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AERB Newsletter

ATOMIC ENERGY REGULATORY BOARD

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From the Chairman's Desk

An AERB delegation visited USNRC, Washington during January 2007 under the on-going AERB-USNRC Nuclear Safety Cooperation Program. A five-member delegation of ASN, the French Nuclear and Radiation Regulatory Organization visited AERB under the cooperation agreement between the two organizations that was signed in 1999 and renewed in 2005. AERB hosted the meeting of the International Nuclear Safety Group (INSAG) in March 2007 at Mumbai when a seminar was also held where seven of the INSAG members from OECD/NEA, Finland, Hungary, Korea, South Africa, Russian Federation and Canada presented technical talks.

AERB accorded clearance for first criticality of unit 3 of Kaiga Generating Station after comprehensive safety review. The AERB Industrial Safety Awards for 2006 were given to the units of Department of Atomic Energy, whose performance in industrial safety was judged to be of high order during the period. Like past years, AERB released the Industrial Safety Statistics- 2006 for the DAE units during the award function held on March 6, 2006.

Hon. Prime Minister dedicated the Tarapur Atomic Power Station Units 3 & 4 (TAPS-3&4) of 540 MWe capacities each, to the service of the nation on 31st August 2007. The design of TAPS-3&4 substantially differs from the 220 MWe units in several respects. Consequently their design was subjected to in-depth safety review by AERB before according clearances for various stages of the plants. In addition to design safety review, AERB officials also conducted a number of regulatory inspections during the construction phase and witnessed various tests during commissioning of the Units. The extent of effort required for the design safety review of TAPS-3&4 can be seen by the fact that over 8000 man-days were spent in formal meetings of various safety committees and specialist groups.

November 15, 2007 marked the beginning of the twenty-fifth year of the AERB. A function was held on November 23, 2007 where Dr. Anil Kakodkar, Chairman, AEC was the Chief Guest and former Chairmen and Vice Chairmen of AERB were Guests of Honour. The "AERB Code of Ethics" and a "Monograph on Probabilistic Safety Assessment" were released on this occasion. The new AERB building, Niyamak Bhavan – B was inaugurated by Prof. A.K. De, the first Chairman of AERB. The "24th DAE Safety, Occupational and Health Professionals Meet" was organized at Rawatbhata, Rajasthan site during December 29 – 31, 2007 and a Monograph on 'Construction Safety' was released.

(S. K. Sharma)

NEWS

Press releases

January 23, 2007

AERB Delegation Visits USNRC, Washington D.C., USA

A nine-member delegation of Atomic Energy Regulatory Board (AERB) led by Shri. S.K. Chande, Vice Chairman, AERB visited the United States Nuclear Regulatory Commission (USNRC), Washington, DC, USA during January 8 to 17, 2007 under the on-going Nuclear Safety Cooperation Program between the two regulatory bodies. Extensive discussions were held during the meeting on the topics of digital system reliability, new control room designs and proactive material degradation programmes. Indian experience in construction of Nuclear Power Plants was also presented. In addition, detailed discussions were held on the collaborative work that will be undertaken on benchmarking of computer codes for severe accident analysis and for assessment of ultimate load capacity of pre-stressed concrete containment structures through analysis of standard problems.

The delegation also called upon the USNRC Chairman, Dr. Dale Klein and other commissioners and also visited Pilgrim Nuclear Power Station and Massachussette Institute of Technology (MIT) at Boston.

This was the 8th meeting under the on-going nuclear safety co-operation programme between USNRC & AERB which started in February 2003. The major areas covered under the programme include: Probabilistic Risk Assessment (PRA) Technology, Fire Safety, Licence Renewal, Design Modifications and Emergency Operating Procedures, New Reactor Designs and Severe Accident Analysis.

As part of this co-operation programme, two officers of AERB were sent on a one year deputation at USNRC since August 2006 and are working in the area of PRA Technology and its Applications.

February 25, 2007

AERB ACCORDS CLEARANCE FOR FIRST CRITICALITY OF KAIGA UNIT - 3

AERB accorded clearance on 25 February 2007 for first criticality of Kaiga Unit-3 located in Karwar district of Karnataka. Kaiga Units-1&2 are already in operation at this site for the last six years. Kaiga Unit-4 is in advanced stage of construction. Each of these PHWR units is of 220 MWe capacities.

AERB issues clearances for nuclear power plants in different stages, viz., siting, construction, commissioning and operation. Commissioning clearances are given for PHWRs in further sub-stages of light water testing, fuel loading, heavy water charging in coolant and moderator systems and first criticality. At each stage, AERB conducts a comprehensive review to ascertain that all the safety requirements are complied with.

After achieving first criticality, reactor power is raised in steps and various tests are conducted at each step to ensure safe and smooth functioning of all reactor systems.

Wednesday, March 7, 2007

AERB INDUSTRIAL SAFETY AWARDS

Atomic Energy Regulatory Board (AERB) presents Industrial Safety Awards to the Department of Atomic Energy (DAE) Units every year whose performance in industrial safety area is of a high order. This year, the annual Industrial Safety Awards presentation function of AERB was held on March 6, 2007. Shri J Ganguly, Executive Vice President from M/s Larsen & Toubro Ltd., Chennai, presented the Safety Awards for 2006 to Bharatiya Nabhikiya Vidyut Nigam Limited (BHAVINI), Kalpakkam in Construction Group and to Narora Atomic Power Station, Narora, Rajasthan Atomic Power Station - 3&4, Rawatbhatata, Heavy Water Plant, Tuticorin and Indian Rare Earths Ltd. - Thorium Plant, Chatrapur in Production Units group.

On this occasion, Shri S.K.Sharma, Chairman, AERB released a compilation of Industrial Safety Statistics- 2006 for the DAE Units. This compilation provides the information on data on accidents and analysis of number of injuries and man-days loss caused by various factors. The data is also compared with units outside DAE. It is seen that Industrial Safety performance of DAE Units is significantly better as compared to other similar industries in the country. The number of injuries, injury rates and the number of fatalities reported were lowest in 2006 among the past few years. The reduction in the number of injuries is the result of strengthening measures taken by all concerned. No case of occupational disease was reported for the year 2006 in the DAE units.

