AERB, delivered the inaugural address and emphasized the corrective measures in submission of the layout plan, which would save time and cost. The Meet had a series of lectures on various aspects of planning of radiotherapy installations and a panel discussion on the issues and their resolution related to layout plan.

3.0 Radiation Safety, Regulatory and Dosimetry Aspects in the Gamma Radiation Processing Facilities

A special safety meet on "Radiation Safety, Regulatory and Dosimetry Aspects in the Gamma Radiation Processing Facilities (GRAPF)" was organized by AERB on March 29, 2010 in AERB Auditorium. The main objective of the meeting was to provide an opportunity for the Radiation Safety Officers and Operators of the GRAPFs to interact and discuss with the regulatory authority their radiation safety related issues and to appraise them with revised regulatory procedures established by AERB for approval of food dosimetry. Dr. Om Pal Singh, Secretary, AERB; Dr. A. K. Kohli, Chief Executive, BRIT, Shri S. A. Hussain, Head, RSD attended and addressed the participants.

Special meet on "Radiation Safety, Regulatory and Dosimetry aspects in Gamma Radiation Processing Facilities (GRAPF)"

(L to R: Dr. Om Pal Singh, Secretary, AERB, Shri A U Sonawane, RSD, Shri S A Hussain, Head, RSD and Dr. A K Kohli, Chief Executive, BRIT)

About 40 participants which included facility-in-charges, radiological safety officers, operators, senior representatives of management from various operating gamma radiation processing facilities, and experts from Divisions/Sections of BARC, BRIT and AERB attended this special meet. Presentations were made by experts from these Divisions/Sections and covered regulatory, safety and dosimetry aspects of GRAPFs. The RSOs of all the GRAPFs also made brief presentations on the operational safety status of their gamma radiation processing facilities during the meet. During the panel discussion, feedback session and deliberations, participants requested to curtail the time period for inter-comparison of the dosimeters during dosimetry studies, for issuance of certificate approval and the licence for irradiation facility.

4.0 One Day Awareness Programme on Radioactive Contamination in Steel Products

In the last four years, cases of radioactive contamination in steel products exported by Indian steel manufacturers to some countries have been reported. On investigation, it has been found that the

steel products were made out of steel produced in foundries where imported metal scrap was used. The scrap is suspected to contain radioactive material. 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 programme, AERB conducted a one-day awareness programme on radioactive contamination in steel products for the steel manufacturers/suppliers in the western region on March 30, 2010 in AERB. The programme was inaugurated by Dr. Om Pal Singh, Secretary, AERB, with an introductory address by Shri S.A. Hussain, Head, RSD, AERB. The need on prevention of radioactive contamination of steel and the role of Indian Steel Manufacturers in that was emphasized.

The programme started with an introductory lecture on the radioactive contamination in steel products by Shri R.K. Singh, RSD, AERB and followed by short presentations by the participants about their experiences on how they could tackle the contamination problem, their present strategies and their expectations from AERB for total elimination of this problem.

5.0 One Day Meet on 'Regulatory Requirement for Nuclear Medicine Radioisotope Suppliers in India'

The above programme was conducted on March 12, 2010 at AERB. Representatives of eight suppliers of radiopharmaceuticals to various Nuclear Medicine centres in India attended the meet. Dr. Om Pal Singh, Secretary, AERB inaugurated the Meet. In his address, Secretary AERB discussed about the present regulation and its importance to meet the radiation safety criteria from the supply of radioisotope in nuclear medicine practice. The participants were apprised of the regulatory requirements to be adhered to during the supply of the radioisotopes to various nuclear medicine centres in India. There were presentations from the participants and discussions on problems faced by the suppliers. The participants were informed that regulations implemented by AERB were from radiological safety point of view and any other regulations from relevant statutory government agencies should be adhered to by the suppliers.

6.0 Special Meet on 'Regulatory Procedures for Safety and Security of Industrial Radiography Sources in India'

A Special Meet was organised on the above subject for radiography companies, contract awarding agencies and supplier / manufacturer of radiography devices / sources on Thursday, 22nd April 2010 at Anushaktinagar, Mumbai. The objective of the meet was to inform the participants (i) current regulatory procedures (ii) safety and security issues (iii) familiarization with revised regulatory protocols and forms (iv) provide an opportunity to industrial radiography agencies to interact with AERB / BRIT / BARC on these subjects and (vii) deliberate over the regularity requirements for safe handling of radiography sources, and to exchange experience on their use.

Shri S.S.Bajaj, Chairman, AERB inaugurated the Meet. Dr. A.K.Kohli, Chief Executive, BRIT was the Chief Guest of the function. About 400 participants from different parts of the country participated in the Special Meet. Members of AERB and BRIT delivered lectures on various topics. Following the lectures, a feed-back session was organized where various issues were discussed at length.

7.0 Industrial & Fire Safety Award Function for the Year 2009

Atomic Energy Regulatory Board is administering the provisions of the Factories Act, 1948 in the Units of Department of Atomic Energy under its purview. In order to promote industrial and fire safety in DAE units, AERB constituted the Industrial & Fire Safety Award Scheme in 1992 and 1993 respectively. The Industrial and Fire Safety Award Function for the year 2009 was held on April 19, 2010 at Niyamak Bhaavn, AERB.

Dignitaries on the Dias at the Industrial and Fire Safety Award Function for 2009

(L to R): Shri S. K. Chande, Vice-Chairman, AERB; Dr. A. K. Chakrabarti, Director-General, DGFASLI (Chief Guest) and Shri R. Bhattacharya, Director, IPSD, AERB

Dr. A.K. Chakrabarti, Director General, Directorate General Factory Advice Service and Labour Institutes (DGFASLI) was the Chief Guest of the Function. Dignitaries from BARC, NPCIL, HWB, IREL, IGCAR and other DAE units were present along with staff of AERB.

Shri S. K. Chande, Vice Chairman AERB 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. He suggested the adaptation of a graded approach similar to orange dot and green dot qualification practiced in nuclear power plants for radiological safety and appealed to the plant authorities to take concerted efforts to ensure that the industrial and fire safety in DAE units is at par with the radiological and nuclear safety standards.

Dr. A.K. Chakrabarti, 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 Dr. Chakrabarti applauded the computation criteria of the awards adopted by AERB. He highlighted the socio-technical framework adopted by behavioral scientist and organizational analysts and its applicability in nuclear industries. The talk delivered by Dr. A. K. Chakrabarti is presented elsewhere in this Newsletter.

There were presentations from the award winning units on the measures adopted for improving the industrial safety in their units. The function concluded with vote of thanks presented by Shri R. Bhattacharya, Director, Industrial Plants Safety Division of AERB.

8.0 International Workshop on 'New Horizons in Nuclear Reactor Thermal Hydraulics and Safety'

The International Workshop on New Horizons in Nuclear Reactor Thermal Hydraulics and Safety was organized in AERB, Mumbai from Jan 7-8, 2010, with co-operation of Board of Research in Nuclear Sciences (BRNS). Recent developments and future challenges in various areas of Nuclear Reactor Thermal Hydraulics and Safety were discussed in the workshop. Dr. S. K. Gupta, Director, Safety Analysis and Documentation Division, AERB made opening remarks. Shri S. S. Bajaj, Chairman-designate, AERB delivered the presidential address. Prof. S. P. Sukhatme, Former Chairman, AERB delivered the inaugural address. About 25 key note addresses were delivered by international and national experts working in reputed organizations and universities in this field. Shri. R.S. Rao Organizating Secretary of the workshop thanked all keynote speakers and participants.

