



AERB

Newsletter

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ATOMIC ENERGY REGULATORY BOARD

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

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From the Chairman's Desk

The nuclear accident at Fukushima, Japan, has compelled nations the world over to re-evaluate their nuclear safety premise and to assure themselves that in their reactors, the parameters that had eventually led to the accident at Fukushima have already been addressed or are at least possible to address. India too has carried out rigorous assessments of its Nuclear power plants, by both, the regulator and utility independently. The outcome of these evaluations reaffirmed the over-all safety in operating the NPPs while identifying areas that can be strengthened by improvements in design or operation.

AERB has reported these safety assessments of Indian nuclear power plants, to the "Convention of Nuclear Safety" a forum of 76 participating countries including India. The Convention requires the member countries to present the safety status of their nuclear power programme every three years. Through this Convention, the contracting parties develop and promote the common interest of achieving higher levels of safety amongst member nations. Towards this, the International Atomic Energy Agency (IAEA) organises periodic meetings and enables "peer reviews" of reports submitted by these member countries. An extraordinary meeting of contracting parties to CNS was held in August 2012 to address specifically the response to lessons learnt from Fukushima. The India report submitted to CNS is in continuation to the last year's initial technical response to CNS immediately after the accident at Fukushima. The highlights of this report are available at our website.

Building and upgrading the knowledge base for nuclear safety regulation and its associated framework is an on-going responsibility of the regulatory body. Apart from the diverse designs of NPPs existing in the country, there is also a distinct possibility that in the near future new designs of Light Water Reactors (LWRs) will be operating in the country. At this juncture, the recent membership of AERB in the Multinational Design Evaluation Programme (MDEP), a global forum for national regulatory authorities is a welcome development. It is anticipated that international exchanges facilitated by this platform, in safety reviews of Light Water Reactors, will prove to be highly beneficial to the LWR programme in the country.

Over the years, one of the methods adopted by AERB for building of know-how has been technical exchanges with international agencies and regulatory bodies of countries with established nuclear power. The global nature of nuclear power facilitates such forums where in there is mutual exchange of operational experiences, safety and regulatory strategies and design improvements to meet with the common goal of safety. The past six months have seen the on-going interaction meets with Nuclear Energy Agency (NEA), United States Nuclear Regulatory Commission (USNRC) and the French Regulatory authorities (ASN) especially on the action plans taken up after the accident at Fukushima.

To address issues, in the national front, concerning broad areas of nuclear safety, AERB organized interaction meets with stake holders such as Nuclear Power Corporation of India Limited, Heavy Water Board, Bhabha Atomic Research Centre and Indira Gandhi Centre for Atomic Research. The topics included, "Physical Protection Systems at Nuclear Facilities", "Effectiveness of Regulatory Inspections" and "External events in Siting of NPPs". Where appropriate, the inputs from the meets will be used to reframe regulatory policy.

Safety research is another important activity in AERB. Research in areas of regulatory importance, is carried out at AERB Head Quarters and the Safety Research Institute at Kalpakkam. As part of this, AERB had organized an international workshop on "New Horizons in Nuclear Reactor Thermal Hydraulics & Safety" for technical exchanges in latest developments in the field of thermal hydraulics of nuclear reactors, the design provisions against severe accidents in thermal/fast reactors and to discuss technical issues related to Fukushima nuclear accident.

All the proactive steps taken by the regulator towards safety however, need to be communicated to the public adequately. The world over it is becoming increasingly clear that addressing public perception is an important obligation of the utility and the regulatory body. To fulfill this, AERB has set up an internal cell to design and undertake appropriate communication programs and has also participated in various public awareness programs.

Fire and Industrial safety are also the areas of paramount importance. AERB organized a workshop on Evolving Trends and Technologies in Fire Safety to spread the awareness about various developments in enhancing fire safety. The annual Industrial and Fire safety awards, instituted by AERB, for encouraging this culture of safety, were presented to deserving units. On this occasion, a compilation of statistics on occupational injury and fire statistics, 2011 was released. The details form part of this newsletter.

This issue of Newsletter has also three scientific notes: one on 'Development of Space-Time Kinetics Model for Square-lattice Pressurized Water Reactors', the second on 'Development of Models for Containment Hydrogen Distribution Analysis' and the third on 'Strengthening Industrial Safety in DAE units'.



S.S. Bajaj
(S.S. Bajaj)

Safety Review and Regulation

AERB Board Meeting

The 106th Board meeting was convened on February 13-14, 2012 at Safety Research Institute (SRI), Kalpakkam. The AERB Board noted that during the last two quarters there was no significant event at any of the NPPs or in the use of radiation sources with rating 1 or higher.



AERB Board Members and invitees at the SRI conference Room

The Board noted and appreciated the review by AERB and the actions initiated by Nuclear Power Corporation of India Limited (NPCIL) in the wake of accident at Fukushima Nuclear Power Plants. The areas of up-gradation of safety were aimed at countering seismic events, Station Black-out (SBO) scenarios and building capability of NPPs to withstand flood.

AERB Board reviewed the present status of Kudankulam Nuclear Power Plant, after the suspension of works on October 13, 2011. Board Members advised NPCIL to take all efforts to preserve the systems and equipment and to ensure the security of the plant and employees under the present situation.

The Board also witnessed and appreciated the progress of the construction activities at Bharatiya Nabhikiya Vidyut Nigam Limited (BHAVINI) with India's first and large commercial fast breeder reactor the Prototype Fast Breeder Reactor (PFBR). The visited sites included turbine building, switch yard, reactor building and reactor simulator.

The board noted the research and development activities carried out at Safety Research Institute (SRI), AERB, such as Reactor Physics studies, Radiation safety analysis, Probabilistic safety assessment level-1 for PFBR, estimation of SBO frequency and duration for MAPS and PFBR, assessment of software reliability for computer based systems, hydrogen safety studies, indigenous code development and validations studies, fire safety studies for reprocessing facilities and environmental safety studies. The board emphasised on the cascading and domino effects be looked into when an accident scenario is

considered for all types of accidents. It also recommended that the new studies on human reliability in the International level should be simulated with the Indian condition by utilising PFBR simulators.

AERB Board reviewed the recent mishap at Nuclear Fuel Complex, Hyderabad wherein one officer succumbed to her injuries and the other grievously injured while carrying out functional testing on a high voltage thyristor converter panel. Board asked NFC to fix the responsibility for such mishaps and to take appropriate actions on person(s) concerned. Board advised that the lessons learnt must be communicated to all DAE units. All the DAE units shall be asked to review their electrical systems particularly the old equipment/ system of upgradation to have inbuilt safety provision. Board endorsed all the recommendations of the AERB Fatal Accident Assessment Committee and also the recommendations of the SARCOP on this accident

The board reviewed the document AERB safety code on "Radiation protection for nuclear fuel cycle facilities" (AERB/NF/SC/RP). The board noted that the code covers facilities such as mining and milling processing of uranium and thorium ores, fuel fabrication facilities, NPP research and experimental reactors, fuel processing radioactive waste management plant etc; The board recommended that the dose limits to various organs can be issued as separate directive as these limits are likely to change.

Board also reviewed a document prepared on the harmonisation of syllabi of various training courses and others for appointment of Radiation Safety Officer (RSO), a mandatory requirement in radiation facilities. Board approved the document and recommended that the document must have the provision such that existing authorised RSOs who are not meeting the requirements/qualification/ experience as per this document are not affected.

The Board reviewed the AERB Award Scheme, for AERB personnel to promote excellence in AERB regulatory work and assessment of R&D activities. The Board approved the proposal and suggested that it shall be made in line with the DAE award scheme. The Board also reviewed a proposal to charge suitable fees for different consenting stages for both Nuclear and Radiation Facilities. Presently AERB is not charging any licence fees from the facilities, even though provisions exist as per Atomic Energy Act, 1962.

