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AERB Newsletter

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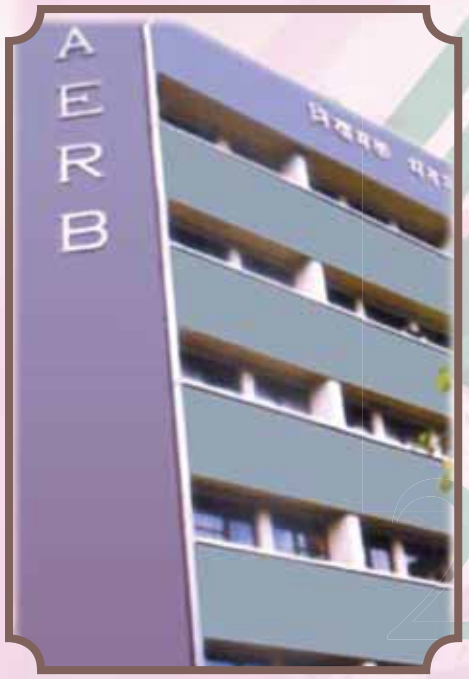
25 Years of Safety Regulation 1983 -2008

ATOMIC ENERGY REGULATORY BOARD

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



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From the Chairman's Desk

November 15, 2007, marked the beginning of the Silver Jubilee Year of AERB. Therefore, this newsletter has the Logo: 25 years of Safety Regulation: 1983– 2008. During this six month period, a series of international co-operation meetings, special workshops and seminars were organised as part of Silver Jubilee celebrations. Some details of these events are covered in this issue.

Additionally, three special one-day Awareness Programmes on Safe Transport of Radioactive Material for Air and Sea Carriers, Radiation Safety for Operators of X-Ray Baggage Inspection Systems at the Airports and on Regulatory Control on Diagnostic X-Ray Equipment and Installations were also organized.

The fourth Review Meeting of Contracting Parties to the Convention on Nuclear Safety (CNS) was held in Vienna during April 14–25, 2008, and an 18 member Indian delegation, consisting of senior officers from AERB, NPCIL, BARC and our Permanent Mission in Vienna participated and presented our first national report. This national report demonstrates, through self assessment, how India fulfills its obligations under the CNS. The report was well received and the various safety practices and the effective regulatory review structure followed in India were appreciated by the Contracting Parties.

This newsletter covers the details of some of the activities mentioned above and the various regulatory activities carried out during this six month period.

(S. K. Sharma)

SAFETY REVIEW AND REGULATION

AERB Board Meetings

Two meetings of Atomic Energy Regulatory Board were held at AERB, Mumbai on February 1, 2008 and at PFBR Site, Kalpakkam on May 1-2, 2008.

The Board granted clearance for Erection of Safety Vessel and for Construction of Upper Lateral of PFBR (Prototype Fast Breeder Reactor), as part of Authorization for Erection of Major Equipment. The Board also reviewed the R&D work being carried out by Safety Research Institute (SRI), AERB, Kalpakkam. Chairman, AERB briefed the Board Members and Senior Scientists / Engineers of PFBR about the presentation of Indian report on the safety of nuclear power plants in India at the 4th Review Meeting of the Contracting Parties to the Convention on Nuclear Safety (CNS) held in Vienna during April 14–25, 2008.

The Board members visited the PFBR Site, had a meeting with senior scientists and engineers of IGCAR and visited the various laboratories carrying out R&D work in support of PFBR design validation. Members also visited the AERB's Safety Research Institute, situated in IGCAR complex, Kalpakkam.

Authorisations Issued

- Clearance for Erection of Safety Vessel and Construction of Upper Lateral for PFBR.
- Authorisation for Hot Conditioning and Light Water Commissioning of Unit-4 of Kaiga Generating Station (KGS-4).
- Authorisation for Development of Tummalapalle Uranium mine.
- Authorisation for Exploratory Development of Gogi Mine.
- Authorisation for Trial Operation of 750 keV DC Accelerator and for Regular Operation of INDUS-1 at RRCAT, Indore.
- Authorisation for addition of 20 Tonnes of Heavy Water to Moderator System of RAPP-5.

Regulatory Inspections

Unit	No. of Inspections
IREL, OSCOM, Chatrapur, Orissa	1
IREL, Udyogamandal, Kerala	1
IREL, Manavalakurichi, Tamilnadu	1
HWPs-Kota, Baroda	1 each
RAPS-1&2, RAPS–3&4, MAPS-1&2, KGS–1&2, KAPS–1&2, TAPS–1&2, TAPS–3&4	1 each
RAPP Cobalt Facility (RAPPCOF), Rawatbhata, Rajasthan	1
Fast Breeder Test Reactor, KAMINI and IGCAR facilities	1 each
Narora Atomic Power Station, U.P.	1
Rajasthan Atomic Power Project - 5 & 6 (RAPP- 5&6), Rawatbhata	1
Kudankulam Nuclear Project (KK-NPP), Tamil Nadu	2
Kaiga Projects - 3&4 (Kaiga- 3&4)	2
Prototype Fast Breeder Reactor (PFBR), Kalpakkam, Tamil Nadu	2
Demonstration Fuel Reprocessing Plant (DFRP), Kalpakkam, Tamil Nadu	2
Interim Fuel Storage Building (IFSB), Kalpakkam, Tamil Nadu	1
RAPP-5&6, Kaiga-3&4, PFBR, DFRP, HEWAC, NFC-ZC (Pazhayakal projects)(Special monthly inspections on Industrial Safety)	22
Raja Ramanna Centre of Advanced Technology, Indore	1
Variable Energy Cyclotron Centre, Kolkata	1
Industrial Radiography Facilities	22
Medical Installations • Nuclear Medicine • Diagnostic X-rays	 6 18
Industrial Gamma Irradiators	1
Nucleonic Gauges Installations	9

SAFETY DOCUMENTS PUBLISHED

During the period, Jan.-June, 2008, AERB issued the following safety documents. In drafting these documents, extensive use was made of the information contained in the relevant safety standards of the International Atomic Energy Agency.

PSA Manual (AERB/SM/O-1)

This safety manual on PSA provides guidance for performing PSAs including its applications for design and operation of nuclear power plants (NPPs) and research reactors for the shutdown, low power and full power reactor states.