Sunday, March 11, 2007

AERB HOSTS INSAG MEETING

The eighth meeting of the International Nuclear Safety Group (INSAG) was hosted by Atomic Energy Regulatory Board (AERB) during 12th to 16th March 2007 in Mumbai. The INSAG is a group of international experts with high professional competence in the field of nuclear safety, working in regulatory organisations, research and academic institutions and the nuclear industry. INSAG provides recommendations and opinions on current and emerging nuclear safety issues to the IAEA, the nuclear community and the public. The members of present INSAG are from Canada, China, Finland, France, Germany, Hungary, India, Japan, Republic of Korea, Russian Federation, South Africa, Spain, United Kingdom and United States of America.

Presently Shri S.K. Sharma, Chairman, AERB is the member of INSAG from India. Before him, Dr. Anil Kakodkar, Chairman Atomic Energy Commission (AEC), was the member of INSAG from India.

The INSAG meeting was inaugurated by Chairman, AEC on 13th March 2007. Chairman INSAG, Dr. Richard Meserve (Formerly Chairman, US Nuclear Regulatory Commission) and Dr. Taniguchi, Deputy Director General of IAEA, also made a courtesy call on

Dr. Anil Kakodkar Chairman, AEC. Apart from the intensive discussions on three days, the INSAG delegates also visited the Tarapur Atomic Power Station (TAPS) and BARC. In BARC, under a special Trombay Colloquium, Dr. Richard Meserve, Dr. Taniguchi and Dr. Carlos Alejaldre, Deputy Director General of ITER delivered technical talks on The Nuclear Renaissance, Global Partnership for Nuclear Safety and Security and International Thermonuclear Experiment Reactor (ITER) respectively. A Press Meet has also been organized at BARC on 15th March.

A seminar where seven of the INSAG members from OECD/NEA, Finland, Hungary, Korea, South Africa, Russian Federation and Canada presented technical talks on a variety of current topics of interest. The INSAG meeting provided a good opportunity to Indian nuclear Scientists and engineers to interact with this group of international experts.

Thursday, May 10, 2007

FRENCH NUCLEAR REGULATORY DELEGATION VISITS ATOMIC ENERGY REGULATORY BOARD

A five-member delegation of the French Nuclear and Radiation Regulatory Organization, namely, Nuclear Safety Authority (ASN) led by Mr. Olivier Gupta, Head of the Direction of Nuclear Power Plants of ASN visited the Atomic Energy Regulatory Board (AERB) during May 8 - 10, 2007. This visit was under the Agreement between the two organizations that was signed in July 1999 on Exchange of Information and Co-operation in the Regulation of Nuclear Safety and Radiation Protection. In the present visit, a seminar on 'Pressurized Water Reactors' was organized under the said agreement. The topics covered in the seminar were: French Side: Organization and Functions of ASN, Licensing and Review Process of EPR, Safety Objectives and Safety Approach and Requirements for New Reactors, EPR Design Assessment with respect to Design Basis Event, External Hazard and Instrumentation and Control, Practically Eliminated Events and Severe Accident Management. Indian Side: Organization and Functions of AERB, Safety Review of Kudankulam Nuclear Power Project (KK-NPP), An approach to Design Safety Review of New Design: Advanced Heavy Water Reactor (AHWR): A case study and Pressurized Water Reactors; Indian Perspective.

Large number of scientists and engineers from AERB, BARC, IGCAR and NPCIL participated in the seminar. The presentations and discussions held in the seminar led to a better appreciation of regulatory practices and safety review approaches followed in the two regulatory bodies, safety objectives for new reactors and safety assessment of reactors with evolutionary new design features.

June 2, 2007

MATERIAL SEIZED BY LUCKNOW POLICE IS NOT URANIUM

With reference to a news item regarding "seizure" of 700 grams of uranium by Lucknow Police that appeared in certain sections of the Press on June 1, 2007. AERB deputed two experts to Lucknow to ascertain the nature of the seized material.

Preliminary examination of the material indicated that the material seized by the police is not uranium. The material was later tested in Bhabha Atomic Research Centre (BARC), Mumbai to identify its chemical compositions and was found to be organic ion-exchange resin.

Thursday, August 30, 2007

DESIGN SAFETY REVIEW OF TAPS-3&4 BY AERB

Construction of Tarapur Atomic Power Station Units 3 & 4 (TAPS 3&4) was started in March 2000 and Unit-4 became operational in March 2005, i.e. 5 years after start of construction which is the shortest period for any nuclear power unit in the country so far. Unit-3 became operational in May 2006.

These units of 540 MWe capacities each are of totally indigenous design and are based on Pressurised Heavy Water Reactors (PHWRs), which is the mainstay of nuclear power programme in the country. While TAPS 3 & 4 design has evolved from the experience of 220 MWe PHWR units, their design substantially differs from the 220 MWe units in several respects and it also incorporates several innovative and state-of-the art safety features. Consequently the design of TAPS 3 & 4 was subjected to an elaborate and in-depth safety review by the Atomic Energy Regulatory Board (AERB) before according clearances for various stages of the plants viz. siting, start of construction, first criticality and operation at high power.

The safety reviews were conducted through the established AERB practice of multi-tier reviews. This involved elaborate design safety review by the Project Design Safety Committee and its various specialist groups, followed by Review by the AERB's Advisory Committee for Project Safety Review and final clearance by the Board of AERB. In addition to design safety review, AERB officials also conducted a number of regulatory inspections during the construction phase and witnessed various tests during commissioning of the Units. The extent of effort required for the design safety review of TAPS 3 & 4 can be seen by the fact that over 8000 man days were spent in formal meetings of various safety committees and specialist groups. This is in addition to substantial time spent by individual experts outside formal meetings.

This press release was issued by AERB for general information on the occasion of dedication of TAPS 3 & 4 to the nation by the Hon. Prime Minister on 31st August 2007.

SAFETY DOCUMENTS PUBLISHED

During the period Jan-Dec 2007, AERB issued the following regulatory documents. In drafting these documents, extensive use was made of the information contained in the relevant safety standards of the International Atomic Energy Agency.