Authorisations issued by AERB

- Licence under the Section 6 of the Factories Act, 1948 issued to Indian Rare Earths Ltd., Udyogamadal – Change of Occupier. (January 6, 2012)
- Renewal of Licence to Rajasthan Atomic Power Station 1&2. (January 6, 2012)
- Renewal of Licence to Madras Atomic Power Station. (January 13, 2012)
- Renewal of License for Operation of TAPS-1&2 upto December 31, 2012. (January 16, 2012)
- Consent for Siting & Construction of 3 TPA Niobium Thermit Production Facility (NTPF) at Nuclear Fuel Complex (NFC), Hyderabad. (February 6, 2012)
- Clearance for Stage-I commissioning of IFSB (viz. receipt and storage of 1000 fuel pins, assembling of two fuel SAs, receipt of blanket pins and assembling of ten blanket SAs) (March 27, 2012)
- Licence to Tarapur Atomic Power Station 3&4, NPCIL. (April 17, 2012)
- Extension of license for operation for MAPS 1&2 till March 2013
- Extension of construction consent of AAFR at TAPS till March 2012
- License for continuous operation of KGS 3&4 5&6 till April 2013
- Authorization for operation of KGS 1&2 till May 2017
- License for continuous operation of RAPS 5&6 till May 2015
- Permission for opening RPV Top Head, Dummy Fuel - Assemblies (DFAs) removal & RPV inspection of KK NPP Unit # 1. (May 10, 2012)
- License for operation of Kaiga Generating Station 1&2. (June 1, 2012)

Regulatory Inspections (January – June 2012)

Unit	No. of Inspections conducted
Nuclear Projects (routine inspections)	
KKNPP 3&4, DFRP, IFSB	1 each
PFBR, KAPP-3&4, RAPP-7&8, KKNPP 1&2	2 each
Nuclear Projects (special monthly inspections w.r.t construction safety)	
KKNPP, RAPP 7&8, DFRP, PFBR, KAPP 3 & 4.	23
Nuclear Power Plants (Routine inspections)	
MAPS 1&2, FBTR/KAMINI, RML, RAPS-3&4, KGS-1&2, KGS-3&4, KAPS 1&2, TAPS-1&2, TAPS-3&4, RAPS-5&6, RAPS-1&2, NAPS 1&2	1 each 2
Nuclear Power Plants (Special Inspections)	
TAPS-1&2, TAPS 3&4, RAPS-1&2, RAPS-5&6, RAPCOFF	6
Nuclear Power Plants (Special Inspections of radiological aspects during BSD)	
RAPS-2, NAPS-1, RAPS-5	1 each
Nuclear fuel Cycle Facilities (Routine Inspections)	
AMD-South region, Eastern region	1 each
UCIL-Tummalapalle mine, Jaduguda mill, Turamdih mill	1 each
Technology Demonstration Plant for recovery of rare metal from phosphoric acid (TDP)-Chembur	1
IREL-Manavalakurichi, Chavara, Chatrapur (OSCOM), Udyogamandal	1 each
NFC-Hyderabad and ZC-Pazhayakal,	1 each
HWPs- Kota, Thal, Tuticorin, Manuguru, Hazira, Baroda, Talcher	1 each
ECIL-Hyderabad, VECC-Kolkata and RRCAT-Indore	1 each
Nuclear fuel Cycle Facilities (Special Inspections w.r.t Electrical Safety)	
HWP-Tuticorin, Baroda, Talcher, Hazira, NFC-Hyderabad, ZC- Pazhayakal	1 each
Nuclear fuel Cycle Projects (Special quarterly Inspections w.r.t construction safety)	
UCIL-Tummalapalle Mill, Medical Cyclotron Project, VECC-Kolkata, Monazite Processing Project, OSCOM	5
NORM Industries	
BSM Facilities-DCW, Miracle Sands, BMC, VVM-Tamilnadu, TGI-Tamilnadu, KKML, IOGS, SRI-Ragvendra, CMRL	1 each
Columbite Tantalite Processing Facilities-MPIL, Taloja	1
Radiation Facilities	
Industrial radiography	67
Nucleonic gauges, gamma chambers, well logging and sealed sources	66
Gamma Irradiators	09
Medical Radiation Facilities	
Nuclear Medicine	20
Diagnostic X-rays	41
Radiotherapy Facilities	67

On 11th April 2012 an earthquake of magnitude 8.5 occurred near Indonesia which led to issue of tsunami alert on eastern coast of India. On 16th April 2012, AERB officers visited MAPS 1&2 to check the action taken by it and its preparedness for ensuring safety during the event of tsunami.

Human Resource Development and Safety Research Programme

AERB Training Activity

1. The valedictory function of OCRP-SRI Course was organised at SRI, Kalpakkam on January 2, 2012 for taking feedback from the participants and distribution of certificates to successful participants.
2. Eight scientific assistants (3 from Electrical discipline, 3 from Mechanical discipline 1 from Chemical discipline, 1 from



Shri V. Balasubramanian, Director, SRI, Addressing the Participants during the Inauguration of OCRP-SRI Course at SRI, Kalpakkam (L to R): Smt. Reeta Rani Malhotra, AERB, Dr. A. Ramakrishna, Course Coordinator, Dr. S.M. Lee, Raja Ramanna Fellow and Shri G. Srinivasan, Director, ROMG, IGCAR, Kalpakkam are seen on the dias

Chemistry Division) were allotted to AERB from BARC training schools as stipendiary trainees. The On-Job Training (OJT) was given to the Trainees for 4 months duration. The induction training was conducted under the following 4 Modules such as Introduction, Regulatory processes, Plant visit/exposure, and Project work.

AERB Colloquium

AERB Colloquium on "Caveats of Programmable Systems (Software & Hardware). Are we doing enough verification?" by Shri R. K. Patil, Associate Director(C), E&IG, BARC and Dr. A.K. Bhattacharjee, SO(H), RCnD, BARC was organized in AERB on April 09, 2012. In this, speakers addressed issues related to present generation of C&I systems, the implementation of software from safety and regulatory perspectives, future generation systems and various caveats that may have impacts on safety aspects of I&C system designs.

AERB Technical Talks

AERB technical talks were organized on the following topics. "Commissioning Programme of KK-NPP-1 & Current Safety Review Status of Commissioning" by Shri Suneet Kavimandan, SO(F), NPSD.

"Information Security -The End-Users' Perspective by Shri M. M. Kulkarni, SO (G), ITSD.

"Regulation of Nuclear Fuel Cycle Facilities and role of AERB/NF/SG/G-2 and AERB/NF/SM/G-2 by Shri Soumen Sinha, SO (E), IPSD.

Safety Research Programme (SRP)

Two meetings of Committee for Safety Research Programmes (CSRPs) were held at AERB in the presence of project co-ordinators and principal investigators, to review the progress of on-going projects, and consider funding new project proposals. The Committee approved 3 new project proposals, recommended revision for 5 new project proposals and renewed 3 on-going projects.

Approved New CSRPs Projects

Sr. No.	Title	PI / Institute
1.	Development & testing of corrosion inhibitors for firewater system materials	Dr. N. Rajendran, Anna University, Chennai
2.	Seismic fragility of the primary containment considering structural integrity and leakage through the damaged containment	Dr. Siddhartha Ghosh, IIT-Bombay, Mumbai
3.	Thermo-mechanical failure in PT-CT tubes used in Indian PHWR	Prof. Krishna N Jonnalagadda, IIT Bombay, Mumbai
4.	Leukocyte DNA damage as a biomarker for radiation exposure to patients undergoing MDCT examinations	Dr. Anupama Tandon, UCMS & GTB Hospital, Delhi

Renewed ongoing CSRPs Projects

Sr. No.	Title	PI / Institute
1.	Transient CHF in horizontal channels under LPLF Conditions.	Prof. S. V. Prabhu, IIT-Bombay, Mumbai
2.	Study on Radioactivity in Phosphogypsum based building and construction material and indoor radon inhalation dose estimate in	Dr. Shahul Hameed J.J. College of Engineering & Technology, Trichy Tamilnadu
3.	Retrospective Assessment of Indoor Radon Exposure in Garhwal Homes by Measurements of ^{210}Po implanted on Glass Surface	Dr. R.C. Ramola, H.N.B., Garhwal University, Tehri Garhwal

AERB becomes the Member of Multinational Design Evaluation Programme (MDEP)

On April 4, 2012, Indian nuclear regulator became the first new member in the MDEP since its inception in 2006. Prior to India joining the programme, MDEP membership included national regulatory authorities from Canada, China, Finland, France, Japan, the Republic of Korea, the Russian Federation, South Africa, the United Kingdom and the United States.