INDUSTRIAL SAFETY AWARD		
Group	Group Title	Winner Units
I	Construction Units	No Award
II	Production Units (NPPs & HWPs)	Kakrapar Atomic Power Station 1&2 Rajasthan Atomic Power Station 1&2
III	Production Units (Others)	No Award
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) Kakrapar Atomic Power Station 1&2
II	Production Units (NPPs & HWPs)	Indira Gandhi Centre for Atomic Research (Kalpakkam)

The objective of the workshop was to discuss the recent developments and future challenges in various areas of nuclear reactor thermal hydraulics and safety especially on:

- The advancement and dissemination of knowledge of thermal hydraulics and safety as they pertain to the steady state design, transient performance and accident behaviour of nuclear power plants.
- Dissemination of the state-of-the-art thermal hydraulics and safety information on current and future generation of nuclear reactors.
- Promote effective interchange of thermal hydraulics and safety information among the many professional groups and organizations participating in the development and application of nuclear reactor technology.

The workshop concluded with a panel discussion moderated by Prof. B. R. Sehgal, Stockholm, Sweden. Dr. N. I. Kolev, Siemens, Germany, Prof. Micheal Podowski, RPI, USA, Prof. U. N. Gaitonde, IIT-Bombay, India,Shri G. Vaidyanathan, IGCAR, India, Shri S. P. Dharne, NPCIL, India were the panelists. The discussion focused on International collaboration in the area of nuclear thermal hydraulics and safety.

9.0 Discussion Meet on 'Setting Effluent Discharge Limits for Indian NPPs'

AERB organized a one-day Discussion meet on "Setting Effluent Discharge Limits For Indian NPPs" on March 29, 2010 in AERB. Nominated members from NPCIL and its site units, BARC and AERB participated. The main aim of the Discussion Meet was to explain to the stake holder participants on a set of revised and harmonized discharge limits issued by AERB as authorized limits (Tech spec limits) with effect from Jan. 1, 2010 for NPPs. Shri.S.K.Chande, Vice Chairman, AERB inaugurated the meet. Details of the revised discharge limits and its advantages are covered separately in an article in this issue.

The gaseous and liquid radioactive effluent discharges to the environment from the NPPs in the country are governed by relevant Technical Specification Limits approved by AERB. These limits are based on the criterion that dose to the members of the public due to the release of effluents shall be well below the ICRP/AERB effective dose limit of 1 mSv/y for the public and were established when the nuclear power industry was in its initial stages of evolution. In view of considerable operating experience gained with regard to effluent discharges, it was felt necessary to revise the technical specification limits to further optimize the discharges from the NPP sites. This methodology and details of harmonized limits were discussed in this discussion Meet.

10.0 Recent Changes in Safety Requirements for Nuclear Power Plants

One of the mandates of Atomic Energy Regulatory Board (AERB) is to lay down safety documents such as safety codes that prescribe the minimum requirements that shall be fulfilled for assurance of safety. One of such safety code was issued in 1988. This code was written based on sound practices in vogue at that time and the technology of that era. Over the years, new technologies have been evolved, new safety requirements have emerged and new practices are being implemented.

Considering these, the operation safety code was revised to include new sections in the code such as operational safety experience feedback, plant life management and probabilistic safety assessment. The section on radioactive waste management in the code has been deleted and a cross reference is made to AERB code on 'Management of Radioactive Waste'. In the section

on plant life management, considerations for extension of operation beyond design life are covered. Requirements for probabilistic safety assessment have been introduced. Feasibility for safe decommissioning and subsequent site remediation are recommended for consideration in design.

The revised quality assurance code has been restructured. A new section on 'Process Implementation' has been added to specify the requirements for managing many processes in various stages of the plant. The explicit coverage on documentation and records in the existing code has been deleted and merged as part of the requirements of generic processes, thus shifting the emphasis from 'documentation' in the existing code to 'performance' in the revised code.

The requirement for minimum Exclusion Zone (EZ) around NPPs has been reassessed taking into account advanced safety features of NPPs of today's design. The assessment takes into consideration the calculated radioactive releases during postulated reference accident and the resultant dose to the public considering all radiation exposure pathways including inhalation and ingestion, at the exclusion zone boundary without taking credit of any countermeasures. Based on these assessment and all the related aspects, AERB has now stipulated that the size of the EZ shall not be less than 1 km from the centre of the reactor for the new reactors.

11.0 Address by Dr. A. K. Chakrabarti, Director General, DGFASLI, Chief Guest of AERB's Industrial & Fire Safety Awards Function Held on April 19, 2010

I would like to thank Industrial Plants Safety Division of Atomic Energy Regulatory Board (AERB) for inviting me here this evening to present the Industrial Safety and Fire Safety Awards for the year 2009. The purpose of any Safety Awards Scheme is threefold: to recognize exceptional safety records, to foster greater interest in safety and to promote the development of more effective accident prevention programmes.

There is no denying of the fact that the starting point for high standards of safety in any plant lies in the existence of strong statutes and enforcement of those statutes by the relevant statutory body. But nobody can and should not underestimate the role of the plant management and employees therein for taking the ownership of safety and its promotion at the place of work.

These awards are not achieved easily. I could see, the IPSD of AERB uses a range of strict evaluation criteria while considering safety standards of DAE units with respect to safety management, injury statistics, housekeeping, safety training, promotional activities etc.

All of you who have won awards have certainly earned it by your dedication, hard team work and commitment towards safety. Well done and congratulations to all of you.

Being a behavioral scientist and organizational analyst working in the field of safety and health for last three decades, let me share a bit of behavioral aspects of safety with you. Behavioral scientists believe that traditional accident modeling approaches like sequential accident models, event based accident models, fault tree analysis, event tree analysis, cause consequence analysis are important but not adequate to analyze accidents in highly complex and high risk organizations like Nuclear power plants, airlines, space missions, air traffic control, large chemical plants etc. A comprehensive analytical framework known as socio-technical systems is adopted by behavioral scientists and organizational analysts in understanding issues of safety in highly complex organizations. This analytical framework allows one to examine organization as a combination of a social and technical subsystem. The five subsystems of a nuclear power plant under a socio-technical system platform include (a) the individual; (b) the team; (c) technology; (d) organization and (e) organizational environment. The best fit between the technical and the social system will optimize systems outputs such a productivity, reliability and safety. The social system is divided into four parts, (a) the individual subsystem, the acting person his/her attitude, values, competence and those functions relating to his function; (b) the work group or team: their competencies, norms, social relations etc.; (c) the organization comprising organizational culture, managerial and organizational values and structure, rules and regulations; (d) the extra organizational environment; all groups and organizations lying outside the focal organization but contributing to the goal of safety including instances of overregulation and tight control from regulatory bodies stifling creativity and sense of responsibility of individual operator in the work setting. Three Mile Island accident, Chernobyl disaster, Challenger accident and many more have given emphasis on the contribution of organizational factors in the catastrophes that occurred. Two prominent schools of thought of organization theorists have addressed issues of safety adopting socio-technical system framework. The approach adopted by the first one is known as Normal Accident Theory (NAT) and the second and the latest one as the High Reliability Organizations (HRO) model.

A number of studies on aviation and maritime accidents have shown human and organizational factors as major contributors to accidents and incidents. An analysis based on socio-technical system was done for all major aviation and maritime accidents in North America during 1996-2006. It was found that the combined casual and contributory factors in the USA aviation accidents showed 48% related to organizational factors, 37% to human factors, 12% to equipment and 3% to other causes; and the analysis of maritime accidents classified the casual and contributory factors as: 53% due to organizational factors, 24-29% as human error, 10-19% to equipment failures, and 2-4% as other causes. The findings of the Royal Commission on Esso gas plant explosion at Longford, Victoria in September 1998 was analyzed by the organizational theorists from socio-technical system perspective. The accident's major contributory factors were related to a series of organizational failures: the failure to respond to clear warning signs, communication problems, lack of attention to major hazards, superficial auditing and, a failure to learn from previous experience.