- **Management of Radioactive Waste (AERB/NRF/SC/RW).**

This safety Code is developed for radioactive waste that is generated during operation, maintenance and decommissioning of nuclear and radiation facilities. This Safety Code establishes the requirements, which shall be fulfilled for the safe management of solid, liquid and gaseous radioactive waste from generation through disposal. The Code specifies basic requirements for the safe management of radioactive waste from various nuclear and radiation facilities. The document stipulates requirements in design, construction and operation of waste management facilities including radiation protection aspects and the responsibilities of different agencies involved.

- **Management of Radioactive Waste from Mining and Milling of Uranium and Thorium (AERB/NF/SG/RW-5).**

This safety guide provides guidance for ensuring safety in handling and disposal of radioactive waste generated from mining and milling of uranium and thorium. This Guide addresses administrative, legal and regulatory framework and radiation protection in the management of radioactive waste from mining and processing of uranium ore, mining and processing of monazite and thorium. It also provides guidance for the management of decommissioning waste of such facilities and monitoring and regulatory control during pre-operation, operation, closure and post-closure period.

- **Radiological Safety in Uranium Mining and Milling (AERB/FE-FCF/SG-2).**

This safety guide provides guidance for ensuring radiological safety in site selection, design, construction, commissioning, operation, maintenance, waste management, decommissioning and controlling of radiation and occupational health hazards of the uranium mining and milling plants. The document addresses the administrative, legal and regulatory framework, radiological monitoring requirements, occupational health safety aspects and emergency plan for mining and processing of uranium with an objective of protecting workers, public and environment from radiological and environmental hazards.

- **AERB Safety Guide on Safety in Thorium Mining And Milling (AERB/NF/SG/IS-6)**

This safety guide depicts the safety procedures and systems to be followed during thorium mining and milling, with the objective of protecting workers, public and environment from radiological, industrial and environmental hazards. The safety procedures include site selection, design and construction of the equipment. It provides guidelines on regulatory control during pre-operation, operation, closure and post-closure period and management of decommissioning. The document addresses the administrative, legal and regulatory framework, radiological monitoring requirements, occupational health safety aspects and emergency plan for mining and processing of Thorium.

- **AERB Safety Guide on Consenting Process for Nuclear Power Plants and Research Reactors (AERB/NPP&RR/SG/G-1)**

This safety guide defines the regulatory consenting process at all the major stages of a nuclear power plant/research reactor. It covers in detail the information required to be included in the submissions to AERB, mode of document submissions and their classification, and areas of review and assessment for granting the regulatory consent.

- **AERB Safety Manual on Regulatory Inspection and Enforcement in Nuclear Power Plants and Research Reactors (AERB/NPP&RR/SM/G-1).**

This safety manual elaborates the organization, requirements and methods for conducting Regulatory Inspections of the nuclear power plants and research reactors. It covers the suggested types of enforcement actions. It is also intended to assist all the participating agencies in fulfilling the stipulated requirements of the relevant AERB safety code and guide.

- **Regulatory Inspection and Enforcement in Nuclear Fuel Cycle Facilities and Related Industrial Facilities other than Nuclear Power Plants and Research Reactors (AERB/NF/SM/G2).**

This safety manual elaborates the organization, requirements and methods of inspection programme of the nuclear fuel cycle facilities and related industrial facilities. This manual also covers the suggested types of enforcement action.

SAFETY REVIEW

BOARD METTINGS

Three meetings of Atomic Energy Regulatory Board (AERB) were held during 2007; one at UCIL Jaduguda, Jharkhand on March 23, 2007, second at AERB, Mumbai on June 22, 2007 and the third at Kaiga site on October 15, 2007.

In the meeting held at Jaduguda, the Board reviewed the work carried out by AERB in the last quarter of 2006, the proposal for installation of windmills beyond Exclusion Zone and within 5 km sterilized zone at KK-NPP and the status of safety review and commissioning of Kaiga Unit-3.

Detailed discussion was held on the causes of two fatal accidents during March 2007 at the construction sites of PFBR at Kalpakkam; one caused by fall of a person from height and the other due to a person being hit by a moving machine. The Board noted that Chairman, AERB had directed PFBR management to stop civil construction work till the incident was reviewed by the Board. The Board decided that BHAVINI should submit a report bringing out the steps taken to prevent recurrence of such accidents and for enhancing the level of supervision of day-to-day work. An overall review of industrial safety in civil construction work should also be carried out. AERB will then conduct a special regulatory inspection of PFBR construction site. The Board authorized Chairman, AERB to issue the clearance for restart of the construction work if the report is found satisfactory and if there is confirmation of compliance of recommendations from AERB inspection.

The Board visited the Tailing Ponds and the Ore Processing Plant at Jaduguda, the Banduhurang Open Cast Mine, the Turamdih Mine and Mill and the Narwapahar Mine.

In the Board Meeting held on June 22, 2007 at Mumbai, the Board granted approval for Erection of Major Equipments at KK-NPP Unit-2. The Board also gave clearance for publication of AERB Safety Code on 'Management of Radioactive Waste', AERB/NRF/SC/RW. The draft of AERB Annual Report 2006-2007 was reviewed and the Board approved its submission to the Atomic Energy Commission.

In the third meeting held on October 15, 2007 at Kaiga Site, the Board discussed the proposal for revision of the size of Exclusion Zone around NPPs. The Board was informed about the suspension of construction activities for RAPS-5&6 during June 29th to July 5th, 2007 arising from a fatal accident. The Board endorsed the action of AERB, and suggested that the industrial accidents at sites should be prevented by all means available to NPCIL and AERB. Board also discussed the analysis of KAPS-2 incident involving double-ended rupture of 10 % feed water line to steam generator-4 due to Flow Assisted Corrosion (FAC). Board suggested that FAC should be understood in depth by conducting experiments and performing analysis by mathematical modeling based on computational fluid dynamics covering the effects like pipe fittings, welding protrusions and other conditions leading to the development of eddies and the effect of these on FAC. Development of precise effect of water chemistry on different materials, leading to FAC should also be studied. The Board visited the KGS operating units and KGS-4 which is under construction.