Human Reliability Analysis (AERB/TD/O-2)

This technical document on Human Reliability Analysis (HRA) has been primarily written to fulfill the existing need of analysts on HRA having specific reference to the Indian context. The document presents HRA methods and data useful for application in HRA studies for Indian NPPs.

Geotechnical Aspects and Safety of Foundation for Buildings and Structures important to Safety of Nuclear Power Plants (AERB/NPP/SG/CSE-2)

This safety guide provides guidance for fulfilling the minimum requirements on geotechnical aspects and safety of foundation for buildings and structures to provide adequate assurance for safety of nuclear power plants in India. The document particularly deals with foundation design, dewatering and monitoring. Safety of earth structures, guidelines on geotechnical instrumentation, liquefaction and soil erosion are also covered in the guide.

Atmospheric Dispersion and Modelling (AERB/NF/SG/S-1)

This guide explains various atmospheric processes involved and methods to be used in evaluating the concentration of effluents in air/ground over a domain extending up to distance of 30 km radius around the Nuclear Facilities. It also gives recommendations on characterization of the site, selection of the appropriate mathematical model for predicting dispersion and deposition, extent of validation required for the use of the model and the accuracy of model predictions, etc.

Extreme Values of Meteorological Parameters (AERB/NF/SG/S-3)

The guide provides the methodology of estimating extreme values of metrological parameters along with different approaches utilized in extreme value statistics and brings out the data requirements for application of these approaches.

Predisposal Management of Low and Intermediate Level Radioactive Waste (AERB/NRF/SG/RW-2)

This safety guide outlines the predisposal management of low and intermediate level radioactive waste that includes collection, segregation, transportation, treatment, conditioning and storage. It includes characterisation of the waste, waste form or waste package at appropriate stages in the processing of the waste, until the delivery of the waste package to a waste repository.

Management of Spent Radioactive Sources and Radioactive Waste arising from the use of Radionuclides in Medicine, Industry and Research, including Decommissioning of Such Facilities (AERB/RF/SG/RW-6)

This safety guide provides guidance on the safe management of radioactive waste arising from the use of radionuclides in medicine, industry, agriculture and research. The guidance is intended for organizations and persons using radioisotopes resulting in generation of radioactive waste and those managing such wastes.

Security of Radioactive Material during Transport (AERB/TS/SG-10)

This safety guide provides guidance to an authorized user of radioactive material, consignor, carrier and other concerned persons, in implementing, maintaining or enhancing security in order to secure radioactive material while in transport against theft, sabotage or other malicious acts that could result in significant radiological consequences.

Land Based Stationary Gamma Irradiators (AERB/RF-IRRAD/SS-6 (Rev.1))

This safety standard specifies the mandatory requirements for the design and manufacture of gamma irradiator facilities. The Standard also specifies the requirements for the design and installation of irradiators to achieve built-in safety. Compliance with these requirements is essential for obtaining approval of the Competent Authority.

Industrial Gamma Radiography Exposure Devices and Source Changers (AERB/RF-IR/SS-1 (Rev.1))

This safety standard specifies the design and performance requirements including quality assurance aspects for the design and manufacturing of various types of exposure devices, source changers and tests on prototypes for demonstration of compliance for the purpose of obtaining Type Approval from the Competent Authority.

SAFETY PROMOTIONAL AND AWARENESS ACTIVITIES

1. 24th DAE Safety and Occupational Health Professionals Meet

The 24th DAE Safety and Occupational Health Professionals Meet was organized jointly by the NPCIL and AERB during December 29 – 31, 2007 at Rawatbhata Rajasthan Site.

The theme of the Meet was "Construction Safety" and "Medical Management of Industrial Accidents". Dr. Anil Kakodkar, Chairman, AEC and Secretary, DAE, inaugurated the meet and released the Monograph on "Construction Safety" prepared by AERB Staff as part of AERB Silver Jubilee Year Celebrations. The 10th Endowment Lecture on "Construction Safety" was delivered by CMD, NPCIL. It was informed by Chairman, AERB, during his address that the endowment lecture from the next Meet will be named as "Dr S. S. Ramaswamy Memorial Endowment Lecture" in the memory of late Dr S. S.Ramaswamy, Former Board Member, AERB.

⇧ Inaugural session during the Industrial Safety Awards Function for DAE units in AERB

(L to R): Shri R. Bhattacharya, Head, IPSD, AERB; Shri S. K. Chande, Vice-Chairman, AERB; Shri S. K. Saxena, Director General, DGFASLI, Mumbai; and Shri S. K. Sharma, Chairman, AERB.

On the first day, the inaugural session was followed by two technical sessions on "Construction Safety" and one session on "Occupational Health". Invited lectures were on "Methodology of Construction and Safety Management" and "Innovative Approach in Construction Safety". Three lectures on "Sustainable Construction and Construction Safety", "Challenges in Construction Safety" and "Innovative measures for enhancement of Safety Awareness amongst the grass root workers" were delivered by experts from construction companies and DAE construction facilities. Invited papers on "Cardio Pulmonary Resuscitation" and "Management of Polytrauma" covering accident management were delivered by Occupational Health professionals from outside DAE fraternity.

On the second day, Injury Statistics and Occupational Health Statistics were presented by AERB. The management of DAE Units presented fatal accident cases and near-miss cases. In Technical Poster Session five papers each were presented on "Innovative Methods adopted at Construction Site to make job Safer and "Electrical and Mechanical Safety Aspects in Construction activities" and twelve papers on "Occupational Health" were presented.

On the third day, there were three presentations from DAE units and two presentations from exhibitors on "Safety Training of Contractor's Workers". This was followed by the discussion on Safety and Occupational Health issues. The venue for 25th DAE Safety & Occupational Health professionals was decided to be held at Kalpakkam with "Safety Management and Safety Culture" as the theme of the Meet.