All of you know about Columbia and challenger accidents.

.....contd. in page 16

Mayapuri Incident

Incident of High Radiation Exposures in Metal Scrap Market in Mayapuri, Delhi

Incident Reported

An incident involving high radiation exposure unfolded, when a message from Indraprastha Apollo Hospital, Delhi was received by Atomic Energy Regulatory Board (AERB) on 7th April, 2010. The message stated that a patient - a scrap dealer from the Mayapuri Industrial area- who was admitted in the hospital since 4th April developed symptoms suspected to be indicative of high radiation dose.

Immediate Follow Up

After confirming the information, within a few hours on the same day (7th April), two officers from AERB rushed to the Mayapuri area to assess the situation at ground zero. They carried out an extensive radiation survey in and around the scrap shop which belonged to the affected patient and identified the shops and adjoining areas where high radiation levels were prevailing. As an immediate measure, they provided shielding by covering the identified radiation hot spots to reduce radiation levels. The entire affected area was cordoned off.

On 8th, April, in a joint effort, the officers of AERB, Emergency Response Centre of DAE, Narora Atomic Power Station (NAPS), National Disaster Response Force (NDRF) and Radiation Safety Systems Division of BARC, assisted by local police carried out combing operations through extensive radiation surveys. This led to the identification and recovery of most of the radioactive sources. The sources were safely recovered and transported to NAPS for safe and secure storage. By forenoon of April 9th, the area which was cordoned off earlier was cleared off radioactive materials and rendered safe as no unacceptable radiation levels in these areas were observed.

Following these events, a quick survey of the entire market area encompassing several hundred shops was carried out on 13th April to rule out the presence of additional sources. Elevated radiation level was noticed near another scarp shop, around 500 m away from the earlier shop. This led to recovery of two more radioactive sources. The sources were transported to the site of the NAPS for safe and secure storage. Another occurrence came to light on 15th April after another shop owner of the same scrap market was admitted to a hospital in Delhi. A small Co-60 source was recovered from him.

While radiation surveys indicated absence of any more radiation sources, some low level contamination left by dust particles of cobalt was detected in a number of spots.

An awareness programme was also conducted on May 6, 2010 for the Mayapuri scrap dealers on the safety aspects along with legal and regulatory requirements in possessing and handling radioactive sources.

By May 2010 the entire Mayapuri scrap market area were cleaned up - including removal of contaminated soil-and declared open for public access and habitation. By June 14, 2010, the final clean up operations at the affected shop was completed and the shop was handed over to the owner by the police. Thereafter, concretization of the road in front of the affected shops was completed.

Throughout this period, AERB issued periodic press releases to allay the apprehensions of the public and apprise them of the situation in perspective.

Furthermore, a public Notice was also issued by AERB through leading newspapers about the legal/statutory and regulatory requirement of possession, handling and disposal of radioactive sources stating clearly that possession of radioactive sources without proper license/ authorization / registration is an offence.

A rating of Level 4 in the International Atomic Energy Agency (IAEA) International Nuclear and Radiation Event Scale was accorded to this incident. Information regarding the above incident was also provided to the Illicit Trafficking Data Base (ITDB).

Facts Emerging From Investigations

Investigations carried out at the site of incident, discussions with the affected personnel and the inspections carried out at NAPS by officers of AERB, Board of Radiation and Isotope Technology (BRIT) of DAE and Delhi police, it was established that the radioactive Co-60 sources recovered from the Mayapuri scrap market in Delhi were from an old gamma cell (Model No 220) made by Atomic Energy Canada Ltd which was purchased by the Chemistry Dept of Delhi University in 1969. The gamma cell was being used by a Chemistry professor till his retirement. Since then it remained disused in the same room for more than 15 years till it was auctioned by the Delhi University in Feb 2010 and reached the hands of the scrap dealer who purchased it through this auction.

The whole event got unfolded when the gamma cell was dismantled by local workers at the metal scrap shop, leading to the highly radioactive Co-60 pencil sources coming out of the cage, causing the tragedy of unwarranted high exposure to 7 persons (who were admitted to various hospitals in Delhi with radiation induced symptoms) of whom one succumbed to radiation sickness.

Regulatory Enforcement Actions Taken

- All the radioactive sources originally present in the gamma cell of the Delhi University were recovered and accounted for their number and source strength. These sources will continue to remain in safe and secure custody of the Department of Atomic Energy. Recovery of the entire inventory present in the gamma cell was confirmed by counting of the recovered cobalt slugs in the hot cells in BARC.
- The unauthorized disposal of the gamma cell by the Delhi University as a scrap is in violation of the Atomic Energy (Safe Disposal of Radioactive Waste) Rules, 1987 and the Atomic Energy (Radiation Protection) Rules 2004. In view of this, AERB issued a show cause notice dated 29-04-2010 to the Delhi University and in the interim, advised the university to suspend forthwith all activities involving the use of radiation sources. Subsequently, the University submitted the preliminary reply dated

.....contd. in page 11

International Co-operation

AERB continues its active participation with the international agencies, namely, IAEA, USNRC, French and Russian Regulatory authorities, CANDU Senior Regulators Group, etc., in the areas of nuclear and radiation safety. The salient interactions and the objectives of the international cooperation during the year are brought out below. Several safety studies have also been carried out as part of international cooperation of AERB with regulatory bodies of other countries and IAEA.

AERB and ROSTECHNADZOR (RTN) Workshop on Safety Supervision and Control of WWER - 1000 Type of Reactors

The AERB-Rostechnadzor (RTN) Joint Workshop was held at Scientific and Engineering Center for Nuclear Radiation Safety (SEC NRS), Moscow, Russia, during March 22-24, 2010. This was the third workshop under the AERB-RTN Co-operation Agreement in the field of Safety Regulation signed in 2003. Two earlier workshops were held in Mumbai during February 2005 and March 2008. Topics discussed during the workshop include:

(i) Experiences during Commissioning of VVERs in the recent past,

(ii) Commissioning of First of A Kind System,

(iii) Safety Aspects of Management of the Reactor Core,

(iv) PSI/ISI and Surveillance Aspects of Reactor Pressure Vessel,

(v) Safety Review and V&V of digital instrumentation and control,

(vi) Role of regulators in QA during manufacture of safety related components,

(vii) Review of design changes incorporated during project implementation stage,

(viii) Safety review experience of KK NPP,

(ix) Regulatory Inspection of NPPs,

(x) Verification and Certification of Codes used for NPP Safety substantiation, etc.

Both the sides expressed satisfaction about technical discussions in the Workshop and agreed for more focused interactions on selected topics in future.

Senior Officials of AERB and Rostechnadzor (RTN) during Joint Workshop at SEC-NRS in Moscow

(Shri S. K. Chande, Leader of Indian Delegation and Shri Boris Gordon, Director, SEC NRS are Seen along with Other Members/Invitees)

AERB- USNRC Meeting

A meeting between AERB Senior Officials and two Officials from USNRC was held on February 1, 2010. The status of various programmes under the on-going AERB-USNRC technical Co-operation was discussed. More specifically the meeting reviewed the status of the on-going Standard Problem Exercise on Containment Ultimate Load Strength and Leak Behaviour (based on experiments carried out in Sandia National Lab.)