MDEP is a multinational initiative to develop innovative approaches to leverage the resources and knowledge of national regulatory authorities who are, or will shortly be, undertaking the review of new reactor designs. Nuclear Energy Agency (NEA) performs the Technical Secretariat function in support of the MDEP. The programme is governed by a Policy Group (PG), consisting of the heads of the participating organizations and implemented by a Steering Technical Committee (STC) and its Working Groups (WGs).

MDEP work is carried out by Design specific and Issue specific Working Groups. Presently two Design Specific working groups (EPR-WG and AP1000-WG) have been established under MDEP to share information and co-operate on specific reactor design evaluation and construction. In addition to this, Issues-specific (generic issues) Working Groups have also been established for the technical and regulatory area, which include: Vendor inspection Co-operation (VIC-WG), Codes and Standards (CS-WG) and Digital Instrumentation and Control (DIC-WG).

AERB will be actively participating in different WGs for mutual sharing of experience in different areas. In view of the envisaged programme of DAE which includes setting up of nuclear power plants of different technologies including EPR, India's participation in MDEP will be very useful while performing the Safety Review for these reactor designs and carrying out licensing activities. AERB membership in MDEP will also enable a VVER design specific group to be set up. The enhanced cooperation among regulators on an international platform will improve the effectiveness and efficiency of the regulatory design reviews of modern reactors, leading to more efficient and safety focused regulatory decisions.

AERB-ASN Steering Committee Meeting and Workshop

A delegation of nuclear safety experts led by Mr. Andre' Claude Lacoste, President ASN held a meeting with Mr. S.S. Bajaj, Chairman, AERB and other senior officials of AERB on February 29, 2012. This was the first steering committee meeting between AERB and ASN. The Steering Committee meeting was followed by AERB-

ASN workshop on March 1, 2012. Both the regulatory bodies agreed to exchange the regulatory documents on radiation facilities, particularly on challenges like lost sources, safety & security of sources, management of X-ray installations etc.



Mr. Andre' Claude Lacoste, President ASN with Mr. S.S. Bajaj, Chairman, AERB at the AERB-ASN Steering Committee Meeting

AERB-USNRC Meeting and Workshop under the Technical Co-operation Program

A delegation of nuclear safety experts from USNRC visited AERB during May 16-17, 2012. One and a half day technical workshop during May 16 and FN of May 17, 2012 was attended by officials of AERB, BARC, IGCAR and NPCIL followed by the Steering Technical committee meeting between AERB and USNRC officials in the AN of May 17, 2012. This was the twelfth meeting under this co-operation program. Workshop was a good opportunity to share the action plans taken by both the countries to strengthen the safety features of the nuclear power plants after the Fukushima accident.

During the meeting USNRC expressed its interest in sharing the experience on Periodic Safety Review (PSR) carried out for all Indian NPPs after every 10 years. AERB expressed its interest in technical co-operation in the areas of digital I & C and ageing management.



Shri S.S. Bajaj, Chairman, AERB addressing the AERB-USNRC Technical Meeting.

Discussion Meet

Implementation and Operational aspects of Physical Protection Systems at Nuclear Power Plants/ Nuclear Facilities

AERB had organised a one day Discussion Meet on "Implementation and Operational aspects of Physical Protection Systems (PPS) at Nuclear Power Plants/ Nuclear Facilities" at AERB on 2nd February 2012. About 75 delegates and invitees from AERB, BARC, HWB, IGCAR, NPCIL and NPPs participated in the discussion meet. Experts from AERB, BARC, DAE, IGCAR, and NPCIL presented their views on state of art PPS technologies and shared the practices followed on the implementation and performance aspects of PPS at NPPs so that PPS can be strengthened. AERB will utilize these inputs to strengthen the regulatory inspection program on nuclear security and in preparation of AERB documents on Nuclear security and regulatory inspection program.

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

Regulatory Inspection of Nuclear Power Plants/Projects

AERB organised a one day Discussion Meet on "Regulatory Inspection of Nuclear Power Plants/Projects" on 16th March 2012. The aim of the meet was to assess the effectiveness of regulatory inspections and to identify the scope for further improvement in its effectiveness and efficiency through exchange of information with utility. About 100 delegates and invitees from AERB, various units of NPCIL & NPCIL HQ, BARC, IGCAR and BHAVINI participated in the Discussion Meet.

Shri S. Duraisamy, Director, Operating Plant Safety Division, in his welcome address briefed about the evolution of regulatory inspection process and the present matured status of regulatory Inspection programme.

Shri S.S.Bajaj, Chairman AERB, delivered the presidential address in which he stated that valuable experience has been obtained from the regulatory inspections of NPPs however significant resources are used in the process and there is a need to optimise the use of resources by re-examining the existing regulatory inspection methodology taking into account international practices. Chairman emphasized on the need to identify the gaps in existing systems & disseminate lessons learnt. He expressed that there is a need to introduce inspections at manufacturing facilities and to establish a well structured training program for inspectors to meet the challenges of new technologies.

Shri S. Krishnamurthy, ED (Operations), NPCIL, informed that in addition to regulatory inspections NPCIL units are being subjected to internal audits, corporate review and WANO peer review. He expressed that regulatory inspection plays an important role in ensuring safe and reliable operation of the NPPs. He informed that NPCIL is in the process of further introducing Operational Safety Review Team review at its units (OSART review) i.e. inspection by IAEA team.

The technical session consisted of presentations from AERB,

NPCIL and other DAE facilities. The following topics were presented in the technical session:-

- International trends on regulatory inspections of nuclear power plants
- International trends on regulatory inspections of nuclear power projects
- Experience of regulatory inspections during operation of nuclear power plants
- International practices and experience on inspections of aspects related to Civil & Structural Engineering of Nuclear Power Plants / Projects
- Experience on inspections of Fire & Industrial Safety aspects of nuclear power plants and projects
- Experience on inspections during construction and commissioning of nuclear power projects
- NPCIL Feedback on regulatory inspection of operating NPPs and projects
- BHAVINI Feedback on regulatory inspection

The presentations brought out international practices which included risk informed inspections, assessment of safety culture, event reporting during construction & commissioning and inspections at vendor facilities. The current regulatory inspection framework for operating NPPs and projects along with generic findings were presented. Regulatory oversight and international trends on aspects related to civil & structural engineering and fire & industrial safety were also presented. It was expressed that database accrued would be useful for future assessment of NPPs/projects.

The participants from NPCIL, BHAVINI & other DAE units provided useful inputs on RI process as feedback from both operating plants as well as projects. They agreed that the RI process enhanced the safety level of operating plants and Construction Projects and this aspect is well recognized. They stressed upon the need to introduce thematic Inspections and training of site personnel in AERB codes & guides, review process and other regulatory aspects.

The technical sessions concluded with identifying key areas for further improvements of efficiency and efficacy of regulatory inspections process. These key areas were deliberated in detail by a panel of experts which emerged with important recommendations. These recommendations included those for strengthening the RI by un-announced inspection and inspection at plants during Biennial Shutdowns. The discussion meet also met the objective of client feedback on regulatory inspection process.

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

External Events in Siting of Nuclear Power Plants

The world witnessed some recent extreme events affecting the human populations and their activities including the Nuclear

Power Plants. To mention some important events, the Tohoku earthquake of March 11, 2011 with a large tsunami affected the east coast of Japan and the Fukushima Nuclear Power Plant site, the large earthquake in Japan in 2007 affected the Kashiwazaki-Kariwa Nuclear Power Plant site and the flooding incident affected the Le Blayais Nuclear Power Plant of France in 1999.