- Compiled by IPSD, AERB

2. AERB Industrial Safety Awards

AERB presents Industrial Safety Awards every year to the units of DAE who achieve high levels of performance in Industrial Safety. The Industrial Safety Awards for the year 2007 presentation function was held on March 7, 2008. Shri S. K. Saxena, Director General, Directorate General Factory Advice Service and Labour Institutes (DGFASLI), Mumbai presented the Safety Awards for the year 2007 to the winner units, i.e., Kudankulam Nuclear Power Project in Construction Units Group, Kaiga Generating Station-1&2 in Production Units Group I, Indian Rare Earths Ltd., Orissa in Production Units Group II and Variable Energy Cyclotron Centre, Kolkata in Research Units Group.

On this occasion, Shri S. K. Sharma, Chairman, AERB released compilation entitled "Industrial Safety Statistics - 2007 of Department of Atomic Energy Units". The compilation provides data and analysis of number of injuries and man-days loss caused by various factors. It is seen that Industrial Safety performance of DAE Units is significantly better as compared to other similar industries in the country. No case of occupational disease was reported for the year 2007 in any of the DAE Units.

- Compiled by IPSD, AERB

3. 'Fire Safety Awards-2007" and Seminar on 'Challenges and Innovations in Fire Safety'.

The fire safety awards ceremony for the year 2007 was organized during April 29-30, 2008 in AERB to award the most deserving DAE unit with 'Fire Safety Awards'. A seminar on 'Challenges and Innovation in Fire Safety' was also organized and a monograph on "Fire Safety" prepared by AERB Staff was released. Shri D. K. Deshpande, Executive Director, Hindustan Petroleum Corporation Limited, Mumbai was the chief guest at the function and presented the 'Fire Safety Award-2007' shields to the winning units.

In the welcome address, Shri R. Bhattacharya, Head, IPSD spoke of the significance of the fire safety day. Shri S. K. Chande, Vice Chairman, AERB in his opening remarks, narrated the criteria for fire safety award selection and formally announced the winners of the fire safety award-2007. This year, there were joint winners i.e., HWP, Kota and TAPS 1&2 in Category-I (high risk units) and KK-NPP and Kaiga Power Project in Category-II (low risk units). Shri Chande applauded the extremely good performance of all the DAE units this year as there were no incidences of fire reported in any of the DAE units. Shri S. K. Sharma, Chairman AERB addressed the gathering and pointed out the steps taken by AERB to bring industrial safety at par with nuclear and radiological

SAFETY PROMOTIONAL AND AWARENESS ACTIVITIES

safety. Shri Deshpande, in his address stressed that along with the maintenance and operability of safety systems, the alertness and carefulness of the employees are equally important. Various safety measures taken for oil fires in refinery units were explained. The winning units made presentations on the improvement measures taken for achieving higher safety standard.

The two day seminar covered the themes like Fire Technologies and Fire Testing Facilities, Fire Analysis and Modelling, Fire Organization, Administration and Past Events, Fire Safety Challenges and Fire Analysis and Operational Plants Fire Safety. There were invited talks from eminent experts from DRDO, HPCL, NPCIL and BARC. In the feedback session, the areas identified for further investigation were: applicability and utility of fire probabilistic safety analysis, fire scenario analysis using CFD model in NPPs & Fuel Cycle Facilities and establishing safety criteria through a testing facility at IGCAR/BARC (XIth plan). The issues involved in oil handling at turbine building, main oil tank, turbine oil tank at NPPs and fire protection systems for transformers were also found to be requiring higher attention.

- Compiled by IPSD, AERB

4. One Day Awareness Programme on Radiation Safety for Safe Transport of Radioactive Material for Air and Sea Carriers

It has come to the notice of AERB that most of the air and sea carriers in India have an apprehension in accepting consignments containing radioactive material for export and also have a misconception on the risk involved in handling packages containing radioactive material. In view of this, a one day awareness programme on the safe transport of radioactive material, for the managerial level officers of airlines, airports and seaports in the country was conducted on June 3, 2008 at AERB. The objective of the program was to allay fear of handling packages containing radioactive material which in turn would help in reducing the number of denials of shipment of such packages by carriers. The programme comprised of lectures on safe transport of radioactive material relevant to the carriers and procedures for accepting the consignment, demonstration on radiation detection and measurement and a feed-back session.

- Compiled by RSD, AERB

5. One Day Awareness Programme on Radiation Safety for Operators of X-ray Baggage Inspection Systems at the Airports

During recent inspection by AERB at an international airport, it was noted that large number of operators are operating the X-ray baggage inspection system at the airports without the basic knowledge of radiation safety. Therefore, a one day awareness programme for the operators on the safe operation of the X-ray baggage inspection systems was held on June 5, 2008, at AERB. The programme comprised of lectures on basic knowledge in radiation safety and Dos and Don'ts for safe operation of such system followed by feed-back session and discussions. There was also a demonstration on radiation detection and measurement techniques.

- Compiled by RSD, AERB

6. One Day Workshop for X-ray Machine Manufacturers/Suppliers on Regulatory Control of Diagnostic X-ray Equipment and Installations

⇧ Panel Discussion at the workshop held for X-ray machine Manufacturers/ Suppliers on Regulatory Control of Diagnostic X-ray Equipment and Installations

(L to R) : Shri Girish Kumar, Adonis Medical Systems, Chandigarh; Shri V. K. Shirva, RSD, AERB; Shri S. P. Agarwal, Head RSD, AERB; Shri K. V. Ramani, Siemens India Ltd., Mumbai; Shri R. K. Narang, M/s. Allengers Medical System Pvt. Ltd., Chandigarh; Shri Anil Jathar, Wipro GE Medical Systems, Mumbai and Shri Vinod G. Vora, M/s. Meditronix Manufacturing Company Pvt. Ltd., Ambernath

The main objective of workshop was to familiarize manufacturers/ suppliers of medical X-ray machines on current radiation safety requirements in the diagnostic X-ray installations and their roles and responsibilities in implementing radiation protection programme. The programme comprised of lectures on topics related to radiation protection standards, techniques and dose limits. There was a demonstration of radiation detection and measurement techniques. In the feedback session, presentations were given by five leading manufacturers of the units on the system followed by them in the implementation of the AERB regulations.

- Compiled by RSD, AERB

7. Discussion Meet on Emergency Exercises at NPP Sites - Site and Off Site: Challenges and Constraints

As part of AERB Silver Jubilee Year Celebrations, a two day Discussion Meet on "Emergency Exercises by NPPs - Site and Off-Site: Challenges and Constraints" was organized at SRI Guest House, Kalpakkam during June 12-13, 2008. The objective of the Discussion Meet was to identify and address challenges and constraints faced while conducting the emergency exercises and also to identify and implement measures to harmonize procedures/practices among NPPs.