It was also proposed to host the next technical discussion meeting in Mumbai or in Washington on the following topics:

a. Feedback for new reactor certification review.

b. Passive safety systems reliability.

The firm programme will be arrived at with mutual concurrence achieved through email and other correspondences.

AERB - IRSN Collaboration

Under the collaboration between AERB and French Institute for Radiological Protection and Nuclear Safety (IRSN), France supplied to AERB an Accident Source Term Evaluation Code (ASTEC) and AERB carried out in kind contribution in form of analyses for a reactor similar to VVER-1000 MWe for different cases using the software. These results were compared with the SCDAP/RELAP results carried out earlier. Following are the three cases analysed.

(i) Simultaneous rupture of all four steamlines (MSLB ALL)

(ii) Simultaneous occurrence of Loss of Coolant Accident (LOCA) with Station Blackout (SBO)

(iii) Station blackout with and without passive decay heat removal system

The accidents sequence progression in cases (i) and (iii) is slow whereas the progression in case (ii) is rapid. In general, the trend and magnitude of the predicted parameters by the two codes are in good agreement with each other. However, differences were observed in a few parameters such as total amount of hydrogen generated.

USNRC-AERB Meeting in Progress between Senior Officials of AERB and USNRC on February 1, 2010

(Shri S. S. Bajaj, Chairman, AERB, Shri S. K. Chande, Vice-Chairman, AERB and Directors of Divisions of AERB are seen in the picture along with USNRC officials)

International Co-operation

Participation in the Seventeenth WWER Regulators' Forum Meeting

17th Annual Meeting of WWER Regulators Forum was held from June 16 to 17, 2010 at Balatonfured, Hungary. Chairmen and/or senior Members of Regulatory Authorities of eleven Member Countries of the Forum: Armenia, Bulgaria, China, Czech Republic, Finland, Hungary, India, Iran, Russia, Slovakia & Ukraine, one observer each from IAEA & GRS of Germany attended the meeting. Shri S.S. Bajaj, Chairman, AERB and Shri R.I. Gujrathi, Director, NPSD, AERB participated in this meeting. The main objective of the annual meeting is to exchange information on important nuclear safety issues which are specific to WWERs. The participating countries presented their reports mainly covering recent salient changes in the nuclear related legislation, regulation of nuclear safety, significant operational experiences, plans for new NPPs, construction related experiences etc. Observers from IAEA and GRS made presentations updates on IAEA activities and major developments on regulatory issues in Germany respectively.

In the AERB report, information on operating NPPs, on-going power projects, future projects covering new identified sites for 700 MWe PHWRs and imported LWRs, broad lines of salient regulatory requirements for setting up of new imported NPPs etc. was presented in-brief. Some of the salient observations made recently during design safety review and /or during regulatory inspections of Kudankulam NPP were presented in-brief.

Delegates of seventeenth meeting of WWER Regulators Forum

.....contd. from page 9

13-05-2010 to AERB show cause notice. Based on the review of this reply from University and further investigations by AERB, an enforcement Order dated 19-08-2010 has been issued by AERB to the University that all radiation sources in the possession of the Delhi University be withdrawn forthwith and return all radiation sources in its possession immediately to the Board of Radiation and Isotope Technology (BRIT), Mumbai.

Reinforcement of Regulatory Mechanism and other corrective actions for Future

Post Mayapuri incident, following actions have been initiated by AERB to reinforce and further strengthening of its regulatory enforcement mechanism.

- Sensitizing all the academic, medical and R&D institutions to undertake inventory of radiation sources under their possession and review their existing safety procedures.
- Issuing guidelines and stipulations regarding the use and disposal of radioactive sources and making the training on radiation emergency management to be part of curriculum in medical education.
- Improving and intensifying the public awareness on legal, regulatory and general safety requirements vis-à-vis radioactive sources by way of issuing notices through print media and knowledge sharing through AERB website.
- Further strengthening the AERB Data base system of records on source inventory.
- Pursuing with the State Governments for the formation of Directorate of Radiological Safety and enhancing the coverage and effectiveness of inspections of radiation facilities all over the country.
- Instituting the Regional Regulatory Centres (RRC) in the country. RRC in East and South have been formed already. Formation of RRC in North is planned in the near future.
- Based on lessons learnt from this experience the system of response to radiation source related emergencies is further strengthened in collaboration with National Disaster Management Authority (NDMA).
- Though not directly related with this incident, following additional actions are being pursued:
  - Ongoing program to install radiation detection equipment at all sea ports is being re- emphasized.

Metal recycling industry has again been advised to install radiation detection equipment at various processing points in handling of scrap metal.

Feature Article

Setting Effluent Discharge Limits for NPPs and Estimation of Public Dose

Hukum Singh, Manoranjan Dash, P. Vijayan, V. Mohan, P. S. Nair and S. N. Rao

Operating Plants Safety Division, AERB

Introduction

One of the important responsibilities of AERB is to ensure that appropriate measures are in place to protect the members of the public and the environment from undue effects of ionizing radiation. As a part of this mission, it is ensured that the low level radioactive effluents generated from nuclear power plants are discharged to the atmospheric and aquatic environment in a controlled manner. These discharges are generally carried out by all the nuclear facilities in the country in accordance with the limits prescribed by the regulatory body under Atomic Energy (Safe Disposal of Radioactive Waste) Rules 1987. The process involved in setting discharge limits and estimation of public dose are briefly described here.

Discharge Limits

The methodology for deriving environmental discharge limits are provided in AERB safety guide AERB/SG/S-5. The discharge limits are derived from the public dose limit which is 1 mSv/y for a site. A fraction of the public dose limit is apportioned to each facility and subsequently to atmospheric and aquatic environment. From this apportioned dose the discharge limits are derived using standard atmospheric predictive models.

The improvement in reactor technology, plant operating condition and regulatory effectiveness resulted in considerable reduction in the radioactive effluent discharges. This and the environmental dose monitoring data of various NPPs / sites indicated that the actual discharges are very low during normal operation compared to the prescribed discharge limit.

In view of the above, it was felt necessary to revise the discharge limits for radioactive effluents. For this purpose, effluent discharge data of various NPPs were analyzed and rationalized based on the plant design features and operating experience of the facility. These normalized discharge values were scaled up by a factor to accommodate the discharges during operational transients and assigned to NPPs as environmental discharge limits. The discharge limits are arrived at by multiplying the normalized activity discharge for a particular radionuclide by a factor called head of margin which is based on the regulatory assessment, As low as Reasonably Achievable (ALARA) principle, public perception and stakeholder considerations.

Estimation of Public Dose

The radiation dose to the public and the environmental impact due to the effluent discharges are related to the site characteristics, physico-chemical characteristics of radionuclide and the quantity of radionuclides discharged to the environment. To demonstrate the compliance with the public dose limit and adherence to ALARA principles, it was necessary to estimate the dose to the public from effluent discharge based on the revised limits. Therefore, the radiation dose to the representative person at the site boundary from various exposure pathways due to discharge of effluents at 100% of the limit was computed using environmental predictive models.

During regular operation, gaseous effluent discharges from NPPs mainly consist of Fission Product Noble Gases (FPNG), ^{41}Ar, ^{3}H, ^{131}I and particulates. The radiation dose to the representative person from FPNG and ^{41}Ar is considered predominantly through external exposure / cloud immersion. In the case of ^{3}H, ^{131}I and particulates, the radiation exposure to the representative person is mainly through ingestion and inhalation pathways.