All these events exceeded the design basis levels considered for the corresponding affected NPPs. Besides the natural events, the world also witnessed some malevolent activities targeting important world monuments and industrial establishments. The glaring example is the aircraft crash into the World Trade Center (WTC) on September 11, 2001. Because of increasing industrialization, co-location of nuclear power plants and other hazardous industries has come into being and this trend is likely to increase in future also. Consideration of external events of natural origin as well as human induced events that can affect the safety of NPPs is a current topic of intense discussion. The Fukushima accident is unique in the nuclear history that was caused by extreme events of natural origin.

It has been a practice in nuclear industry world over to learn lessons from past events, to share experiences from such extreme events and to come up with proposals for enhancing safety of the nuclear power plants in the light of their experiences. Accordingly, Siting & Structural Engineering Division of AERB organized a one day discussion meet on "External events in siting of Nuclear Power Plants" at AERB premises, Mumbai on 6th January, 2012. The theme of this discussion meeting was highly pertinent in light of the recent extreme external events. AERB is also undertaking revision of its Siting Code incorporating the lessons learnt from these events. The objectives of the meeting were to have discussions on the proposed revisions in the Siting Code and invite views from the experts and users about the rationality of the revision, discussions on adequacy of current methodology of deriving design basis external events and possible approaches/methodologies to quantify extreme external events beyond design basis to be used in safety margin assessment. Logical conclusions drawn out of the discussion are expected to serve as an input while undertaking revision of regulatory documents, particularly on Siting.

Total of 123 delegates and invitees from AERB, NPCIL, BARC, IGCAR, UCIL, HWB and other national expert agencies as well as members of AERB safety committees participated in the Discussion Meet. Twelve presentations were made on different topics related to Siting of Nuclear Power Plants. The technical session was highly interactive, which was followed by a panel discussion. Shri S.C Chetal, Director, IGCAR, steered the discussions. Based on the deliberations during various presentations in the technical session, the following issues were further discussed in the panel discussion:

- Proposed revisions in Siting Code.
- Considerations for beyond design basis external events – quantification of BDBE and design considerations. Whether there should be exclusive design provisions or margin assessment only?
- PSA for external events.

Issues related to derivation of Ground Motion Parameters at Nuclear Power Plant Sites

Scarcity of earthquake data in peninsular India makes the estimation of the design basis ground motion (DBGM) parameters at nuclear power plant (NPP) sites a challenging task. Worldwide, DBGM parameters for engineering of an NPP are derived conservatively following rational approach.

Observations from NCO earthquake of August 2006 in Japan brought out the importance of conservatism in estimation of design basis earthquake as well as derivation of DBGM parameters. This event induced earthquake excitation of about three times higher than that associated with the DBGM of Kashiwazaki-Kariwa NPP (KK-NPP). In depth investigations revealed that incomplete information on source mechanism, inadequacy of attenuation relation and focussing effect of seismic waves on KK-NPP site are responsible for such higher accelerations.

The safety guide AERB/SG/S-11 provides conservative guidelines for deriving DBGM parameters for NPPs in India. With the advancement of state of the art in seismic science and earthquake engineering, it was considered prudent to update the guidelines on derivation of DBGM parameters with the aim of incorporating advances in the related field, and minimising uncertainties with regard to postulation of nature of fault, estimating its maximum potential, use of site specific or site compatible attenuation relations, input parameters for synthetic ground motion generation.

To discuss the salient issues identified during review of design basis parameters for NPP sites, experience feedback from response of NPPs worldwide during real events and to get more input for preparation of regulatory documents, AERB organized a discussion meet on "Issues related to derivation of ground motion parameters at Nuclear Power Plant (NPP) sites" at AERB on April, 13, 2012. Many eminent experts from various national institutions viz. National Geophysical Research Institute (NGRI), Oil and Natural Gas Corporation (ONGC), Indian Institute of Technology (IIT), Geological Survey of India (GSI), Institute of Seismological Research (ISR), etc. participated in the discussions besides experts from BARC, NPCIL and AERB.

Detailed deliberations were held on the following issues:

- Identification of a fault and assessment of its nature (capable/active/dead)
- Estimation of maximum potential of a fault
- Investigations to identify possibility of differential ground motion at a site
- Identification of sub-surface faults
- Evaluation of potential for surface displacement/surface rupture
- Handling of uncertainties in generation of synthetic ground motion.

Necessity of conservatism for estimation of design basis earthquake as well as derivation of DBGM parameters to minimize the impact of uncertainties associated with data generated was highlighted during the meeting. The inputs from discussion and conclusions drawn would be incorporated in the AERB regulatory documents appropriately.

Theme Meeting / Workshop

New Horizons in Nuclear Reactor Thermal Hydraulics and Safety

A theme meeting on 'New Horizons in Thermal hydraulics' was organized in the SRI Guest House at Anupuram during 2-3 January, 2012. Participants from research and educational institutions from abroad, BARC, NPCIL, AERB and IIT's attended this program. The objective of the meeting was to take stock of the recent activities in thermal hydraulics of nuclear reactors.

The presentations were on current status of thermal hydraulic safety studies, design provisions against severe accidents in thermal and fast reactors, technical issues related to Fukushima nuclear accident, application of CFD for improvement in analysis of nuclear systems, severe accident research for fast reactors, various



Panel Members of the Workshop

(L to R): Prof. Revankar, Dr. Choi, Dr. Prabhat Kumar, Shri K. K. Rajan, Shri S. G. Markandeya

experimental and numerical research programmes towards enhancement of safety in nuclear reactors. The presentations were followed by a panel discussion that took summary of the deliberations and suggested avenues for further work.

Visit of Dr. M. R. Srinivasan to SRI, Kalpakkam

Dr. M. R. Srinivasan, Former Chairman, Atomic Energy Commission and currently Member, National Security Advisory Board visited Safety Research Institute, Kalpakkam on February 27, 2012. Director, SRI made a brief presentation on the R&D activities being carried out at SRI. Dr. Srinivasan appreciated the selection of research activities in important areas of regulatory interest.



Dr.M.R.Srinivasan along with SRI and IGCAR officials

Theme Meeting on Severe Accident Analysis and Experiments

Following the Fukushima accident, there is a need for review and re-assessment of the strategies adopted in various nuclear facilities for severe accident management. This is essential for evolving a robust severe accident mitigation and management guideline for all future nuclear reactors based on feedback from state-of-art R&D. In this connection, a theme meeting on "Severe Accident Analysis and Experiments" was organized by SRI-AERB in co-operation with IGCAR at SRI Guest House, Anupuram Township, Kalpakkam during 26-27 April. This meeting was intended to take a consolidated look at the current status of on going analytical and experimental research work on various aspects of severe accident management, within the DAE units as well as at academic institutions within the country. It is envisaged that the outcome of the deliberations would provide the necessary thrust and direction in focusing research activities on challenging areas of R&D on severe accidents and reorient collaborative research activities among the participating organizations.



Panel Members of the Theme Meeting

(L to R) : Shri H.G.Lele, Shri S.S.Bajaj, Shri S.K.Mehta, Prof. Kannan Iyer, Shri Chellapandi, and Shri P.K.Malhotra

Shri S.S. Bajaj, Chairman, AERB, in his introductory remarks, emphasized that Fukushima accidents have changed the nuclear communities' perspective in responding to such events and evolving mitigating measures. Shri S.K. Chande, VC, AERB while delivering the key note address highlighted the shift in safety focus and practices post Fukushima. A total of twenty lectures were delivered by eminent invited speakers from various R&D organizations and academic institutions, on a wide range of issues relating to R&D on severe accidents in thermal as well as fast reactors. The theme meeting was concluded with a panel discussion chaired by Shri. S. K. Mehta, Former Director, Reactor Group, BARC.