AUTHORIZATIONS ISSUED

- Site proposed for Tummalapalle Process Plant (Mill) of UCIL.
- Siting and Construction of Technology Demonstration Plant (TDP) at Rashtriya Chemicals & Fertilizers (RCF), Chembur, Mumbai to be operated by Heavy Water Board.
- Construction of a Medical Cyclotron facility based on a 30 MeV 500 μA proton accelerator on a plot of land situated near the Peerless Hospital at Chakgaria, South 24 – Parganas, West Bengal.
- Siting clearance for Radiation Processing Facility for Agricultural Products adjacent to Flower Mandi of Choithram Mandi Complex, Indore.
- Continuation of storage of spent fuel in the dry storage concrete casks of old design at RAPS 1&2 upto 2015
- Clearance for Erection of Major Equipment for Kudankulam Nuclear Power Project (KK NPP) Unit # 2.
- Clearance for commencement of "Revamping activities of Uranium Oxide Plant (UOP)" at Nuclear Fuel Complex, Hyderabad.
- Operation of Kaiga Unit – 3 upto 90% Full Power (FP) –May 3, 2007.
- Authorization for hot conditioning and light water commissioning of RAPP-5 of Rajasthan Atomic Power Project (RAPP-5) was issued on October 12, 2007.
- Construction consents for Rajasthan Atomic Power Project Unit - 5&6 (RAPP 5&6) were suspended on June 29, 2007 subsequent to 3 fatalities resulting due to similar conditions occurred in a period of 6 months. Suspension of construction consents was revoked on July 05, 2007 after detailed safety review of corrective actions carried out by NPCIL.
- Authorisation for trial operation of 12 MeV microtron at max. 20 mA current in IMA building of RRCAT was granted for a period of one year.
- Authorisation was issued for commissioning of Boron Enrichment Exchange Distillation (BEXD) facility at HWP-Talcher on June 20,2007.
- Permission for Cold Commissioning run of Turamdih ore processing plant with inactive material was granted with certain stipulations to Uranium Corporation of India Limited on June 23, 2007.
- Authorisation for safe disposal of radioactive waste from NUOFP was issued on July 20,2007 and valid upto December 31,2009
- Authorisation for construction of HEWAC facility at HWP, Kota was granted by Chairman, AERB on August 28, 2007 with certain stipulations. The authorisation is valid till end of August 2012.

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SAFETY REVIEW

REGULATORY INSPECTIONS CARRIED OUT DURING THE PERIOD, JAN-DEC 2007	
Unit	**Number of Inspections**
UCIL-Jaduguda, Narwapahar, Bhatin, Turamdih, Banduhurang, Bagjata mines	2 each
UCIL-Mohuldih mine	1
UCIL, Jaduguda uranium mill, Jharkhand	3
UCIL, Turamdih uranium mill, Jharkhand	2
IREL, OSCOM, Chatrapur, Orissa	2
IREL, Udyogamandal, Kerala	2
IREL, Manavalakurichi, Tamilnadu	1
IREL, Chavara, Kerala	1
NFC, Hyderabad, A.P.	2
HWPs-Talcher, Hazira, Thal, Manuguru, Tuticorin, Baroda	1 each
RAPS - 1&2, RAPS – 3&4, MAPS -1&2, KGS – 1&2, KAPS – 1&2, TAPS – 1&2, TAPS – 3&4	2 each
Narora Atomic Power Station, U.P.	4
RAPP Cobalt Facility (RAPPCOF), Rawatbhata, Rajasthan	1
Fast Breeder Test Reactor, KAMINI and IGCAR facilities	1 each
Rajasthan Atomic Power Project 5&6, Rawatbhata (RAPP 5&6)	3
Kudankulam Nuclear Project (KKNP), Tamil Nadu	3
Kaiga Projects - 3&4	2
Prototype Fast Breeder Reactor (PFBR), Kalpakkam, Tamil Nadu	3
Demonstration Fuel Reprocessing Plant (DFRP), Kalpakkam, Tamil Nadu	3
Interim Fuel Storage Building (IFSB), Kalpakkam, Tamil Nadu	1
RAPP 5&6, Kiga-3&4, KKNP, PFBR, DFRP, HEWAC, NFC (ZC) -Pazhayakal projects (Special monthly inspections on Industrial Safety)	37
Raja Ramanna Centre of Advanced Technology –Indore (RRCAT), INdore, M.P.	1
Variable Energy Cyclotron Centre (VECC), Kolkata, W.B.	2
Electronics Corporation of India Ltd.-Hyderabad (ECIL), Hyderabad, A.P.	1
Beach Sand Minerals (BSM) Facilities	5

Industrial Radiography facilities	44
Medical Installations	
• Nuclear Medicine	37
• Diagnostic X Rays	41
• Radiotherapy Facilities	12
Gamma Irradiators	11
Nucleonic Gauges	16

Personnel Joined

Sl.No. Name & Designation

1. Shri. Bibekananda Misra, SO(C), RSD
2. Shri. Hariharan Seshadri, SO(D), SRI
3. Smt. Prabha M. Das, Steno Gr. III, RSD
4. Shri. O.S. Seikh Mansoor Ali, SO(E), SRI
5. Shri. P.K. Dixit, SO(C), RSD
6. Shri. C. Anandan, SO(D), SRI
7. Shri. P.K. Baburajan, SO(E), SADD
8. Shri. V.V. Muthekar, SO(D), C&SED
9. Shri. V.M. Thomas, AO-III, Admn.
10. Shri. Megh Raj Singh, SO(C), RSD
11. Shri. Ashis Kumar Panda, SO(E), IPSD
12. Shri. Animesh Pal, SO(D), IPSD
13. Shri. Suresh Kumar, SO(C), SRI
14. Shri. Surendra Jain, SO(C), ITSD
15 Shri. A.B.Gerira, APO (Gen), Admn.
16. Shri. J.V.K.Sunil Kumar, SO(C), RSD
17. Shri. Nishant Kumar Sangam, SO(C), OPSD
18. Shri. Sunil L.S. Pagar, SO(C), OPSD
19. Shri. Pankaj Gupta, SO(C), IPSD
20. Shri. Anuj Kumar Deo, SO(C), ITSD
21. Smt. Vasantha Sasi, Accounts Officer
22. Shri. J. Vincent Kumar, DCA

Personnel Retired

Sl.No. Name & Designation

1. Shri. J. Prasad, SO(G), IPSD (retired)
2. Shri. K.D. Pushpangadan, SO(E), RSD (retired)
3. Smt. P. Samuel, Sr. Accts. Officer, Accounts (retired)
4. Shri. C.K.Vijayan, AO-II, Admn. (retired)
5. Shri.S.S. PrabhuZantye, DCA (retired)
6. Shri. G. Janakiraman, SO(F), SRI (retired)
7. Smt. Sutapa Bhattacharya, SO(G), NPSD (Retired Voluntary)