The Meet was inaugurated by Additional Collector, Kanchipuram

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TRAINING

AERB In-House Training Programme

An AERB In-House Training Programme was conducted during the year September to November 2007 for twenty-one newly recruited scientific/technical staff members of AERB. The salient topics in the Programme included: Functions and Responsibilities of AERB, Functions of various Divisions in AERB, Reactor Concepts and Systems, Probabilistic Safety Analysis, Accident Analysis, Basic and Operational Reactor Physics, Radiological Safety, Operational Health Physics, Industrial Plant Safety topics (Fire, Chemical, Environment, Electrical, Mechanical and Occupational health), AERB Acts and Rules, Civil Engineering Safety Aspects, Regulatory Inspections, Life Cycle Management, etc. A total of 57 lectures were held. Chairman, AERB distributed the certificates to the successful participants of the Programme during the valedictory function held in February 2008.

AERB Colloquia

The following AERB Colloquia were organized:

(a). "NAPS-1 Criticality and Phase-B Experiments after Enmasse Coolant Channel Replacement (EMCCR) Works" by A. Ramakrishna, AERB on 5th February 2008.

(b). "Online E-Training for Continuous Improvement at Rapid Pace" by Dr. Mihir K. Das, California State University, USA on 11th March 2008.

(c). "Radiation Therapy of Tumors by Heavy Ions and Associated Radiation Protection" by Dr. Klaus Henrichs, Germany on 27th March 2008.

Continued Education Programme of BARC Training School

Twelve Scientific Officers from various divisions of AERB attended the Continued Education Programme conducted by HRDD of BARC on "Vibrations", "Preparedness and Response to Nuclear Emergencies", "Database Management System", "DSP and Computer Vision", "Software Engineering" and "Feedback Control Systems".

SAFETY RESEARCH PROGRAMME (SRP)

AERB Committee on SRP held two meetings during this period. In these meetings, seven principal investigators (PI) of the research projects made presentations on the work carried out, methodology followed, results obtained by them and future work planned. The committee reviewed the detailed evaluation of the presentations and recommended suitable midcourse corrections in achieving the final objectives of the project.

The funding for the new project proposals and renewal of old projects was considered during these meetings. After deliberations, the committee approved 5 new projects as given in Table-1 below and granted renewal of 5 on-going projects.

Table 1: New Projects Approved

Sr. No.	Title	Principal Investigator / Institute
1.	Thermal Hydraulics Studies on Stability and CHF of Relevance to AHWR	Dr. Kannan Iyer, IIT-Bombay, Mumbai
2.	Hydro geochemical Modeling of Coastal Aquifers in & around Kalpakkam- An Integrated Approach	Dr. S. Chidambaram, Annamalai University, Annamalai Nagar
3.	Microbial Biofilm Formation & Corrosion of Firewater Pipelines in NPPs	Prof. S. Jayachandran, Pondichery University, Pondichery
4.	Experimental Investigations on Transient CHF	Dr. S. V. Prabhu, IIT-Bombay, Mumbai
5.	Development of a TLD based on Borate Glass: Implication to Clinical Dosimetry	Dr. A. Nabachandra Singh, Thoubal College, Manipur

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District and presided over by Vice Chairman AERB. In his presidential address, VC focused on the role of AERB relevant to emergency, its present status and aspects for improvement. There were two key note addresses: one given by Director (O), NPCIL, and the other by Director, OPSD, AERB. The Station Directors from NPPs made the presentations on their experiences in conducting plant, site and off-site emergency exercises. The Meet concluded with the talks by Shri K.Muralidhar, Secretary, AEC and Shri V.P.Raja, Principal Advisor and Chairman CMG, DAE. Three senior delegates of AERB gave their comments/ views in the feed back session. At the end, Director, OPSD summed up the highlights of the Meet.

The Meet brought out several important issues related to the topic. Some of them are, 1) optimisation of frequency of exercises in multi NPPs site, 2) personnel accounting 3) decontamination of large areas in public domain, 4) evacuation of people at odd hours. Some of the suggestions made were: 1) feasibility of posting a Liaison officer by NPCIL at the District Collector Office, 2) feasibility of conducting modular exercises and 3) making use of local NGOs such as milk-cooperatives for communications during off site emergency etc.

⇧ Inaugural Session during Discussion Meet on Emergency Exercises by NPPs-Site and Off-Site: Challenges and Constraints

(L to R): Shri S. E. Kannan, Director, SRI, Kalpakkam; Dr. V. M. Pingale, I.A.S. Additional Collector, Kanchipuram Dt, T. N; Shri S. K. Chande, Vice-Chairman, AERB; Shri G. Nageshwara Rao, Director(O), NPCIL; Shri P. Periah, Supdt. of Police, Kanchipuram Dt. TN; and Shri R. Venkataraman, Director, OPSD, AERB

- Compiled by OPSD, AERB

INTERNATIONAL CO-OPERATION

AERB-USNRC Nuclear Safety Discussion Meeting

A six member delegation of the United States Nuclear Regulatory Commission (USNRC) led by Mr. James Edward Lyons, Director, Division of Site and Environmental Reviews, Office of New Reactors, USNRC visited the Atomic Energy Regulatory Board during February 25 - 28, 2008 under the on-going nuclear safety co-operation programme between the two regulatory bodies. Topics discussed during this meeting included Advanced Light Water Reactor Designs and Digital Systems Reliability and Software. The Indian side made presentations on experience with construction and operation of new reactors in India. The ongoing collaborative work related to joint exercises of benchmarking computer codes through analysis of standard problems in thermal hydraulics was also discussed. The NRC delegation later visited the Powai works of M/s Larsen & Toubro where several large sized components for Indian nuclear power plants are under manufacture. On 3rd & 4th March, the USNRC delegation visited the PFBR construction site and some of the facilities of IGCAR at Kalpakkam.