Workshop on Evolving Trends and Technologies in Fire Safety

A one day workshop on Evolving Trends and Technologies in Fire Safety was organised by Industrial Plants Safety Division of AERB on February 9, 2012. Shri S.K. Ghosh, Director, Chemical Engineering Group, BARC delivered the Keynote Address. He briefly summarized the defence-in-depth approach applied to fire

Safety Promotional Activities

protection and different types of fire models available for analysing the fire hazard. He laid emphasis on new directions in Fire Safety Engineering such as combination of CFD and FEM technique for fluid-structural interaction, IR/UV Beam Detector, "Next Generation" Wireless detection and Alarm system, Dry Sprinkler Powder Aerosol etc. He also shared information on the work progress of BARC National Fire Test Facility.

The Workshop emphasized on design and development of fire detection and protection systems, usage of eco-friendly fire extinguishers (Halon alternatives), advanced methods and techniques of fire hazard analysis and fire modelling, fire probabilistic safety assessment, fire and explosion consequence analysis techniques, familiarization with AERB Fire Standard (revised) and evolving preventive measures on fire safety. Experts from AERB, BARC, NPCIL and BPCL delivered lectures on these topics.

About 120 delegates from various DAE units participated in the Workshop. The Workshop was very productive and valuable suggestions and recommendations were made to enhance fire safety measures in DAE units.

AERB Industrial and Fire Safety Awards

The annual Industrial Safety Awards and Fire Safety Awards for Department of Atomic Energy (DAE) units presentation function was held on April 17, 2012 at Atomic Energy Regulatory Board (AERB), Mumbai. AERB presents Industrial Safety Awards and Fire Safety Awards to DAE Units every year.



Dignitaries in the Industrial and Fire Safety Award Function

(L to R) : Shri S. S. Bajaj, Chairman, AERB, Shri S. B. Mathur, Deputy Director General, DGFASLI, Shri S. K. Chande, Vice-Chairman, AERB and Shri R. Bhattacharya, Secretary, Director IPSD and ITSD, AERB.

Industrial Safety Award in Production Units Group comprising Nuclear Power Plants and Heavy Water Plants was bagged by Madras Atomic Power Station (Tamil Nadu). Rajasthan Atomic Power Project 7&8 (Rajasthan) has received the Industrial Safety Award in the Construction Group. The Industrial Safety Awards are given for achieving high levels of performances in industrial safety activities.

Fire Safety Award in the category of high fire risk units was given to Kaiga Generating Station 3&4 (Karnataka). Kakrapara Atomic Power Project 3&4 (Gujarat) is the winner of the Fire Safety Award in Category of low fire risk units group. Fire Safety Awards are given for achieving high levels of performance in fire safety aspects.

The Chief Guest of the function, Shri S.B. Mathur, Deputy Director General, Directorate General Factory Advice Services & Labour

Institute (DGFASLI), Mumbai presented the Awards to the winner units of the DAE for the year 2011. On this occasion, Shri S. S. Bajaj, Chairman, AERB released a compilation for DAE units titled "Occupational Injury & Fire Statistics 2011". This compilation provides the information on number of accidents, injuries and man-days lost due to such injuries and their analysis. Analysis of fire incidents based on severity is also given in this document. The industrial safety related data is also compared with similar units outside DAE. It is seen that industrial safety performance based on incidence rates of DAE Units is far better as compared to other similar industries in the country and comparable with international levels. Shri S.K. Chande, Vice-Chairman, AERB and Shri R. Bhattacharya, Director, Industrial Plants Safety Division, AERB also spoke on industrial and fire safety aspects at the award presentation ceremony.

Radiological Safety Awareness activities

1. Most of the equipments containing small amounts of radioactive material and radiation generating equipments used in the country for various purposes are not indigenous and there are no harmonized international guidelines for these products. After getting recommendations from the apex committee (SARCAR), AERB has formulated regulatory requirements for import and/or use of such devices/equipments. To familiarize the regulatory requirements, AERB conducted a one day awareness programme on "Familiarization of the regulatory requirements for the import and use of the equipments containing small amounts of radioactive material and radiation generating equipments used for various purposes" on March 20, 2012, at AERB Auditorium for the suppliers/importers/local manufacturers of the above mentioned products.

About twenty participants attended the programme. The lectures in the programme included radiation protection techniques, dose limits and regulatory procedures for export/import, procuring and manufacturing of the equipments containing small amount of radioactive material and radiation generating equipments used for various purposes. Also, representatives from five companies made presentations about their experience on the import/supply of such devices. The programme ended with discussion session including feedback.

2) Special Meet on "Radiation Safety, Security and Regulatory Aspects of Ionizing Radiation Gauging Devices (IRGDs)/Nucleonic Gauges (NGs)"

A special meet on "Radiation Safety, Security and Regulatory Aspects of Ionizing Radiation Gauging Devices (IRGDs)/Nucleonic Gauges (NGs)" for manufacturers/suppliers of IRGDs/NGs was organized by RSD, AERB on Friday, February 24, 2012 in AERB, Mumbai. The main objectives of the Special meet was (i) to explain the role and responsibilities of manufactures/suppliers in implementation of regulatory requirements of radiation protection; (ii) safety and security of nucleonic gauges/sources during transport and in use; (iii) disposal of disused nucleonic gauges/sources; (iv) dissemination of information on current regulatory

Safety Promotional Activities

requirements on handling of IRGDs/nucleonic gauges.

About 47 participants consisting of senior representatives from various nucleonic gauge manufacturers/suppliers institution including one participant for Japan and expert(s) from BARC, BRIT and officers from RSD, AERB, attended the special meet.

Shri S. K. Chande, Vice-Chairman, AERB; Dr. Y. S. Mayya, Head, RP&AD, BARC; Shri S. A. Hussain, Head, RSD addressed the participants during inaugural session of the programme.

Shri S. K. Chande, Vice Chairman, AERB, in his inaugural address, explained the existence of effective regulatory control system in the country to ensure safe handling of radiation sources. He elaborated the mission of AERB 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, which is ensured by proper enforcement of relevant regulatory provisions. The IRGDs are the largest chunk of radiation sources after X-rays, there are about 1700 user institution possessing 8500 devices, all may not be equally hazardous. There are around 45 representatives of foreign suppliers and 8 indigenous manufacturers/ suppliers who have obtained type approval from AERB for various IRGD models. AERB has published various safety documents in respect of radioactive sources/devices, i.e. safety standard on "Design and Construction of IRGD, safety guide on security of radioactive material during use and transport, safety code for

transport of radioactive material.

A series of presentations were made by AERB officials in the meet mainly to provide updated information to the participants on the radiation safety, regulatory aspects, built-in-safety design features, design standard and lessons learned from unusual occurrences involving IRGDs. This was followed by brief presentations from the manufactures/supplier on experience in procurement, installation, handling, servicing/maintenance and disposal of IRGDs.

Guidelines on AERB Sponsored Safety Research Programmes

One of the mandates of AERB is to promote and fund research on reactor safety, radiation safety, front end and back end fuel cycle safety related problems and industrial safety as part of its programme. The Committee for Safety Research Programmes (CSR/P) recommends, evaluates and monitors the research projects of various organisations. The Committee also recommends financial assistance to universities, research organisations and professional associations for holding symposia and conferences of interest to AERB after scrutinising the applications from the organisations. A detailed list of the topics of interest to AERB and further additional details on AERB sponsored research projects are available at our website (<http://www.aerb.gov.in>).

Official Language Implementation

Several activities related to implementation of official language were undertaken by AERB.

Bilingual (English-Hindi) Glossary on technical and regulatory terms consisting of about 4000 words, has been finalized with Commission for Scientific and Technical Terminology, Ministry of Human Resource Development, New Delhi, and released by Vice-Chairman, AERB in April, 2012.