NEW RADIATION WARNING SYMBOL

New ISO Standard - Supplementary Ionizing-Radiation Warning Symbol

Figure-1. Supplementary Ionizing-Radiation Warning Symbol

A new radiation warning symbol to supplement the existing trefoil symbol has been published by ISO as Standard 21482- Ionizing-Radiation Warning –Supplementary symbol. The new symbol is the result of a multi-year effort by the IAEA to develop a universal radiation warning symbol that anyone anywhere will understand the message of "Danger-Stay Away". The new symbol was developed with human factor experts, graphic artists, and radiation protection experts. Many possible symbols were initially tested in international children, and then those symbols that were most successful in conveying the desired message were tested further by the Gallup Institute in both people with limited education and those educated in 11 countries around the world. The new symbol universally conveyed the intended message regardless of the person's age, education or cultural background.

The symbol **(Fig.1)** is intended for IAEA Category 1, 2 and 3 sources defined as dangerous sources capable of causing death or serious injury. The symbol should be placed on the device housing the source, as a warning not to dismantle the device or to get any closer. Where practical, it should be placed under the device cover such that it is not visible under normal use but would be visible if anyone attempts to disassemble the device. The symbol is not intended for doors or shipping containers.

Many source manufactures have agreed to use the symbol on newly manufactured large sources such as irradiators, teletherapy heads and industrial radiography units. Strategies to place the symbol on existing large sources are being developed by the IAEA. The standard can be obtained at www.iso.org.

Information: Carolyn Mac Kenzie, c.mackenzie@iaea.org

From page 5

- Authorisation for siting and construction of Versatile Solvent Production Plant (VSPP) at HWP-Talcher was granted on September 11, 2007.
- Authorisation for development of Mohuldih undergrounds mine of UCIL in Sarikela district of Jharkhand on October 24, 2007.
- Authorisation for construction of 10,000 tpa Monazite Processing Plant (MoPP) at IREL, OSCOM was granted by Chairman, AERB on October 24, 2007 with certain stipulations.
- Restart of NAPS-1 after EMCCR campaign
- Authorization for regular operation of TAPS-3&4
- Authorisation for operation of THRUST – II, IREL Udyogamandal was approved by SARCOP during its 549th meeting held on April 11, 2007.

OFFICIAL LANGUAGE IMPLEMENTATION

AERB continued its efforts to ensure effective implementation of official language policy and enhance the use of Hindi in official work. An Inspection Team was constituted in January 2007 to monitor the progress of use of Hindi in official work. Hindi stenography training class commenced in February, 2007 and nine Stenographers of AERB were trained. Fourteen officers/staff Members of AERB were trained for Pragya /Praveen examinations under the Hindi Teaching Scheme, Ministry of Home Affairs, Govt. of India.

In order to train employees to write letters, notes etc. in Hindi, two Hindi Workshops were organized jointly with DPS, DCSE&M, HWB, Mumbai. Four employees of AERB attended these workshops.

To create a conducive atmosphere to encourage the use of Hindi by the officers and staff, 11 competitions such as Story Writing, Essay and Slogan Writing, Scientific & Technical Translation, Noting & Drafting, Quiz, Elocution, etc. in Hindi were organized during February, 2007 and September, 2007. Forty-four AERB Officials participated in these Competitions.

Hindi Day, Hindi Week and Prize Distribution function was organized from 10.9.2007 to 14.9.2007 by the Joint Official Language Co-ordination Committee of DAE units of Mumbai (AERB, DPS, DCSEM, and HWP). Elocution, Poetry Recitation and Quiz Competitions in Hindi were organized. AERB team participated in Quiz Programme and stood second.

AERB library procured 55 books in Hindi on various topics to encourage and develop interest in scientific and literary works in Hindi. During the year, 2 documents have been printed in Hindi and 4 documents have been translated into Hindi.

To promote the use of Hindi in AERB, appropriate ISM-2000 Software tools were installed in all the computers in AERB. Hindi version of Annual Report of AERB was published and circulated to DAE units, academic and R&D institutes, medical institutions and media personnel.

TRAINING AND SAFETY RESEARCH PROGRAMME

IN-HOUSE TRAINING ACTIVITY

An in-house Training Programme was conducted for 21 participants during September 2007 to November 2007. A total of 57 lectures were delivered. Feedback was collected using the parameters: Administration of the Programme, Applicability, Content, Environment, Faculty, Course Length, Audio-Visuals and Overall Rating. The feedback from the participants ranged between A (Excellent) and B (Good) for majority of the lectures. The performance of participants was evaluated on regular basis through 13 examinations.

AERB REFRESHER COURSE

A Refresher Course was conducted involving a series of lectures on various aspects of **"Fast Breeder Reactor Technology and Engineering Aspects of Prototype Fast Breeder Reactor"** for the benefit of AERB Staff. In-house faculty members and officers from IGCAR delivered four lectures in the series on topics **'PFBR Core Engineering Design '**, **'Design of Reactor Assembly Components'**, **'Sodium Circuits'** and **'Shutdown Systems and Decay Heat Removal System'**.

AERB COLLOQUIA

Two lectures were delivered, by Dr. B.S. Rao, former Head, Radiological Physics and Advisory Division, BARC, on **'Radiobiological basis of ICRP'** and **'Recommendations and Highlights of current ICRP and Recommendations'**.

Shri A. R. Sundarajan, Former Director, Radiation Safety Division, AERB gave a talk on **"The Ecstasy and Agony of Two Alpha Emitters Radium & Plutonium"**, on February 27, 2007. This talk gave a historical account of the early unscrupulous and scandalous exploitation of these two highly radioactive elements soon after their discoveries.

A talk on **"Fifty Years of Radiation Protection"** was presented by Shri. G. Venkataraman, former Head, Radiation Protection Services Division of BARC. This talk focused on the development of radiation protection measures in medical, industrial and research applications of radiation during the last fifty years.