⇧ 9th Discussion Meeting between AERB and USNRC held in February, 2008 at AERB

Shri S. K. Sharma, Chairman, AERB on the right and Shri S. K. Chande, Vice-Chairman, AERB on the left are seen at head of the table. Shri J. E. Lyon, USNRC delegation leader is sitting on the side of Shri S. K. Chande

AERB Nuclear Safety Workshop with Russian Nuclear Regulatory Body

A Workshop on Information Exchange on Nuclear Safety between Atomic Energy Regulatory Board and Rostekhnadzor, the Regulatory Body of Russian Federation was held during March 25-27, 2008 at Mumbai. This was the second workshop organised under the Agreement for co-operation in the field of nuclear safety, between the two regulatory bodies. A three member delegation from the Russian Federation, led by Mr. Vladislav Manakov, Deputy Department Head of the Rostekhnadzor participated in this Workshop.

Technical presentations were made by the members of Russian delegation and the Indian team on the topics of regulatory and licensing process, aspects related to construction experience, severe accident analysis, experience on safety review of control and instrumentation, pre-stressing system for primary containment and reactor pressure vessel of the Kudankulam VVER type reactors. Two units of 1000 MWe, each of VVER type are under construction at Kudankulam in Tamil Nadu in co-operation with the Russian Federation.

⇧ AERB and French Regulatory Body, ASN Delegates deliberating in a meeting after the AERB-ASN Seminar on Nuclear Reactor Safety

(L to R): Dr. Om Pal Singh, Director, ITSD, AERB; Dr. P. C. Basu, Director, CSED,AERB; Shri S. K. Chande, Vice-Chairman, AERB; Shri G. Wack, Shri Claude Barbalat, Ms. Anne Claude Benoit and Shri Arnauld Laverie, ASN; Shri R. I. Gujarathi, Director, NPSD, AERB and Shri R. Venkataraman, Director, OPSD, AERB.

AERB-ASN Seminar on Nuclear Reactor Safety

A four member delegation of ASN, the French Nuclear and Radiation Regulatory Organization, led by Mr. Guillaume Wack, Head of the Nuclear Power Plants Department of ASN visited the Atomic Energy Regulatory Board during May 27 – 29, 2008. This visit was under the Nuclear Safety Co-operation Agreement between the two organizations that was signed in July 1999. During the visit, a seminar on 'Nuclear Reactor Safety' was organized during which the topics of reactor containment, reactor pressure vessel and periodic safety review were discussed.

A large number of scientists and engineers from AERB, NPCIL, BARC and IGCAR participated in the seminar. The presentations and discussions held in the seminar led to a better appreciation of regulatory practices and safety review approach, evolution of design and engineering of reactor containment, periodic safety review practices and aspects like operational experience feedback, nondestructive testing, and neutron embrittlement, irradiation monitoring program and ageing management of the reactor pressure vessel that are followed in India and France. The previous seminar under this information exchange programme was held in May 2007 in Mumbai.

REPORTING ON ...

India's Participation in 4th Review Meeting of the Contracting Parties to the Convention on Nuclear Safety (CNS), April 14 – 25, 2008, Vienna, Austria

An eighteen member delegation of senior officers from AERB, NPCIL, BARC and India's Permanent Mission in Vienna, led by Chairman, AERB participated in the 4th Review Meeting of the Contracting Parties to the CNS during April 14 – 25, 2008, Vienna. India signed the convention in 1994 and ratified it in March, 2005. In 2005, India attended the 3rd Review Meeting as an observer, as India had ratified the CNS before less than 3 months of the start of the 3rd Review Meeting, as per CNS rules. Presently, there are 61 Contracting Parties to the convention which include all the 30 countries which operate nuclear power plants. The CNS is an incentive convention that seeks to maintain a high level of safety in NPPs worldwide through an exhaustive peer review process conducted every three years.

The national report on safety of our NPPs was submitted in September 2007 for review by Contracting Parties. The report demonstrates, through self assessment, how India fulfills its obligations under articles 6 to 19 of the convention. These articles deal with topics like legislative and regulatory framework, regulatory body, responsibility of licensee, human and financial resources, siting, design and construction, assessment and verification of safety, radiological protection, emergency preparedness and quality assurance.

A total of 143 questions were raised by 20 countries on the Indian report and detailed responses to these were provided before the meeting. In the Review Meeting the national report was orally presented which was followed by a discussion session.

In the Review Meeting, the presentations made by the Indian delegation, were:

- Historical development aspects of the Indian nuclear power programme, its strengths including comprehensive capability for the entire fuel cycle, human resource development, strong R&D support and regulatory structure in the country.
- Siting of NPPs, seismic and flood/tsunami considerations and current R&D work on structural integrity.
- Safety Analysis and Radiation Protection.
- Design, Construction and Operation of NPPs and update since the submission of the National Report to CNS.
- Regulatory Review Process in India and Thematic responses to the questions on the national report posed by the Contracting Parties.
- Concluding remarks highlighting the good practices followed in the country, challenges faced and future activities for enhancement of safety.

Based on the national report, the presentation in the Review Meeting and the discussion held thereafter, a summary was prepared in which the following good practices, challenges ahead and planned measures to improve safety in India were highlighted.

The good practices include (i) conduction of brief reviews every five years between two Periodic Safety Reviews, (ii) presence of a dedicated radiological environmental laboratory at each NPP site that starts its activities well before plant operation starts. iii) dose limits for contract workers that are half compared to regular staff, (iv) systematic collective dose reduction programme, (v) utility's internal safety review mechanism and corporate peer review mechanism following closely the World Association of Nuclear Operators (WANO) methodology, (vi) review of siting aspects during PSR, and (vii) strong experience feedback mechanism that is in place, both in the utility and the regulatory body.

The challenges are: Recruitment and training of about 100 additional experts to strengthen AERB within the next 5 years for future activities and identify the key areas of concern such as (i) Reliability and Safety of Digital I&C, (ii) Licensing of the New Designs for upcoming plants and (iii) Reliability of Passive Systems.

The planned measures to improve safety are: Severe Accident Management (SAM) Programmes, PSA (Level 2, Shutdown, External Events) and technical improvements in the areas such as (i) EMCCR of NAPS-2 and KAPS-1; All PHWRs with Zr-Nb Pressure Tubes, (ii) Life Management of Zr-Nb Coolant Channels, (iii) Feeder thinning, Flow Assisted Corrosion (FAC) of Secondary Piping, (iv) Safety of Digital I&C, (v) Development of a Seismic Qualification Programme by Experience Data Base, and (vi) Assessment of the Reliability of Digital I&C for Safety Functions.