In order to promote usage of Hindi in official work, competitions in Hindi such as Scientific and Technical Translation, Noting and Drafting, Hindi Slogan and Essay writing were organized for the



Nuclear Safety Glossary being released during a special function held in AERB on 10.04.2012. Adorning the stage are (from right to left) Shri S.K. Chande, Vice-Chairman, AERB, Shri S. Krishnan, CAO, Shri S.S. Bajaj, Chairman, AERB, Dr. A. Ramakrishna, Chairman, OLIC, AERB and Shri K. Zahir Hussain, AD (OL), AERB.

employees of AERB in February, 2012. Shri S.S. Bajaj, Chairman, AERB distributed the prizes to the winners of the competitions during a cultural Program.

Internal inspections were carried out in various divisions and areas for improvements were identified. AERB officials participated in three day Hindi workshop conducted during June 12-14, 2012 in Administrative Training Institute (ATI) on behalf of Joint Official language implementation committee of the four units of DAE.

As part of the Hindi talk series in AERB, two talks were organized in AERB. One on Positive Living by Ms Malini Shah from Aasthachrysalis and other one on Health and Nutrition by Shri G.N. Kalyane, BARC.



Shri S.S. Bajaj giving away the prizes to the winners of Hindi Competitions held in AERB.

Development of Space-time Kinetics Model for Square lattice Pressurized Water Reactors

Dr. Obaidurrahman K.

Nuclear Safety Analysis Division, AERB

Improved analytical capabilities in reactor dynamics allow detailed assessment of transient scenarios in operational as well as accidental situations. On these lines, use of full 3D core dynamics models to analyze many nuclear transients is an international practice, which being realistic provides a basis to undertake an in-depth evaluation of the safety margins. This also helps in optimizing the fuel use at the same time improving the confidence in nuclear safety. Now a days need of 3D reactor kinetics is further accentuated due to higher degree of neutronic decoupling in upcoming scaled up reactors. Consistent with this objective and review needs of VVER-1000, an indigenous space time kinetics code TRIKIN was developed at AERB. It was validated against a series of international benchmark problems involving different degree of multiphysics modeling. This model is presently being used at AERB and SRI for analysis of many transient problems related to reactivity and power distribution related anomalies in KKNPP. Considering the likely induction of western type of large PWRs having square lattice fuel assembly in near future, capabilities of TRIKIN have been extended to analyze such problems in these reactors. Core physics solver for square lattice geometry has been developed and based on the experience of 24 triangles per fuel assembly in VVER core, each PWR fuel assembly has been subdivided into 25 meshes (5X5 grid). This has given acceptable accuracy. Engineering correlations used in thermal hydraulics model have also been modified to take care of square lattice geometry. Kinetics modules handling point amplitude equations were not modified as they are geometry independent. Individual steady state modules for square lattice geometry have been validated against few standard problems.

Complete coupled square lattice TRIKIN model has been validated against an OECD-NEA rod withdrawal accident benchmark problem. This benchmark is a transient problem, which is initiated by uncontrolled withdrawal of a bank(s) of control assemblies (CAs) from an initial core at Hot Zero Power (HZP) state. The moderator inlet conditions viz. mass flow, pressure, temperature and boron concentration are held constant during the transients. CA banks move up with a constant speed (1.94 cm/s) during withdrawal. Scram signal is generated when the fission power reaches 35% of nominal reactor power with a delay of 0.6 s. All CAs participate in scram with a constant speed of 167.5 cm/s. Transients have to be analysed till 10 s after calculated initiation of the scram. The benchmark has been analyzed by more than 10 participants from different countries. After analyzing all four combinations of CAs bank withdrawal it has been demonstrated that TRIKIN results are in excellent agreement with reference international code PANTHER. This additional feature to simulate square lattice 3D kinetics has made AERB TRIKIN code a versatile space-time kinetics tool to analyze wide array of transients in all types of pressurized water reactors.

Development of Models for Containment Hydrogen Distribution Analysis

R. S. Rao & Avinash J. Gaikwad

Nuclear Safety Analysis Division, AERB

Large amounts of hydrogen could be generated and released into the containment during severe accident conditions in a nuclear power plant. Combustion of hydrogen may jeopardize the integrity of containment. It is imperative that a detailed modelling of containment thermal hydraulics is necessary to predict the local distribution of hydrogen in the presence of steam and air inside the containment. A multi-dimensional tool, such as Computational Fluid Dynamics (CFD) code, is necessary for prediction of hydrogen transport and distribution accurately. Further, these codes also permit integration of different models to simulate basic phenomena. However, the commercial CFD codes do not have condensation models incorporated as a standard feature and this needs to be implemented before using it for hydrogen distribution analysis. It is therefore necessary to incorporate models such as recombiner models, condensation models, sump models etc. in these hydrogen distribution and transport models.

In this context, a wall condensation model was implemented in the CFD code for the mass, momentum, energy and species balance equations together with associated turbulence quantities viz., kinetic energy and dissipation rate. This model was benchmarked against a simple flow domain (idealized version of the CONAN test facility) using the enhanced wall treatment approach and also validated against the ISP-47 test of TOSQAN test facility (Figure 1) using the standard wall functions and enhanced wall treatment approaches. 2-D axis-symmetric domains were used for the simulations. The predictions were found to be in good agreement with the experimental data. Sensitivity studies were performed with different mesh sizes. Figure 2 shows the refined grid near the walls. Figure 3 shows the comparison of the pressure evolution during the test with the experimental data.

Homogenous nucleation occurs when gas molecules collide to form a water droplet of critical size or greater. Above this critical size the droplet will grow due to condensation of the surrounding gas. Homogenous condensation is also termed as spontaneous or bulk condensation. A model based on the classical theory of homogenous nucleation was implemented. The sink terms such as mass, momentum, energy, species and turbulent quantities were developed to simulate the bulk condensation process.