'Effective Communication Techniques' by Shri. R. Bharathan from BARC highlighting on how to listen while hearing and speak while talking. The talk covered various day-to-day incidents and situations related to communication gaps and how they can be used in an effective way.

The talk on **'Recent Developments in Radiobiological Research: Implications to Human Health Risk and Radioprotection'** by Dr. K.P. Mishra, former Head, Radiobiology and Health Services Division, BARC, highlighted the present emerging new perspectives in radiobiology with implications to risk assessment and radioprotection standards for human health.

A talk on **'Bomb Detection & Disposal'** was delivered by Shri. R.P.Raju, Manager (Protocol and Public Relegations) NPCIL, highlighting the various techniques involved in the detection of bombs, various precautions by the public and disposal methods.

'Regulatory Activities Prior to Formation of AERB' by Shri S. D. Soman, Ex- Chairman, AERB. This talk highlighted the regulatory activities for nuclear and radiation facilities prior to the formation of AERB. This talk also addressed how the regulatory procedures have evolved in AERB over a time period for ensuring the safety of nuclear and radiation facilities.

'Compact Reprocessing facility for Advanced fuels in Lead shielded cell (CORAL) Operations: Stepping-Stone for Fast Reactor Fuel Reprocessing Technology' by Shri R. Natarajan, Group Director, Reprocessing Group, IGCAR, Kalpakkam. This talk addressed various aspects involved in the reprocessing of spent fuel, experience of reprocessing of FBTR fuel, CORAL facility for advanced fuels in Lead Shielded Mini Cell, design aspects of the Demonstration Fast Reactor Fuel Reprocessing Plant (DFRP) and the Fast reactor fuel Reprocessing Plant (FRP).

SAFETY RESEARCH PROGRAMME

The AERB Committee for Safety Research Programmes (SRP) met three times on 13th June 2007, 20th/21st July 2007 and 8th October 2007. Eight new project proposals were taken up for discussion and following five projects were approved (Table 1). Committee also approved the renewal of 6 on-going projects. Eighteen Principal Investigators of the projects made presentations to CSRP.

Table 1: AERB approved Projects in 2007

S.No.	Title of the project	Institution
1.	Enhancement of Durability of Concrete Structures using Microbes.	Thapar Institute of Engineering & Technology, Patiala
2.	Validation of Gel Dosimetry as 3D Verification Tool for Highly Conformal Radiotherapy Techniques.	AIIMS, New Delhi
3.	Multi-Material Multi-Rod 3-D Temperature Distribution in a Fuel Bundle with Temperature/Time Dependent Thermo-Physical Property with Dirichlet/Neumann/ Robbins and their combination as Boundary Conditions.	College of Engineering & Technology, Biju Patnaik University
4.	Development of Model to Calculate Radiative Heat Transfer in Fuel Channels of PHWRs.	IIT-Guwahati, Guwahati
5.	Development of a Thermo Luminescence Dosimeter (TLD) based on Borate Glass: Implication to Clinical Dosimetry.	Thoubal College, Manipur

AERB SILVER JUBILEE YEAR CELEBRATION

November 15, 2007 marked the beginning of the twenty-fifth year of the Atomic Energy Regulatory Board. In the year 1981, The Meckoni Committee had recommended for the creation of AERB by the Central Government with the powers to lay down safety standards and framing rules and regulations for enforcing regulatory and safety requirements envisaged under the Atomic Energy Act, 1962. On November 15, 1983, the AERB was officially set up through a Gazette notification.

A series of metamorphoses have taken place over the years to give AERB its present outlook. AERB started its work in 1983, with its office located at the Anushakti Bhavan, with a handful of employees. AERB has now grown up to an organization housing about two hundred employees located at Niyamak Bhavan in Anushaktinagar, Mumbai. Over the years, AERB has firmly established itself to meet the challenges of regulating the fast expanding nuclear and radiation facilities in India. Having realized the need for dedicated research on the issues of regulatory interest, an in-house R&D facility, the Safety Research Institute (SRI) was set up by AERB at Kalpakkam in 1999. AERB had made its presence felt in the international arena too. Today it commands a position, which is on par with the best international regulatory authorities.

To commemorate the beginning of the Silver Jubilee year of AERB, a function with a small gathering of AERB staff together with the past Chairmen and Vice Chairmen of AERB, former directors/heads of divisions of AERB and Chairmen of various Committees of AERB was held on 23 November, 2007 at Niyamak Bhavan. The Chief Guest of the function was Dr. Anil Kakodkar, Chairman AEC. Chairman AERB, Shri S. K. Sharma delivered the welcome address acknowledging the tremendous efforts put in by AERB staff; both past and present over these past twenty-four years. There is a certain atmosphere that comes with adulation. And it was this very ambience servicing in the auditorium when the former Chairmen of AERB Prof. S.P. Sukhatme, Prof. P. Rama Rao, Shri S.D. Soman and Prof. A.K. De and the former Vice Chairmen Shri G.R. Srinivasan and Shri S.Vasant Kumar delivered their nostalgic speeches, recollecting their association with AERB, the major achievements, their vision, and the forthcoming challenges that AERB should prepare for. Dr. Anil Kakodkar conveyed his compliments and greetings to AERB for the excellent work done over the past 24 years and released the AERB 'Code of Ethics' and a monograph on 'Probabilistic Safety Assessment' on this auspicious day. Shri S.K. Chande, Vice Chairman, AERB presented the vote of thanks and informed that AERB shall look forward to more such interactions with the former Chairmen and Vice Chairmen of AERB all through out this Silver Jubilee Year. A series of events is planned as part of AERB Silver Jubilee celebrations, the foremost of them being the inauguration of the much awaited new building of AERB 'NIYAMAK BHAVAN-B'. The ebullient gathering cheerfully applauded as Prof. A.K. De, the first Chairman, of AERB unveiled the plaque commemorating the opening of Niyamak Bhavan-B. The Silver Jubilee Year celebrations will culminate with an International conference on Topical Issues in Nuclear Installation Safety, that AERB and the International Atomic Energy Agency will jointly organize in Mumbai during 17-21 November 2008.

-Soumen Sinha

Release of "AERB Code of Ethics" and a Monograph on "Probabilistic Safety Assessment" by Dr. Anil Kakodkar, Chairman, AEC & Secretary, DAE.