India's report was well received in the Review Meeting and the various safety practices and effective Regulatory Review Structure followed in India were appreciated by the Contracting Parties.

- Compiled by OPSD & ITSD, AERB

AERB Silver Jubilee Year Celebrations

As reported in the previous issue of this newsletter, the beginning of the Silver Jubilee Year Celebration was marked by organizing a function in which Dr. Anil Kakodkar, Chairman, AEC was the chief guest and all the former Chairmen of AERB (except Dr. A. Gopalkrishnan) and former Vice Chairmen were present as Guests of Honour and addressed the gathering. AERB 'Code of Ethics' and a 'Monograph on PSA' prepared by AERB staff were released on the occasion and the new AERB building, "Niyamak Bhavan-B" was inaugurated by Prof. A. K. De, the first Chairman of AERB.

In the following months till June 2008, several seminars, workshops and awareness programmes were conducted and two monographs on "Construction Safety" and "Fire Safety" were brought out. Details of these are given in this newsletter.

In the remaining period of the silver jubilee year, some more seminars of AERB interest are envisaged. Technical talks by eminent scientists/engineers including the AERB Board Members are also planned. Finally, in November 2008, an IAEA International Conference on Topical Issues in Nuclear Installations Safety will be organized and a book on historical aspects of AERB will be released.

- Compiled by ITSD, AERB

REPORTING ON ...

Quality Management System of AERB

Realising the importance of quality in the regulatory systems, AERB decided to get its activities audited for compliance with IS/ISO 9001:2000 QMS requirements. The three processes identified for the scope of certification of the QMS are: (i) Consenting Process of Nuclear and Radiation Facilities, (ii) Regulatory Inspection of Nuclear and Radiation Facilities and (iii) Development of Safety Codes, Standards and Guides. Bureau of Indian Standard (BIS) carried out the Third Party Initial Audit on October 30-31, 2006. Being satisfied with the QMS followed in AERB, auditors recommended certification of QMS of AERB. BIS awarded IS/ISO 9001:2000 certification to AERB on 15th November, 2006; the foundation day of AERB.

After certification of IS/ISO 9001:2000, the following actions were taken to further improve the QMS in AERB

- Management Representative (MR) of AERB underwent the Lead Auditor Course on Quality Management System (QMS).
- For strengthening of the internal audit team and better understanding of the quality management systems requirement, a training programme was conducted on "Internal Quality Audit cum Documentation". The total number of trained internal auditors now in AERB is 40.
- Quality Manual of AERB was modified by incorporating changes like modification of organisation chart, interaction of three main processes, etc.
- Two new Level-II documents were prepared; one on procedure for consenting process of new projects and other on procedure for consenting process for operating plants/facilities.
- Standard Format for minutes of meeting was prepared and incorporated in the new Level –II documents.
- Procedure for Internal Audit was modified and format for Audit Report has been prepared.
- All the Divisions of AERB have framed their quality objectives in line with the requirements of IS/ISO 9001:2000.
- Draft checklist for carrying out Internal Audit has also been prepared.

Periodic Monitoring of QMS was assessed using internal audits and management review meetings. Internal audits of all the Divisions of AERB were carried out twice during the last one year. All the non-conformances raised during the internal audits were discussed; necessary actions were taken for compliance and were subsequently verified and closed.

Management review meetings were also held to review the results of internal audits, client feedback and process performance of the QMS. Decisions like framing of measurable quality objectives, analysis of data, and preparation of standard format of minutes of meetings were taken to improve the effectiveness of the QMS and its processes.

- Report from M. K. Pathak & P. C. Basu, AERB

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 has been constituted in March 2008 during a meeting of the Official language Implementation Committee (OLIC) of AERB to inspect the progress in use of Hindi in official work.

To create a conducive atmosphere to encourage the use of Hindi by the officers and staff, 10 competitions such as Story, Essay and Slogan Writing, Scientific and Technical Translation, Noting and Drafting, Extempore, Cross-words etc. in Hindi were organized during February 19 to March 14, 2008. AERB Officials participated in these Competitions. On the occasion of "Vishva Hindi Diwas" two technical lectures on "Green House Effects" by Shri S.A.Sukheshwalla and "Historical Aspects of Hindi Literature" by Shri K.C. Upadhyay were organized in Hindi on January 10, 2008 at Mumbai.

As in the past, AERB continued its efforts to prepare scientific and technical literature in Hindi and make the same available for use to various DAE Units, other institutions and to the public. So far, 32 AERB safety documents have been translated and published in Hindi. AERB Annual Report 2007-2008 and AERB Newsletter, Vol. 20 No. 1&2, 2007 were also translated in Hindi and distributed.

- Compiled by OLIC, AERB

ANNOUNCEMENTS

IAEA International Conference on Topical Issues in Nuclear Installation Safety

An international conference on "Topical Issues in Nuclear Installation Safety: Ensuring Safety for Sustainable Nuclear Development" is being organized by International Atomic Energy Agency (IAEA) and hosted by Government of India through AERB in Mumbai from 17-21 November, 2008. The objective of the conference is to foster the exchange of information on topical issues in nuclear safety, especially on issues that ensure safety for sustainable nuclear development. The conference will identify foundations for international consensus on the basic approaches for dealing with these issues and will propose recommendations on the vital role of regulators and international agencies on the globalization, harmonization of nuclear safety, opportunities for nuclear development, safety infrastructure, operational experience feedback and relationship between safety and security. Further information about the conference can be seen on the conference website:

http://www-pub.iaea.org/MTCD/Meetings/Announcements.asp?ConfID=158 and the AERB Website: www.aerb.gov.in.

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FEATURE ARTICLE

Radiation Protection Programme in Indian Nuclear Power Plants

V. Mohan, S. A. Hussain and R. Venkataraman

Operating Plants Safety Division, AERB

1.0 Introduction

In any Nuclear Power Plant (NPP), Radiation Protection[1] Programme (RPP) is an integral of its overall safety programme. The programme limits the radiation exposures to the occupational workers and the members of the public considerably less than the permissible levels. RPP also plays a significant role in the management of radioactive wastes and in emergency preparedness. In this paper, various features of RPP in an Indian NPP are presented.