Scientific Notes

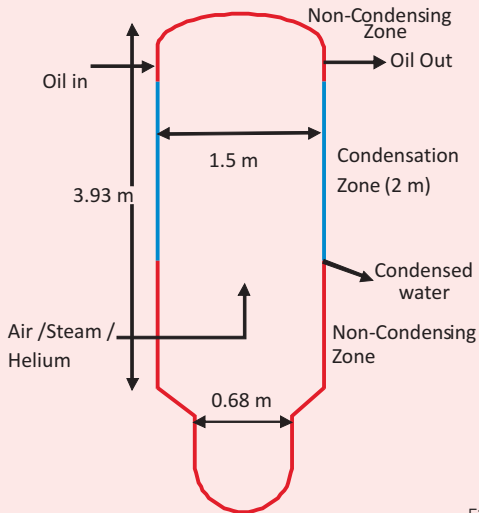


Figure 1: TOSQAN test facility

Figure 2: Two-dimensional axi-symmetric model of TOSQAN

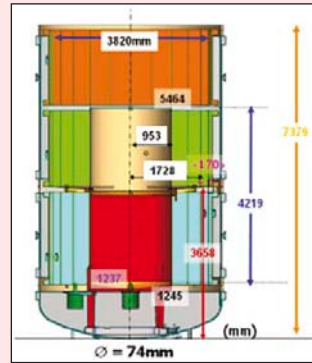


Figure 4: MISTRA test facility

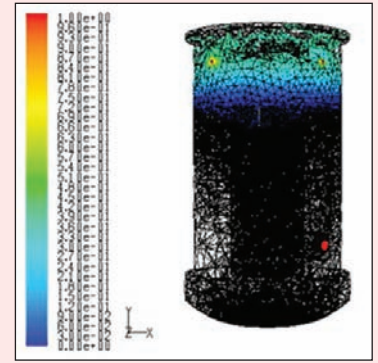


Figure 5: Contours of mole fraction of helium

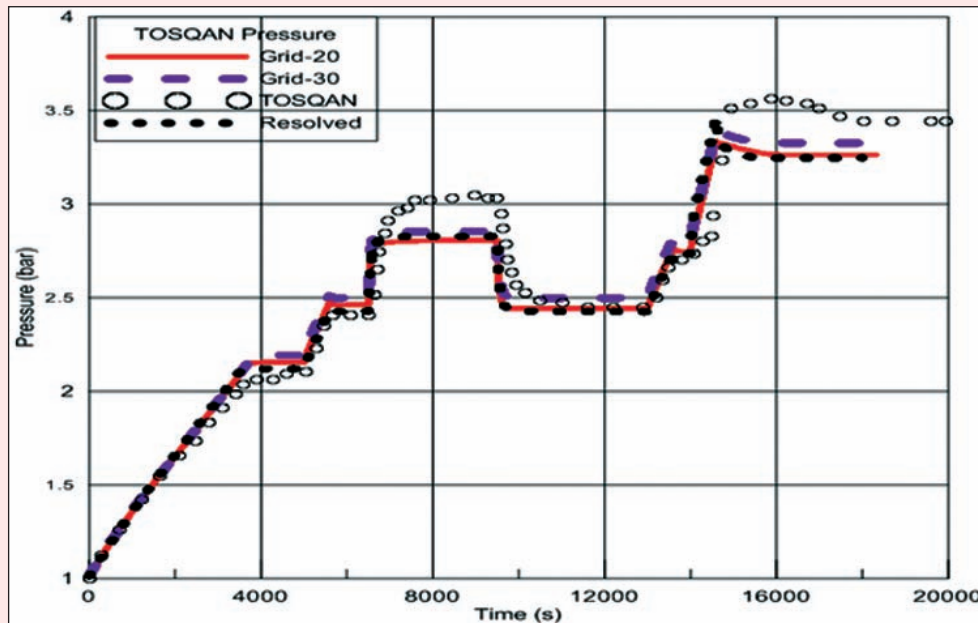


Figure 3: Pressure evolution during the test

Simulation of the MISTRA experiment INITIALA was carried out with an objective to validate the CFD code. Under severe accident conditions, large amount of hydrogen may be released into the containment and may get stratified locally. The stratification is expected in Fuelling Machine Vault (FMV) region during the initial phase and also in the dome region in later phases of the severe accident scenario in a typical Pressurised Heavy Water Reactor (PHWR) containment. This phenomena was also simulated. With this objective, the validation of the CFD code is performed against the experiments related to stratification and its erosion (INITIALA) performed in the MISTRA test facility (Figure 4). Figure 5 shows the contours of helium mole fraction at the end of the helium injection.

The containment thermal hydraulic analysis for LOCA with loss of emergency core cooling was carried out for TAPP3&4 containment using Accident Source Term Evaluation Code (ASTEC). The analysis was carried out to find the hydrogen distribution and to check the flammability limits in various compartments of the containment using

CPA module of the severe accident code ASTEC. The hydrogen distribution analysis was carried out in which the proposed scheme of intermixing is credited. The proposed hydrogen management scheme is provided to dilute the fuelling machine vault atmosphere by intermixing it with pump room atmosphere and comprises of provision of axial fans and associated ducts connecting pump room with fuelling machine vaults. The proposed scheme also involves switching off of FM Vault coolers for initial one hour. Figure 6 shows the ternary diagram for the break compartment. It was found that the mixture does not reach flammable limits with the mixing scheme.

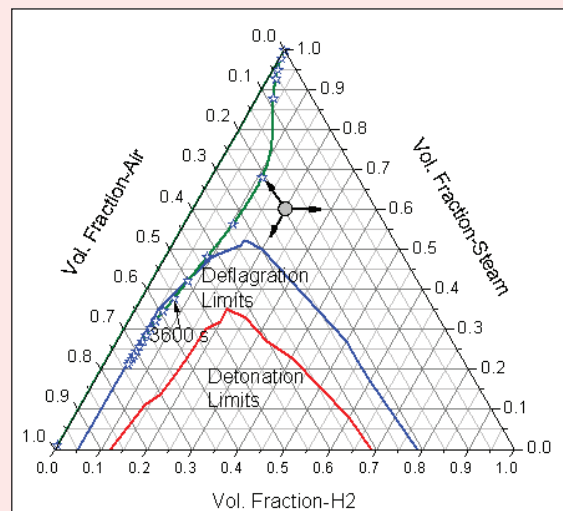


Figure 6: Ternary Diagram for the Break Compartment

New Appointments

Shri S. Duraisamy takes charge as Vice-chairman, AERB and Chairman, SARCOP



Shri S. Duraisamy has taken charge as Vice-chairman, AERB and Chairman, SARCOP with effect from August 1, 2012, consequent to the retirement of Shri S.K. Chande.

Shri Duraisamy, an Electrical and Electronics Engineer joined the Department of Atomic Energy, in the year 1975, after graduating from 18th Batch of BARC Training School. He started his career as an Operation

Engineer in the research reactor Cirus at Trombay. He was subsequently involved in the commissioning of the high flux research reactor Dhruva and later was heading the Reactor Operation Division and was responsible for safe and efficient operation of the research reactors at Bhabha Atomic Research Centre, Trombay. He was a member of IAEA Technical Working Group on Research Reactor and also has undertaken expert missions for IAEA in the areas of research reactor. For more than a decade, Shri Duraisamy was associated with the design, commissioning and operational safety review of the Pressurized Heavy Water Reactors (PHWRs) and Fast Breeder Reactors (FBRs) and providing technical support to AERB. Shri Duraisamy joined AERB in August 2011 as Director, Operating Plants Safety Division, and was responsible for; assessment of safety of operating NPPs & research reactors, regulatory activities related to renewal of their licence, conduct of periodical inspection of NPPs, preparation/revision of regulatory documents. He was a member of SARCOP and is designated as Chairman, SARCOP and Vice Chairman, AERB with effect from August 1, 2012. He is the national contact point for Convention on Nuclear Safety and CANDU Senior Regulator's Forum.

Director OPSD



Shri P. R. Krishnamurthy, an Electrical Engineer from the Karnataka Regional Engineering College, Surathkal, and belonging to the 24th batch of BARC Training School, has been appointed as Director, OPSD on 31st July, 2012. He began his career from the RAPS-1&2 NPP at Rajasthan. After having gained experience in RAPS-1&2, he was actively involved in

Commissioning, Criticality and Synchronization of MAPS-1&2. His dedicated service at MAPS-1&2 for fifteen years helped him to occupy several capacities such as Control Engineer, Assistant Shift Charge Engineer and Shift Charge Engineer. Shri Krishnamurthy was responsible for commissioning of Turbine Generator, Feed Water & Steam systems of KGS-1&2 as Senior Commissioning Engineer. He played a vital role in the first criticality and synchronization of both the units of KGS-1&2. He joined AERB in Nov, 2000. Shri Krishnamurthy is involved in several AERB Committees and continues to contribute in design, commissioning and operational safety reviews of PHWRs and Regulatory Inspections of NPPs for more than a decade. Currently, Shri Krishnamurthy is designated as the Member Secretary, Safety Review Committee for Operating plants (SARCOP) since 2011.

Head NSAD



Shri Avinash J. Gaikwad, has been appointed as Head, Nuclear Safety Analysis Division (NSAD), AERB on July 03, 2012. He is a Chemical engineering gold medallist from Pune University. He is from 32nd batch of BARC Training School and is presently pursuing Ph.D. in the area of development of

interleaving configuration for main heat transport system in advanced channel type BWRs. He has been working at reactor safety division of BARC for more than two decades (1989 to 2012). His area of specialization include thermal Hydraulics for Probabilistic Safety Assessment, Passive System Reliability, Severe Accident Studies, Deterministic Safety Analysis, In-house computer Code development and safety analysis using RELAP5/SCDAP. He has more than 90 publications in different international journals and conferences to his credit. He has been extensively involved in Safety analysis for different reactor systems like AHWR, PHWR, PWR, BWR, ADSS including Passive System Reliability Analysis and advanced process control studies.

Head RSD



Dr. Avinash Uddhav Sonawane, from the Radiological Safety Division (RSD), took over charge as Head, RSD from Shri Hussain with effect from August 1, 2012. Dr. Sonawane obtained his Ph.D. from the University of Mumbai on the studies on Radiation Protection of Patients in Diagnostic Radiology.