The radiation dose to the public due to the aquatic discharges is mainly through ingestion. For coastal sites, the ingestion of marine water fish and salt are considered as the important exposure pathways. For inland sites, drinking water and ingestion of fresh water fish are considered as the predominant pathways of exposure. The important parameters that may affect aquatic dose computation are;

- radionuclide composition;
- the concentration factors (Bio-accumulation factors) for fresh/ marine water fish;
- dietary intake data (annual water intake, fish intake and salt intake for coastal site);
- aquatic media dilution factor; and
- ingestion dose conversion factors (DCF) of a particular radionuclide.

The present dose computation of aquatic pathways, the radionuclide concentration in water at the exclusion zone boundary or at the nearest water utilization point is considered for dose computation. The dilution studies and environmental monitoring data at various NPP sites shows significant dilution of radionuclides in the aquatic media before reaching to the public utilization point. The studies carried out various sites observed a dilution factor of 10 to 100 at the inland sites and 100 to 300 at the costal discharge point along the stream flow direction. Considering the uncertainty in computation of dilution factor for aquatic pathways, the lowest value of the observed dilution factor of 10 and 100 respectively is adopted for inland and coastal sites

The projected radiation dose to the representative person at each site due to operation of NPPs is given in Table and substantial reduction in projected dose could be achieved.

Public dose at NPPs sites from Effluent Discharges

Site	Dose estimated as per old tech spec(μSv/y) limit Allowed limit = 1000 μSv/y	Dose estimated as per new Tech spec(μSv/y) limit Allowed limit = 1000 μSv/y
Tarapur	730	210
Rawatbhata	570	177
Kalpakkam	810	674
Narora	480	91
Kakrapar	270	72
Kaiga	250	127

Conclusion The previous dose estimation used a highly conservative approach resulting in overestimated values. The downward revision and rationalization of technical specification limits for effluent discharges from NPPs and the use of improved methodology for dose computation has resulted in reduction of estimated public dose around NPPs.

Feature Article

Beach Sand Minerals Facilities: the dawn of regulation

Soumen Sinha and R. Bhattacharya

Industrial Plants Safety Division, AERB

"In every outthrust headland, in every curving beach, in every grain of sand there is the story of the earth" --Rachel Carson

Nothing could have better described the presence of the vast mineral resources in the coastal sands since time immemorial and India having one of the largest coastline, is blessed with some of the very precious minerals namely titanium bearing minerals (ilmenite, rutile, leucoxene), zircon, garnet, sillimanite and monazite. These minerals have wide applicability in various commercial as well as strategic sectors. Hence these minerals were regarded as prescribed substances under the Atomic Energy Act, 1962 and their mining and processing were carried out solely by the units of Department of Atomic Energy (DAE).

However, in 1995, to boost up the mineral exploitation of non-strategic minerals such as garnet and sillimanite, these minerals were delisted from the prescribed substance list. Consequently a Policy on Exploitation of Beach Sand Minerals (BSM) was notified by the Government of India in 1998 which for the first time encouraged the participation of private players in the field of beach sand mining and mineral separation.

A few facilities in Tamilnadu and Kerala forayed into the business. However, along with garnet, these facilities were also interested in separating out the titanium bearing minerals, which were still listed as prescribed substances. Hence, these facilities needed a licence from the DAE under the Atomic Energy (Working of the Mines, Minerals and Handling of Prescribed Substance) Rules, 1984. In the process of issuance of licence, the applications were referred to Atomic Energy Regulatory Board (AERB) for assessment of the radiological safety aspects and only after grant of a 'No Objection Certificate' from AERB, licences were issued by DAE to these facilities.

The titanium bearing minerals (ilmenite, rutile, leucoxene), garnet and sillimanite are not radioactive minerals. Hence, naturally there were queries and doubts raised on the need of assessment by AERB from radiological safety angle. Well prima facie, it may seem so. However, all these beach sands minerals remain invariably associated with the radioactive mineral monazite which is the source of thorium and uranium. The preferential separation of other heavy minerals results in enhancement of the monazite content in the left over sands generally referred to as tailings.

Atomic Energy Regulatory Board took an independent assessment of all these facilities and a special Committee was constituted in 2004 with experts from AERB and BARC to evaluate the radiological safety aspects in these facilities. In view of the unregulated disposal of the monazite enriched tailings which can cause undue exposure to the members of the public, it was decided that all these facilities warrant radiological safety regulations.

In 2007, DAE decided to further delist the titanium bearing minerals and zircon from the list of prescribed substance to encourage effective utilization of these valuable minerals and their value addition. As a consequence, these facilities no longer required licence from DAE and hence, the process of radiological assessment by AERB also got stopped. The participation of private players started increasing and many facilities started mushrooming in the coastal stretches running down from Maharashtra to Kerala on the western peninsula and from Orissa to Tamilnadu on the eastern peninsula.

Hence, to take stock of all these Beach Sand Minerals Facilities especially with respect to disposal of monazite enriched tailings, a gazette notification was issued in May 2009 specifying the requirement of licence from AERB under the Atomic Energy (Radiation Protection) Rules, 2004. Subsequent to it, the detailed licensing procedure along with the requisite application forms were prepared and circulated by AERB.

Till date AERB has licensed seventeen BSM facilities and many other applications are under review. Based on the raw material input and monazite enriched tailings generated, the private BSM facilities can be categorized into four major categories.

Firstly, there are facilities crrying out mining and mineral separation of beach sands and producing ilmenite and/or garnet. Such facilities generate large quantities of monazite enriched tailings and the monazite content in these tailings is generally <5%. These facilities have therefore been recommended to mix these monazite enriched tailings with silica rich tailings prior to their disposal in the backfilled sites so that the background radiation level does not increase.

Secondly, there are a few facilities carrying out mining and mineral separation of beach sands and producing ilmenite, rutile, garnet, zircon and silimanite. Such facilities generate relatively less quantities of monazite enriched tailings and the monazite content in these tailings is generally 10-25%. These facilities have therefore been recommended to keep the monazite enriched tailings in trenches located within their premises and to top them with silica rich tailings so that the background radiation level does not increase.

Thirdly, there are certain facilities procuring ilmenite for value addition. Such facilities prior to chemical processing of ilmenite subject it to further physical separation for purification and in the process generate small quantities of monazite enriched tailings and the monazite content in these tailings is generally about 5%. These facilities generally sell these tailings to other parties who further recover the other associated mineral values.

Finally, there are facilities which procure the monazite enriched tailings for recovery of the other heavy minerals present in these tailings. Such facilities generate small quantities of monazite enriched tailings and the monazite content in these tailings is generally 10-25%. These facilities have therefore been recommended to keep the monazite enriched tailings in trenches located within their premises and to top them with silica rich tailings so that the background radiation level does not increase.

Some of the important regulatory requirements in these facilities with respect to radiological safety are designation of AERB approved Radiological Safety Officers, periodic radiation monitoring of the workplace, the waste disposal sites, identifying the radiation prone areas with caution boards etc. Records of quantities of monazite enriched tailings disposed/stored and the monazite content in the tailings and records of the dose received by the plant workers are to be maintained and periodically reported to AERB in prescribed formats. Any changes or deviation from the licensed conditions also needs to be immediately informed to AERB.

In order to facilitate the availability of qualified radiological Safety Officers, special five day training cum certification course pertaining to radiation safety in Beach Sand Minerals facilities was organized by Indian Association of Radiation Protection (IARP) in collaboration with the Safety Research Institute of AERB at Kalpakkam. Thus, efforts have been put forth by AERB in bringing the large sector of beach sand mineral facilities under radiological safety regulation and continuous efforts are being made to streamline these regulations so that the valuable minerals resources of India can be utilized effectively without any undue radiological exposure to the workers and the public.