(Standing from Left: Shri. S.K. Sharma, Prof. S.P. Sukhatme, Prof. P. Rama Rao, Dr. Anil Kakodkar, Prof. A.K. De, Shri. S.D.Soman and Shri. S.K. Chande)

Inauguration of Niyamak Bhavan-B by Prof. A.K. De, the First Chairman of AERB

RADIOLOGICAL SAFETY IN RADIATION THERAPY FACILITIES

R. M. Nehru, Information and Technical Services Division, AERB

1.0 INTRODUCTION

Radiation Therapy (RT) is one of the recognized modalities for the management of cancer. Under the mandate of the Atomic Energy Act 1962 and the Atomic Energy (Radiation Protection) Rules 2004 (RPR-2004), AERB develops and enforce specific codes and standards to regulate radiation safety aspects of instrument and equipment using radiation. In India, there are 231 radiotherapy facilities equipped with 283 Telecobalt machines, 87 Medical Linear accelerators and 88 remote afterloading Brachytherapy machines. The AERB documents "Safety Code for Telegamma Therapy Equipment and Installations" and "Safety Code for Brachytherapy Sources, Equipment and Installations" were issued by AERB between 1986 –'88 cover the mandatory safety and regulatory requirements to be complied with by the operators. These codes are under revision to incorporate new technologies and other developments in radiation therapy. In this article, some of the safety aspects on radiation therapy are discussed.

2.0 RADIATION THERAPY

Radiation therapy is generally used in combination with surgery and/or chemotherapy. The typical sequential steps involved in radiation therapy are diagnosis and/or image acquisition for target and other normal tissues /organs delineation, treatment planning and verification, patient immobilization, dose delivery and verification and follow-up.

Fig.1: Medical Linear Accelerator (1-Linear Accelerator, 2 - the adjustable treatment couch)

Radiation therapy is divided broadly into two categories: External Beam Therapy and Brachytherapy. In External Beam Therapy, Co-60 or Cs-137 sources are used traditionally in Teletherapy machines. Due to some of the technical and dosimetric disadvantages, Cs-137 Teletherapy machines were being phased out. At present, due to technological advancements, Co-60 units are also being replaced by Medical Linear Accelerators (Fig.1) delivering high energy X-ray beams /Electron beams. These beams are directed at the tumor from outside the patient's body.

In brachytherapy, radioactive sources in the form of tubes/pellets are introduced into a human cavity (Intracavitary therapy) in close proximity to the tumor or in the tissues themselves (interstitial therapy) to deliver a high dose of radiation to a limited volume. Presently, Brachytherapy involves use of radioactive sources such as Cs-137, Co-60, Ir-192 and I-125. Brachytherapy is further divided into Low Dose Rate (LDR) and High Dose Rate (HDR) Brachytherapy depending upon the type and activity of the source used.

In today's advanced radiation therapy, many modern techniques such as three Dimensional Conformal Radiation Therapy (3D CRT), Stereotactic Radiation Therapy (SRT), Stereotactic Radiosurgery (SRS) and Intensity Modulated Radiation Therapy (IMRT), Image Guided Radiation Therapy (IGRT), Tomotherapy and HDR are applied using medical linear accelerators for better tumor control and for reducing dose to the normal tissues.

3.0 RADIATION SAFETY

Overall radiation safety is achieved by built-in safety combined with operational safety.

3.1 BUILT-IN SAFETY

3.1.1 Radiation Therapy Equipments and Sources

Type Approval and Design Approval: Sealed sources and radiotherapy equipments are designed such that these equipments and sources conform to applicable standards of the International Electrotechnical Commission (IEC) and the International Standards Organization (ISO) or to equivalent national standards. This ensures design safety of the mechanical, electrical and electronic components associated with the equipment. Type approval is accorded only after AERB is satisfied that the equipment and sources comply with these standards. The following are some of the IEC and AERB standards applicable to radiotherapy:

- IEC-601-2-1 for medical electron accelerators
- IEC-60601-2-11 for gamma external beam therapy
- IEC-60601-2-17 for remote afterloading brachytherapy
- IEC-60601-2-29 for therapy simulators
- IEC-62C/62083 for treatment planning systems
- AERB/SS-3 (Rev.1) Safety Standard for Testing and Classification of Sealed Radioactive Sources

3.1.2 Radiotherapy Installation

Safety can largely be ensured by the design of the facilities and equipment. So the layout design of the radiotherapy installation and shielding of the installations should comply with the requirements of prescribed AERB Codes and Standards. The layout should be approved by AERB before the construction begins.

Adequate structural shielding are provided for the walls, ceiling, floor of the treatment room so that radiation doses outside the room does not exceed the specified radiation level. The treatment room in

the case of teletherapy and remote after loading brachytherapy equipment shall be equipped with appropriate door interlock and warning light at/or near the entrance to the treatment room so as to warn against inadvertent entry of persons during irradiation. A legend in Hindi and in English indicating radiation hazard and restricted entry and an equivalent in local language shall also be posted along with the radiation symbol in control areas.

3.1.3 Transport Safety

The licensee has to comply with the requirements of the AERB for all activities involving transport of radioactive sources. Transport containers designed for transport of radioactive sources need to conform with the requirements established by AERB.A mobile shielded container is needed for transport of sources and the shortest route possible should be used.

4.0 OPERATIONAL SAFETY

The safety aspects which need to be considered for operation of the facility are periodic calibration of output of teletherapy and brachytherapy machines and associated accessories, appropriate workplace monitoring, training for personnel handling the radiation therapy equipment and radioactive sources, safe and secure storage of brachytherapy sources, ensuring availability of appropriate personnel monitoring devices for all personnel handling radiation therapy equipments and radioactive sources, establishment of safety protocol and periodical verification of safety systems and display of emergency procedures to be followed in two events namely 'failure of telegamma and remote afterloading brachytherapy source to return to the safe position during treatment' and in loss of brachytherapy source. The operational safety ensures the dose limits set by AERB Safety Directives are not exceeded by keeping the ALARA principle for workers, the patients and the public. AERB has implemented the recommendation of the International Commission on Radiological Protection (ICRP) in a phased manner on dose limits for practices using radiation sources. The cumulative effective dose limit for five years block is one hundred millisevert (100 mSv) and the annual effective dose to individual workers in any calendar year shall not exceed 30 mSv. The dose limit for the Public is 1 mSv per year.