2.0 Sources of Radiation in NPP

In NPPs, electricity is produced from nuclear energy produced as a result of fission of Uranium-235 (or Plutonium 239). Each fission results in production of two fission fragments accompanied by two or three high energy neutrons and gamma rays. Most of the fission fragments are radioactive. The radioactivity in the reactor is of the order of Peta Becquerel[2] (PBq). Further, activation products are produced in the reactor due to activation of coolant, reactor components and the fuel due to bombardment of neutrons. Though the radioactivity content of activation products in the reactor is far less than that of fission products, the former constitute major potential source of radiation exposure to occupational workers and general public due to their presence in out-of-the reactor areas. There are several barriers that separate the public from the radioactivity in the fuel. The first is the ceramic form of the oxide fuel which retains the fission products in its matrix to a large extent; second is the fuel cladding, the third is the closed loop coolant system and the fourth is the reactor containment building. In addition, a 1.6 km radius exclusion zone around the plant where no public habitation is allowed, provides another barrier to the fission fragments from the public.

3.0 Legislative, Legal and Regulatory Frame Work

Atomic Energy Act-1962 and the Rules promulgated there under provide the basic legislative and legal frame work for radiation protection programme in India. AERB, constituted under Atomic Energy Act, provides regulatory framework for radiation protection through publication of Standards, Codes, Guides and Manuals. AERB prescribes dose limits[3] for radiation workers and general member of public. The Atomic Energy (Radiation Protection) Rules-2004 is followed in the implementation of radiation protection by various structured procedures in NPP and is reviewed by SARCOP.[4] The discharge of radioactive waste is governed by the Atomic Energy (Safe Disposal of Radioactive Wastes) Rules 1987. Under the above rules, it is mandatory for the NPP to obtain authorization from the competent authority (Chairman, AERB) for disposal of radioactive wastes.

4.0 Features of Radiation Protection Programme

4.1 Design & Lay out

The effective radiological protection is achieved by a combination of good design, proper selection of materials, high quality construction and Quality Assurance in all stages of plant design, construction, commissioning and operation. At NPP, vital installations are located in an area called Operating Island. Entry to operating island is restricted. Taking food items into the operating island is strictly prohibited. Operating island areas are further classified into four radiological zones. In Pressurised Heavy Water Type Reactor (PHWR), the Reactor building (RB) areas are classified into, 'Accessible Areas', "Shutdown Accessible Areas" and "Inaccessible Areas". There are access control procedures for entering into these areas of reactor building.

4.2 Operating stage

AERB Manual on Radiation Protection for Nuclear Facilities (AERB/NF/SM/O-2 Rev.4) prescribes the requirements for implementation of radiation protection measures in NPP. The responsibilities of the Plant Management and Health Physics Unit are outlined in this manual. The overall responsibility of the establishment and implementation of radiation protection programme lies with the Station. All the plant personnel have individual responsibility for their own radiation protection. Each NPP has a Health Physics Unit (HPU), comprising a group of trained and experienced radiation protection professionals, who in co-ordination with plant management, implement the radiation protection programme in the plant. HPU is also entrusted with the responsibility for providing radiological surveillance and safety support functions. Some of the other essential requirements on radiation protection prescribed in this Manual are the following:

- General design provisions /Good engineering practices
- Training, Qualification for Access to Radiation areas
- Procedures for employing temporary workers
- Exposure Monitoring
- Dose limits and dose constraints
- Exposure Investigations
- Maintenance of Personnel Dose records
- Emergency preparedness and Intervention Levels

[1]This can also be called by a more comprehensive term, Radiological Protection.

[2]Becquerel is the unit of radioactivity. 1 Bq is equal to the disintegration of 1 radioactive atom per second (dps). 1 PBq is equal to 10^{15} dps.

[3]AERB has prescribed an annual dose limit of 30 mSv for a radiation worker and a limit of 100 mSv over a period of five consecutive years. This limit is more conservative than that prescribed by International Commission. On Radiological Protection (ICRP) for a radiation worker which is 50 mSv for a year and 100 mSv for 5 years. In addition AERB specifies monthly/quarterly dose limits, dose limits for temporary worker and Investigation Levels. For general member of public, a dose limit of 1 mSv per year is prescribed.

[4]AERB is supported in its work by an elaborate committee structure. Safety Review Committee for Operating Plants (SARCOP) is an apex committee that supervises the safety surveillance and enforces safety stipulations in the operating NPPs.

FEATURE ARTICLE

4.3 Review of Radiation Exposure Control

A three-tier arrangement is in place to review and monitor implementation of recommendations pertaining to radiological safety. The first level review is done at the plant level and the second and third levels of review are done by AERB. Exposure cases exceeding the investigation limits are investigated by a special committee set up at each NPP. Reports of this Committee are reviewed by AERB appointed Unit Safety Committees and SARCOP. The root causes of such exposures are established and corrective measures are implemented. AERB approves the annual collective dose budget along with planned activities submitted by each NPP. The adequacy of radiation protection programme and its implementation in the operating NPP are inspected by AERB teams twice a year. The deficiencies are reported and corrective measures are recommended and followed up through enforcement procedures.

4.4 Radiation Protection in Waste Management

Gaseous wastes from the reactor building are filtered using pre-filters and High Efficiency Particulate Air (HEPA) filters and released after monitoring through a tall stack (100 m height). The release rates and integrated releases of different radionuclides are monitored and accounted for, to demonstrate that the releases are within the prescribed limits. The radioactive liquid wastes are segregated, filtered and conditioned as per procedures and after dilution, to comply with the limits of discharges, disposed to the water bodies. The activity is monitored at the point of discharge and accounted on a daily basis. AERB has prescribed limits on annual volume and activity of discharge, daily discharges and activity concentration from each NPP which are site-specific. Solid radioactive wastes are disposed in tile holes or in concrete trenches and buried within the earmarked area of the NPP site.