Feature Article

ICRP 60 and ICRP 103: A Bird's Eye View

G. K. Panda and S. A. Hussain
Radiological Safety Division, AERB

The International Commission on Radiological Protection was created by International Congress of Radiology in 1928 with the name as "International X-Ray and Radium Protection Committee (IXRPC)". In 1950 it was renamed as "International Commission on Radiological Protection". The first publication under the current series was published in 1958. The second recommendation was in 1977 (ICRP-26), third recommendation was in 1991(ICRP-60). The commission reviews the published Recommendations regularly and, from time to time, has issued supplementary reports in the "Annals of the ICRP". When the committee feels that there is a need for consolidation of new data, then the committee issues new recommendations. In line with this the committee has published the new recommendations in ICRP publication 103(2007), which replaces the recommendation made in publication 60(1991). Following are some of important points given in tabular form for comparison between ICRP 60 and ICRP 103 recommendations.

	ICRP 60	ICRP 103
1. Year of publication	1991	2007
2. Types of exposure situations	i. Practices* ii. Intervention*	i. Planned exposure* ii. Emergency exposure* iii. Existing exposure*
3. Categories of exposure	i. Occupational ii. Public iii. Medical	i. Occupational ii. Public iii. Medical
4. Fundamental Principles of Radiation Protection	i. Justification (applicable to all types of exposure situations) ii. Optimisation (only applicable to practices) iii. Dose limits (only applicable to practices)	i. Justification (applicable to all types of exposure situations) ii. Optimisation (applicable to all types of exposure situations) iii. Dose limits (only applicable to planned exposure)
5. Terms used for types of biological effects	i. Stochastic effect ii. Deterministic effect	i. Stochastic effect ii. Both 'deterministic effect' and 'tissue reaction' are synonymously used
6. For Protection of Public:	Critical Group is considered	Representative Person is introduced
7. Estimation of doses from internal and external exposure	Doses from internal and external exposures were estimated from mathematical models.	Doses from internal and external exposures were estimated from voxel phantoms, which are based on the tomographic images.
8. Dosimetric System followed	DS86	DS02
9. No. of generations considered for estimation of risk for heritable effects	All future generations	Two generations
10. Radiation weighting factors	Photons, all energies .....1 Electrons and muons, all energies .....1 Neutrons, energy < 10 keV .....5 10 keV to 100 keV.....10 > 100 keV to 2 MeV.....20 > 2 MeV to 20 MeV.....10 > 20 MeV.....5 Protons, other than recoil protons, energy>2 MeV.....5 Alpha particles, fission fragments, heavy nuclei 20	Photons .....1 Electrons and muons .....1 Protons and charged pion .....2 Alpha particles, fission fragments, heavy ions ...20 Neutrons .....A continuous curve as a function of neutron energy
11. Tissue weighing factors	Bone surface .....0.01 Bladder .....0.05 Breast.....0.05 Colon .....0.12 Gonads.....0.20 Liver.....0.05 Lungs .....0.12 Oesophagus.....0.05 Red bone marrow .....0.12 Skin .....0.01 Stomach.....0.12	Bone-marrow (red), Colon, Lung, Stomach, Breast, Remainder tissues.....0.12 each Gonads .....0.08 Bladder, Esophagus, Liver, Thyroid .....0.04 each Bone surface, Brain, Salivary glands, Skin .....0.01 each Remainder tissues: Adrenals, Extrathoracic (ET) region, Gall bladder, Heart, Kidneys, Lymphatic nodes, Muscle, Oral mucosa, Pancreas, Prostate, Small intestine, Spleen, Thymus, Uterus/cervix.

	Thyroid.....0.05 Remainder.....0.05 Remainder tissues: Adrenals, brain, upper large intestine, small intestine, kidney, muscle, pancreas, spleen, thymus and uterus.	
12. Risk models used for calculation of tissue weighting factors	ERR:EAR = 50:50 (ERR-Excess Relative Risk EAR-Excess Absolute Risk)	ERR:EAR = 0:100% for breast and bone marrow, ERR:EAR = 100:0% for thyroid and skin, ERR:EAR = 30:70% for lung ERR:EAR = 50:50% for all others
13. Dose and Dose Rate Effectiveness Factor (DDREF)	DDREF = 2 except for leukemia	DDREF = 2 except for leukemia
14. Detriment adjusted nominal risk coefficients for cancer (10^{-2} Sv^{-1})	Whole population.....6.0 Adult 4.8	Whole population .....5.5 Adult 4.1
15. Detriment adjusted nominal risk coefficients for heritable (10^{-2} Sv^{-1})	Whole population.....1.3 Adult.....0.8	Whole population .....0.2 Adult 0.1
16. Detriment adjusted nominal risk coefficients for cancer + heritable (10^{-2} Sv^{-1})	Whole population.....7.3 Adult 5.6	Whole population .....5.7 Adult 4.2
17. Dose Limits	**The dose limits prescribed in both ICRP 60 and 103 recommendations are essentially same.** **Type of limit** — **Occupational** — **Public** **Effective dose** — 20 mSv per year, averaged over defined periods of 5 years — 1 mSv in a year **Annual equivalent dose in:** Lens of the eye — 150 mSv — 15 mSv Skin — 500 mSv — 50 mSv Hands and feet — 500 mSv — - **Pregnant woman: In ICRP 60, the dose to the abdomen was 2 mSv, in ICRP 103 the dose to the fetus is 1 mSv.**	
18. Protection criteria in emergency exposure situations	Intervention levels*- Occupational exposure: i. Life-saving (informed volunteers) - No dose restriction ii. Other urgent rescue operations - 500 mSv effective dose and 5 Sv dose to skin iii. Other rescue operation - not given	Reference level*- Occupational exposure: i. Life-saving (informed volunteers) - No dose restrictions if benefit to others outweighs rescuer's risk ii. Other urgent rescue operations - 1000 mSv effective dose and 5 Sv dose to skin iii. Other rescue operation- <=100 mSv
19. Protection to the environment	The Commission has concerned itself with mankind's environment only with regard to the transfer of radionuclides through it, mainly in the context of planned exposure situations.	In these recommendations the commission acknowledges the protection of other species and proposes reference plants and animals.

Explanation of some of the important points in the comparative table:

Types of exposure situations: In the previous recommendations the commission only considered practices and interventions. But in these present recommendations the commission realized that by considering only practices and interventions, it had not covered all the radiation exposure areas like natural exposures and exposures from past events. So it introduced the concept of existing exposure.

Fundamental Principles of Radiation Protection: In the ICRP 103 recommendations, the committee recommended that not only the practices should be optimized, but also the emergency exposures and existing exposures should also be optimized.

Estimation of doses from internal and external exposure: In the previous recommendations mathematical models were used for the estimation of dose. But in the present recommendations calculative anthropomorphic phantoms are used for the estimation of dose. The voxels of the anthropomorphic phantoms are based on the tomographic images.

No. of generations considered for the estimation of risk for heritable effects: In the present recommendations, only two generations are considered for the estimation of heritable risk. The reason behind this is: most of the mutations occur in the first two generations.

Radiation weighting factors: The radiation weighting factor of the protons has been changed from 5 to a factor of 2. The reason is: internal exposure from protons is unlikely to occur. From external exposure, protons of energy less than 10 MeV hardly can penetrate the skin. So protons of practical interest is of energy more than 10MeV and the radiation weighting factor of protons more than 10 MeV is 2.

The radiation weighting factors of the neutrons should be taken from

the continuous curve given in the publication 103. The reason behind this: in practice all the conversion factors used for neutrons are based on the continuous function of energy.