4.1 Staff Requirement

Radiation Oncologist/Therapist: Radiation Oncologist is a medical professional trained in radiation physics, radiation biology and clinical oncology for the management of cancer. Radiation oncologist also oversees and follows-up radiation therapy treatments regularly and formulates strategies to improve therapeutic response. A radiation oncologist/therapist should have a basic degree in medicine from a recognized university; a post-graduate degree in radiation therapy/radiation oncology or an equivalent qualification and a minimum of 2 years' experience as senior resident or equivalent in a well-equipped radiation therapy department.

Medical Physicist: Medical Physicist works directly with the radiation oncologist during the development of treatment planning (manual / computerized) and dose delivery. He contributes to the development of therapeutic techniques (e.g., SRS, SRT, and IMRT) and collaborates with radiation oncologists to design treatment plans, and monitors equipment and procedures to ensure that cancer patients receive the prescribed dose. He is responsible for developing and directing quality control programs for complex equipment and procedures by way of precise measurements and other safety tests in a periodical manner. A medical physicist should have a basic degree in science from a recognized university, with physics as one of the subjects combined with a post-graduate diploma/degree in radiological/radiation/medical physics from a recognized university.

Radiation Therapy Technologist / Technician: Radiation Therapy Technologist works in tandem with the radiation oncologist and medical physicist in delivering a prescribed course of radiation therapy and their supervision. The responsibilities include assisting in localization of tumor volume, treatment planning, and the daily delivery of radiation treatments, as well as providing comfort and support to patients and their families, maintaining daily records and regularly check the treatment machines to make sure they are working properly. The required qualifications of a radiation therapy technician are; 10+2 or equivalent examination passed with science subjects from recognised board with 2 years' radiation therapy technologists' course or equivalent-passed from a recognized institution with in-field training and it is desirable to have a certification from the competent authority for the safe handling of radiation therapy equipment and sources.

Radiological Safety Officer (RSO): RSO carries out routine measurements and analysis on radiation and radioactivity levels in the controlled area, supervised area of the radiation installation and maintains records. He is responsible for safe storage and movement of radioactive material within the radiation installation, initiation of suitable remedial measures in respect of any situation that could lead to potential exposures and routine measurements and analysis on radiation and radioactivity levels in the off-site and around the radiation installation and maintenance of the results thereof. RSO having appropriate qualification is nominated by the employer and approved by AERB. In India, Medical Physicists are generally nominated and designated by the Employer as RSO in case they are approved by AERB under the Atomic Energy (Radiation Protection) Rules, 2004. An RSO should have a basic degree in science from a recognized university, with physics as one of the subjects; a post-graduate diploma/degree in radiological/medical physics from a recognized university; and an authorization from the competent authority to function as RSO.

4.2 Quality Assurance (QA)

QA ensures the functional performance of the radiotherapy equipment and helps in early detection of electronic malfunctions, component failures, mechanical breakdown, and deterioration and aging of the components. The QA

.....contd. in page 12

AERB Day Celebrations in 2007

The AERB Day Programme was celebrated on November 17, 2007 in the Multipurpose Hall of BARC Training School Hostel. About three hundred persons, which included AERB staff and their family members, graced the occasion. The programme started with lighting of lamp by Shri. S.K. Sharma, Shri. S.K. Chande, Dr. Om Pal Singh, Shri. A. Ramakrishna and Shri. R. Bhattacharya. Shri. Vaibhav P. Gholap, Secretary, AERB Staff Club gave the welcome address. This was followed by a cultural programme from AERB Staff and their family members consisting of dances, songs, music etc., and a Bharatnatyam Group Dance by a professional artists group. Smt. Sharma and Smt. Chande presented the prizes to the winners of various sports tournaments such as Table Tennis, Badminton, Chess and Carrom conducted by Staff Club for the year 2007. The artistes of the programme were presented with mementos in appreciation of their performance.

⇦ Shri. S.K. Sharma lighting the lamp at the AERB Cultural Programme.

National Integration Theme Dance performed by professional artists group during the celebrations.

Obituary

AERB staff were deeply saddened by the untimely demise of Shri N.S. Nair, AO-III, AERB on April 08, 2007. A condolence meeting was organized in AERB on April 09, 2007 where many speakers paid tributes to Shri N.S. Nair.

Shri. N.S. Nair (Late) ⇨

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tests are repeated at specified intervals and the appropriate records are maintained.

4.3 Personnel Monitoring

All personnel handling radioactive sources and/or radiation generating equipments use appropriate personnel monitoring devices. Employer shall ensure the availability of personnel monitoring services such as Thermoluminescence Dosimeters for occupational workers.

4.4 Patient /Public Protection:

Patient protection is ensured by periodic QA of the safety systems/procedures of the RT equipment, including sources and accessories. Some of the checks of QA are verification of patient chart and treatment parameters before treatment, calibration and maintenance of RT equipments, dosimetry instruments/ accessories, monitoring the patient during dose delivery.

Adequate structural shielding of the radiation facilities, monitoring the workplace, classification of areas, periodic radiation survey around the facilities and local rules and supervision ensure public protection.

4.5 Emergency Preparedness Plan

Emergency response plans as specified in the relevant AERB safety codes should be in place. In any emergency situation, the licensee reports the incident to the competent authority within 24 hours of its occurrence submitting a detailed report on the emergency/ unusual occurrences stating (i) date and time of occurrence, (ii) brief description, (iii) action taken, (iv) probable causes, and (v) steps taken to avoid its recurrence in future.

4.6 Decommissioning

When a radiation installation or radiation generating equipment ceases to be in use, the employer ensures it's decommissioning with the prior approval from AERB. This includes a plan with due cognizance of disposal of radioactive wastes, recycling of materials, and reuse of equipment and premises.

5.0 SUMMARY

The use of many advanced technologies is changing the face of radiation therapy. Society is deriving immense benefits from the application of radiation in medicine. Care need to be taken against the hazards associated with handling of these advanced radiation generating machines and radioactive materials. The use of trained man power with excellent quality control and safety culture, the commitment of management and workers to radiation safety would ensure the medical uses of radiation without undue risk to the patient, occupational workers and public in radiation therapy arena.

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