5.0 Radiation Protection of Members of Public

General members of public are protected by a multi tier levels of built-in safety of the NPP through defense in depth. There are adequate back up so that simultaneous failures of several systems, even serially, do not lead to conditions which are unsafe to the operating personnel or to the public. The sources contributing to generation of solid, liquid and gaseous radioactive wastes and their release to the environment are examined with respect to minimization of waste at the source at the design stage itself. The regulatory limits (also called authorized limits) of radioactive effluents are based on the apportionment of effective dose limit of 1 mSv per year to the member of public arising from nuclear facilities at a site considering all the routes of discharges and radionuclides in each route of discharge.

6.0 Emergency Preparedness

AERB stipulates that the design analysis of NPP should demonstrate that the calculated doses to the members of the public at the site boundary under design basis accidents should not exceed the prescribed reference dose levels. Stringent standards and good practices ensure a high level of safety in the design and operation of NPP that the possibility of an accident occurring is extremely low. However, as a measure of abundant caution, emergency response plans are in place and tested by NPPs to assure their effectiveness to mitigate the consequences of an accident, should it occur. Mock emergency exercises are conducted periodically at the plant and at the whole site to observe the response of the individual and agencies. Off site emergency exercises are held once in two years to see the response of district administration and general public in the 16 km emergency planning zone.

7.0 Environmental Protection

Environmental surveillance is aimed at assessing the radiological impact under all operating states of the NPP and also for demonstrating the compliance with the exposure limits set by AERB for the members of the public. This objective is achieved by carrying out environmental monitoring by the Environmental Survey Laboratory (ESL). The ESL is reporting to Health Physics Division (HPD), BARC and hence is independent of the NPP management. ESL is established many years before the commissioning and operation of the NPP so as to collect base line data on environmental samples and gather dietary data of the population. Extensive micro meteorological data such as wind speed and wind direction, temperature and rain fall, etc. are collected for a few years to identify the worst sector and critical population affected in the unlikely event of radiological emergency. Areas of land upto a distance of 30 km around NPP are covered under the environmental survey programme.

8.0 Effectiveness of Radiation Protection

Due to various means of effective enforcement of procedures and practices, the radiation protection in NPPs has been strengthened both during normal and off normal conditions. For a twin unit NPP, the annual collective dose which was of the order of 10-50 p-Sv in the seventies, came down to 1-2 p-Sv in 2007 which is close to international standards. The annual average dose of occupational worker which was around 5 mSv two decades ago now stands at about 1 mSv. Cases of over exposures are virtually nil in the past few years. Radioactivity discharges to environment also came down to low levels as compared to earlier years of reactor operation. The actual annual dose to the member of public is around a few μSv which constitutes around 1 percent of the annual permissible dose. To put this in a different perspective, the estimated dose due to ten years of discharges from a standard PHWR received by a member of public hypothetically residing at its 1.6 km site exclusion boundary is less than the dose that he would receive due to a single chest X-ray exposure!

9.0 Summary

A comprehensive and structured radiation protection programme is in place in Indian NPP, backed by strong and sound legislative, legal and regulatory framework. Over the years, the implementation of effective radiation protection programme had resulted in substantial reduction in the individual radiation worker's dose, plant collective dose and the dose to the members of public.

HOME PAGE

Personnel Joined

Sl.No.	Name	Date of appointment
1.	Kum. S. Renuka, SA(B), OPSD	15/02/2008
2.	Shri R. G. Dhoke, SA(B), OPSD	19/02/2008
3.	Shri R. Kannan, SO(F), RSD	Transferred from RPAD, BARC to AERB on April 25, 2008.
4.	Dr. Pankaj Tandon, SO(E), RSD	
5.	Shri Rajeshkumar Yadav, SO(E), RSD	
6.	Smt Manju Saini, SO(D), RSD	
7.	Shri Neeraj Dixit, SO(C), RSD	
8.	Shri Rajoo Kumar, SO(C), RSD	

Personnel Retired

Sl.No.	Name	Date of retirement
1.	Shri S.A. Sukheswalla, SO(H), OPSD	30/04/2008
2.	Smt Kanta Chhokra, SO(G), RSD	31/05/2008
3.	ShriV.K. Shirva, SO(G), RSD	30/06/2008

From page 9 (Announcements)

AERB Graduate Fellowship Scheme

(Academic year starting July – August)

The Atomic Energy Regulatory Board sponsors every year a maximum of 2 students for the M. Tech. Programme in Mechanical Engineering and Metallurgical and Materials Engineering in IIT, Madras, Chennai and a maximum of 2 students per year for the M.Tech Programme in Mechanical Engineering (Design and Thermal Engineering), Chemical Engineering and Energy Systems Engineering in IIT, Bombay, Mumbai. The selected candidates are governed by the same terms and conditions as the Department of Atomic Energy (DAE) Graduate Fellowship Scheme (DGFS-2007). As per this scheme, the selected candidates would receive a monthly stipend of Rs. 15000/- and a one time educational material allowance of Rs. 5000/-.AERB selected candidates who join M. Tech. towards the end of July each year are expected to complete the M. Tech. Programme in two years. After successful completion of the M. Tech. programme, they would join a 4 months orientation course for DGFS Fellows (OCDF) conducted at the Bhabha Atomic Research Centre (BARC) Training School, Mumbai starting from September 1, each year. The selected candidates would be absorbed in the grade of Scientific Officer - C in the scale of Rs. 8000-275-13500 with upto 5 advance increments depending on the performance during M. Tech. and the 4 months orientation course. More details can be obtained from the AERB web site, www.aerb.gov.in and about the DGFS programme from www.barc.gov.in.

AWARDS & HONOURS

⇧ Shri S. K.Chande, Vice Chairman, AERB receiving the INS Award from Prof. P. Rama Rao, President, INS

- Shri S.K.Chande, Vice-Chairman, AERB has been awarded the prestigious Indian Nuclear Society (INS) High Technology Award for the year 2006.

- Shri A.U.Sonawane of Radiological Safety Division of AERB was awarded INS Medal for the year 2006.

- Dr. P. C. Basu, Director, CSED has been selected by Vividhlaxi Audyogik Samshodhan Vikas Kendra, Mumbai, as winner of "VASVIK Award" for the year 2004 for his contribution in Mechanical and Structural Sciences & Technology.

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