Tissue weighing factors: Based upon the current dosimetry, the new tissue weighting factors are given. Previously the tissue weighting factor for gonads were over estimated and the tissue weighting factor for the breast was under estimated.

Risk models used for calculation of tissue weighting factors: ICRP 60 considered a 50:50 weightage of the EAR and ERR models. But data shown that some tissue weighting factors were over estimated and some were under estimated. In the current recommendations, appropriate weightage of EAR and ERR models has been taken to match the data.

* Planned exposure situations: Everyday situations involving the planned operation of sources including decommissioning, disposal of radioactive waste and rehabilitation of the previously occupied land. Practices in operation are planned exposure situations.

Emergency exposure situations: A non-routine situation or event that necessitates prompt action primarily to mitigate a hazard or adverse consequences for human health and safety, quality of life, property or the environment. This includes situations for which prompt action is warranted to mitigate the effects of a perceived hazard.

Existing exposure situation: A situation that already exists when a decision on control has to be taken, including natural background radiation and residues from past practices that were operated outside the Commission's recommendations.

Practices: Any human actions increasing exposure either by introducing whole new blocks of sources, pathways, and individuals or by modifying the network of pathways from existing sources to individuals and thus increasing the exposure of individuals or the number of individuals so exposed.

Interventions: Any human actions that decrease the overall exposure by influencing the existing form of the network.

Reference level: In emergency or existing controllable exposure situations, this represents the level of dose or risk, above which it is judged to be inappropriate to plan to allow exposures to occur, and below which optimization of protection should be implemented. The chosen value for a reference level will depend upon the prevailing circumstances of the exposure under consideration.

Acknowledgement

The authors are thankful to Dr.D.N.Sharma, Head, RSSD, BARC and Dr.Pushparaja. Scientific Officer (Rtd.), BARC, Mumbai for reviewing and giving valuable comments on this article.

.....contd. from page 8

Organizational theorists using socio-technical approach have established that both accidents resulted due to organizational system failures, and present a casual explanation that links the culture of production, the normalization of deviance, and structural secrecy in NASA. A study of nuclear weapons organizations found to be infused with politics, with many conflicting interest at play both within the military command and control, and between military and civilian leaders. Power and politics should be taken seriously not only to understand the organizational causes of accidents, but also to start the difficult processes of designing reforms to enhance safety and reliability in organizations.

Let me share with you couple of interesting findings related to organizational culture derived from a recent research project undertaken by the university of California, Berkley on organizations involving a variety of complex, high technology operation like commercial airlines, military air force and nuclear power plants.

It was found that people have different categories of risk perception and risk acceptance while interacting with their work environment. Such perceptions were found to have made significant impact on the safety performance of the plant. What increases safety over time is not just job experience of the pilot or the nuclear plant operator but the recognition or the belief of the pilot or the operator that work that he or she does is always subject to unexpected events or unfamiliar conditions. It corroborates that pilots or the plant operators are most at risk when they have gained enough experience to be overconfident to the extent of believing that the environment in which they work is a safe environment rather than an inherently dangerous one. Research suggests that belief of pilots that flying is inherently risky and that the environment in which they operate is potentially hostile is found to be the most significant factor in their culture of safe operation. This is one of the most remarkable findings of research elicited through interviews with pilots, air traffic controllers and nuclear plant operators and maintenance people.

The research further revealed a sharp contrast between organizations in which hero stories were prevalent and welcome and those in which such stories were rare and not encouraged (hero avoiding). Hero embracing strategies emphasize extraordinary performance and rapid response, need for individual action to accomplish goals and maintain performance. The need is most evident in organizations such as navy, fire department, electric utility lineman and in fact naval pilots. These stories serve among other things, as an effective means for organizational learning and maintenance of cumulative knowledge.

In contrast, not only were hero stories completely absent among nuclear power plant operators, their presence would have been disturbing. In this context, hero is a term of criticism, describing an operator who will act on his or her own personal achievements and judgment with little regard for the collectively or for rules and regulations. However, these are the research findings in the context of the US culture. It would be interesting to know what the socio-technical dynamics of safety are in Indian context.

I am confident that you have made your plants a safer place to work. I believe that a small group of dedicated individuals can change the world. On this note, let me once again congratulate all award winners for their excellent safety performance. I wish you a great evening. Thank you.

International Nuclear and Radiological Event Scale (INES) (Revised)

Level/Descriptor	Nature of the Events	Examples
7 MAJOR ACCIDENT	• Major release: Widespread health and environmental effects requiring implementation of planned and extended counter measures.	Chernobyl NPP, USSR(now in Ukraine), 1986
6 SERIOUS ACCIDENT	• Significant release: Likely to require full implementation of planned counter measures.	Kyshtym Reprocessing Plant, Russia,1957
5 ACCIDENT WITH WIDER CONSEQUENCES	• Limited release: Likely to require partial implementation of some planned counter measures • Severe damage to reactor core/Several Deaths from radiation. • Release of large qualities of radioactive material within an installation with a high probability of significant public exposure. This could arise from a major criticality accident or fire	Windscale Pile, UK, 1957 Three Mile Island, NPP, USA, 1979 Goiania, Brazil, 1987
4 ACCIDENT WITH LOCAL CONSEQUENCES	• Minor release of radioactive material unlikely to result in implementation of planned countermeasures other than local food controls. • Fuel melt or damage to fuel resulting in more than 0.1% release of core inventory. • At least one death from radiation/Release of significant quantities of radioactive material within an installation with a high probability of significant public exposure.	Tokaimuro,Japan,1999Saint-Laurent des Eaux NPP, France, 1980 Fleurus, Belgium, 2006
3 SERIOUS INCIDENT	• Near accident of an NPP with no safety provisions remaining. • Highly radioactive sealed source lost or stolen/misdelivered without adequate radiation procedures in place to handle it. • Exposure rates of more than 1 Sv/hr in an operating area • Severe contamination in an area not expected by design, with a low probability of significant public exposure • Exposure in excess of ten times the statutory annual limit for workers/ Non-lethal deterministic health effect(e.g. burns)from radiation	Vandellos NPP, Spain, 1989 Ikitelli, Turkey, 1999. Sellafield,UK,2005 Yanango,Peru,1999
2 INCIDENT	• Significant failures in safety provisions but with no actual consequences • Exposure of member of public in excess of 10mSv/Exposure of a worker in excess of the statutory annual limits/Radiation level in an operating area of more than 50mSv/hr • Significant contamination within the facility into an area not expected by design • Found highly radioactive sealed orphan source, device or transport package with safety provisions intact./Inadequate packaging of highly radioactive material sealed source	Forsmark.Sweden,2006 Atucha,Argentina,2005
1 ANOMALY	• Minor problems in safety components with significant defence in depth remaining/ Low activity lost or stolen radioactive source, device or transport package • Overexposure of member of public in excess of statutory limits.	Breach of operating limits at a nuclear facility/Theft of a moisture density gauge
0 DEVIATIONS BELOW SCALE	No safety significance	

Official Language Activities

AERB continued its efforts to ensure effective implementation of Official Language policy and increase the use of Hindi in official work. Various Hindi competitions such as Hindi Typing, Hindi Dictation, Story writing, Essay Writing, Scientific and Technical Translation, Noting and Drafting, Extempore Speech, Debate, Cross-words and Slogan, etc., were held in the month of November-December 2009. The prize distribution function was organized on January 6, 2010 to give away the prizes to the thirty-nine winners of these competitions.

Bhasha Varta was organized on Jan 18, 2010 jointly by AERB and the three DAE units i.e. DPS, DCS&EM and HWB. Renowned literary figure, Dr. Suryabala, delivered the lecture on the importance of languages, particularly Hindi in communication. A grand cultural programme was also organized on this occasion.

A Hindi Workshop was conducted during March 17 to 20, 2010 at Vikram Sarabhai Bhavan, Mumbai jointly by AERB, DPS, DCS&EM and HWB.

Scientific Talk in Hindi

A talk on 'Scientific Concepts in Vedas and General Information about Vedas' was organized at Niyamak Bhavan - B on 23rd April 2010. The speaker Shri K.C. Upadhyaya, Member, Official Language Implementation Committee and Scientific Officer (E), AERB gave general information about Vedas in brief and talked about scientific concepts of Vedas in detail. He narrated that the Vedic Literature deals with Archaeology, Anthropology, Maths, Meteorology, Mineralogy, Zoology, Military Sciences, Astronomy, Toxicology, Medicine, law & logic, Ethics, Mythology, Spiritual Science, Music and many more subjects. He explained that the scientific concepts like Gravity, North Pole, South Pole, Equator, Ozone layer, Life in Plants, Seven colours in the Sun rays and many other concepts already exist in Vedas. The speaker also quoted the Vedic Mantras related to scientific concepts. It is learnt that information about various instruments like Compass, Energy Meter etc., is also given in Vedas.

Purchase of Hindi Books

Twenty six Hindi books were purchased on various subjects including Science, Indian Culture, Literature, Official Language, History, etc., in the month of March. These are in addition to various Hindi Magazines available in the Library.

Official Language Prize Distribution Function in Progress
(L to R): Shri M. M. Gaikwad, DCA, AERB, Shri S. K. Chande, Vice-Chairman, AERB, Shri S. K. Sharma, Chairman, AERB, Shri A. Ramakrishna, Chairman, OLIC and Shri V. M. Thomas, AO-III, AERB

International Women's Day Celebration

'Women's Day Celebration' by AERB Women Staff and Invited Guests

A cultural programme was organized by the lady employees of AERB on International Women's Day on March 8, 2010. The Chief Guest of the programme was Smt. Surekha Chande and other invitees namely Smt. Rita Basu, Smt. Swati Gujrathi, Smt. Pushpa Devi Singh, Smt. Rama Lakshmi Rao and Smt. Suman Gaikwad were present. 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.

New Appointment

Shri V. Balasubramaniyan appointed as Head, Safety Research Institute

Shri V. Balasubramaniyan, who was heading the Heat Transport Systems Division in Reactor Engineering Group at IGCAR joined as the Head, Safety Research Institute (SRI), AERB at Kalpakkam on June 01, 2010 upon superannuation of Shri S. E. Kannan on May 31, 2010. He is a Mechanical Engineer and a recipient of Homi Bhabha Medal from the 28th batch (1984 - 85) of BARC Training School, Mumbai.

Shri R.Bhattacharya takes over as Secretary, AERB

Shri R.Bhattacharya, who is currently heading the Industrial Plants Safety Division (IPSD) of AERB as Director, took over charge from the outgoing Secretary Dr.Om Pal Singh with effect from August 1, 2010 as Secretary, AERB. He is also holding the post of Director, Information and Technical Services Division (ITSD) in addition to Director, IPSD.

Farewell

AERB bids Farewell to Shri S. E. Kannan

Shri S.E.Kannan, Director Safety Research Institute (SRI), AERB, superannuated on May 31, 2010. He was directing SRI since 2006. As Director, SRI, Shri Kannan provided dynamic leadership to the institute and shaped significantly the R&D activities of SRI. Before joining SRI, Shri Kannan was heading the Engineering Safety Division of IGCAR. He contributed significantly in the fuel handling system of Fast Breeder Reactor (FBTR) operating in IGCAR and safety related R&D of PFBR, which is under construction in Kalpakkam.

AERB bids Farewell to Dr. Om Pal Singh

Dr. Om Pal Singh, Secretary, AERB and Director, ITSD retired on superannuation on July 30, 2010. A farewell was organised on August 2, 2010 in AERB. Shri A. Ramakrishna, ITSD, AERB welcomed all the distinguished guests from other units of DAE and AERB staff who graced the occasion. Dr. Om Pal Singh's professional achievements were recalled and summarized. Dr. K.B. Sainis, Shri S.K. Mehta, Directors of Divisions of AERB, Shri S.K. Chande, Vice-chairman, AERB who had been a long associate of Dr. Om Pal Singh in IGCAR and Shri S.S. Bajaj, Chairman, AERB spoke on this occasion wishing Dr. Singh a fruitful retired life. Dr. Singh was felicitated in a traditional manner with a shawl, coconut, an AERB memento and a gift. Dr. Singh humbly accepted the farewell and thanked one and all.

AERB Staff Club Activities - 2010

Shri Shekhar Chavan receiving the award for Men's Singles Championship at DAE Sports & Cultural Meet-2009

The XXVth DAE Sports & Cultural Meet 2009 - Table Tennis was held at Kalpakkam from February 8-12, 2010. The Ellora Group comprising of Mumbai based DAE units other than BARC won the overall championship of the tournament. Shri Shekhar Chavan, APO, AERB won the "First Prize" in the Men's Singles Championship. Shri Vaibhav Gholap, AERB won the "Best Manager of the Meet" award.

AERB Staff Club started a Fitness Centre at the Ground Floor of Niyamak Bhavan - A building since March 2, 2010. The fitness centre comprises equipments such as Treadmill, Bicycle, Multigym, Abdominal Benches and Dumb bells aimed at providing health care benefits to its members.

Home Page

Personnel Joined (January – June, 2010)

Sr. No.	Name	Designation	Date of Joining
1.	Shri Satinder Singh Bajaj	Chairman, AERB	14/01/2010
2	Shri Jolly Joseph	SO/C, RSD	05/02/2010
3.	Smt.Bharati Chandrasekhar Sant	AD (OL), Admn.	22/02/2010
4.	Shri Rajnish Kumar	SO/D, NPSD	08/03/2010
5.	Shri P. V. Mohandas	SA/F, IPSD	05/04/2010
6.	Shri Rajendra R Shete	SO/C, RSD	05/05/2010
7.	Shri Avinash V Ramteke	SO/C, RSD	07/05/2010
8.	Shri Ajeet Singh	SO/C, RSD	11/05/2010
9.	Shri Ajay Kumar Gocher	SO/C, RSD	12/05/2010
10.	Shri Dipesh N Naik	SA/B, CSED	20/05/2010
11.	Shri V. Balasubramaniyan	Head, SRI, Kalpakkam	01/06/2010
12.	Shri N. Naushad	SO/C, RSD	09/06/2010
13.	Shri Vipin Chander	SO/D, OPSD	14/06/2010
14.	Smt. L. Thilagam	TO/D, SRI, Kalpakkam	29/06/2010
15.	Shri Parshi Satish Kumar	SO/C, SRI, Kalpakkam	30/06/2010

Personnel Retired (January – June, 2010)

Sr. No.	Name	Designation	Date of Retirement / Expiry of Tenure of Appointment
1.	Shri S. K. Sharma	Chairman, AERB	13/01/2010
2.	Shri S. E. Kannan	Director, SRI	31/05/2010
3.	Shri K. C. Upadhyay	SO/E, RSD	31/05/2010

Edited and published by **Shri R. Bhattacharya,** Secretary, Atomic Energy Regulatory Board, Niyamak Bhavan, Anushaktinagar, Mumbai-400 094.
Tel. & Fax No.: 25576255, E-mail: rbhattacharya@aerb.gov.in
Designed, Processed & Printed by Printania Offset Pvt. Ltd., Ph. : 24078866/7996.