Dr. Sonawane is a recipient of the Gold Medal of Indian Nuclear Society in 2007 for his outstanding contribution in establishing regulatory framework for ensuring safe usages of radiation sources in multifarious applications in the country. He has been empanelled as Assessor by the National Accreditation Board for Hospitals & Healthcare Providers (NABH) for Medical Imaging Services (MIS). Dr. Sonawane has participated and contributed significantly in several Consultant and Technical meetings on radiation protection organised by the International Atomic Energy Agency (IAEA), Vienna.

Head SRRC



Shri V. Mohan has been appointed as Head, Southern Regional Regulatory Centre (SRRC) of AERB at Kalpakkam. Shri.V.Mohan joined OPSD, AERB in 2006 with 30 years of operational health physics experience in Rajasthan Atomic Power stations-1 &2 and Madras Atomic Power station. In 2010, he

was transferred to Radiological Safety Division. In Feb 2011, Shri Mohan was made as Officer-in-Charge of SRRC at Kalpakkam. The objective of SRRC is to decentralise some of the regulatory functions of AERB and regulate radiation facilities in the southern States in a phased manner.

AERB Bids Fond Farewell to former Vice-Chairman, Shri S.K. Chande

Shri S.K. Chande, Vice-chairman, AERB retired on superannuation on July 31, 2012. Shri Chande was felicitated for his contribution in regulatory areas in AERB as well as his technical expertise both in DAE and AERB in the Theme Meeting on "Evolution of Regulatory Framework for Nuclear Safety and Challenges Ahead" held on July 26, 2012 at AERB, Mumbai. Shri Chande had been instrumental in AERB not only in bringing sea change in nuclear regulatory domain

but also in the development of human resources in AERB. A fond farewell was also organised on July 31, 2012 in AERB Auditorium. Many distinguished guests from other units of DAE and AERB staff spoke on both the occasions. Shri Chande was felicitated in the Executive Committee meeting as well as in the last Board meeting. Shri Chande spoke on this occasion and thanked one and all and wished AERB success in all its endeavours.



Shri Chande being felicitated at the farewell function



Shri Chande addressing the farewell function

Farewell to other Dignitaries



Shri Hussain's farewell function (Shri Hussain was the former Head, Radiological Safety Division, AERB and retired on 31/07/2012)



Dr.S.K.Gupta's farewell function (Dr.S.K.Gupta was the former Director, Safety Analysis and Documentation Division, AERB and retired on 31/01/2012)



Shri R.I. Gujrati's farewell function (Shri R.I. Gujrati was the former Director, Nuclear Projects Safety Division, AERB and retired on 31/12/2011)



Shri Krishnan's farewell function (Shri Krishnan was the Chief Admionsitrative Officer, AERB and retired on 31/07/2012)

Strengthening Industrial Safety in DAE units

Soumen Sinha, A.K. Panda, R. Bhattacharya & S.K. Chande¹

Industrial Plants Safety Division, AERB
(1-Former Vice-Chairman, AERB)

Prior to formation of Atomic Energy Regulatory Board (AERB), industrial safety aspects of units of Department of Atomic Energy (DAE) were looked after by Industrial Hygiene and Safety Section (IHSS) of Health Physics Division, BARC. The Inspection Section (Factories Act) of BARC used to enforce the provisions of the Factories Act, 1948 in the units of DAE. These sections provided the inputs to the erstwhile Safety Review Committee of DAE (DAE-SRC) which had the responsibility for overseeing the safety of DAE units. However, when Atomic Energy Regulatory Board (AERB) was constituted in 1983, AERB was mandated to administer the provisions of the Factories Act, 1948 in all DAE units.

Over the years, with constant encouragement and advice from AERB and strong commitment and sustained efforts of the DAE units, the industrial safety performance of these units has improved appreciably. The frequency rate which was prevailing above 1 at the start of this decade has come down to around 0.5 at the end of this decade with clear decreasing trend as can be seen from figure-1. Last year it further reduced to 0.23. During later half of the decade, reportable injuries which was almost one per 1000 employees, has come down to 0.58 in 2011.

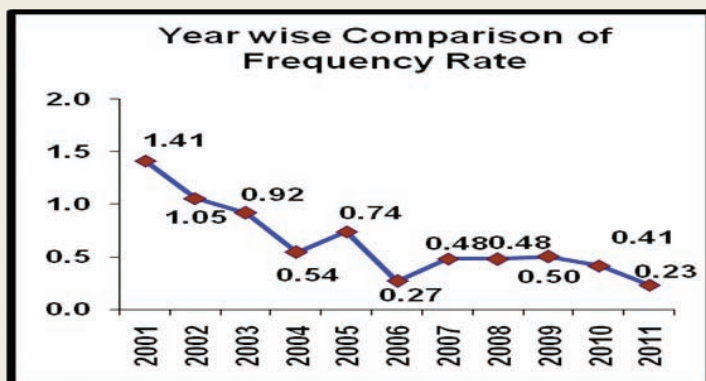


Figure-1: Year-wise Frequency Rate of DAE units i.e lost time injuries/ million man-hours worked

However, just when the last decade was witnessing a sudden surge of construction activities in almost all DAE units, fatal accidents at the construction sites was also on a steady rise. AERB took serious note of this and several actions for improvement of Industrial Safety at construction sites were initiated

AERB issued a notification in July 2002 specifying the minimum qualifications and strength of the safety organization at construction sites. Further to this, AERB issued another notification in November 2004, empowering the Inspectors to stop work if the stipulated minimum safety precautions are not followed at any plant or site. In August 2005, AERB directed NPCIL construction sites to suspend all jobs involving work at height until detailed review of work practices was carried out by senior management. From 2006 onwards, AERB started focused monthly inspection of industrial safety at nuclear project construction sites of DAE units. In 2007, the construction consent of one of the construction sites was suspended for a week due to unacceptable industrial safety performance. In view of the deteriorating industrial safety in some of the construction sites, series of workshops and symposia were organized frequently to address topical issues on industrial and fire safety. Monographs on

'construction safety' and 'fire safety' were published and distributed.

However, even with systematic implementation of several measures by plant authorities and at corporate level, sporadic instances leading to serious industrial accidents kept recurring at construction sites. AERB expressed serious concern over these accidents which continued to occur in DAE units despite the best efforts from the plant management. This triggered the idea to arrange a Discussion Meet on "Challenges and Strategies in Industrial Safety Management at DAE Construction sites" in March 2011 involving all the unit heads of DAE installations to discuss the strategies to prevent recurrence of such accidents in future. Several important views were expressed and valuable suggestions were made in the meet to control the industrial accidents at DAE units.

The major recommendations from this meet are as follows:

Training and certification of workers

Workers in India have tendency to by-pass procedures and are prone to taking short-cuts. They need to be trained and frequently reminded of the hazards and the consequences. Therefore, some presentations on illustrative case studies are required. With regard to contract workers, the workforce employed for various casual jobs are often illiterate/semi literate and are from different regions in the country. Audio-visuals during the training programmes would therefore enable the workers to grasp the message irrespective of their regional background. In lines similar to orange and green dot qualification of the radiation workers, action needs to be initiated for industrial safety certification programme for the workers. In addition, even the supervisors should also be trained on various safety aspects including the statutory requirements.

Consideration for construction and maintenance aspect during design stage

Many a times due consideration is not given during design phase for construction and maintenance aspects and there are deficiencies specially in the lay out and equipment and material movement, fire escape routes etc. Therefore, safety during construction should be explicitly addressed in design and layout of equipment and systems. Proper sequence of construction activities needs to be specified so that exposure to hazards is minimized by design.

Regular Supervision and Commitment of Line Management

There should be regular supervision of the construction sites since the situations are very dynamic. Steps should be taken to eliminate the unsafe conditions prevailing at the sites. Commitment of line Management towards this with support from corporate office is very much required in this regard. Top management must have passion to achieve zero injuries and should ensure that line managers are responsible for safety performance.

Effectiveness of Job Hazard Analysis

Serious concerns were raised on the utilization of the Job Hazard Analysis as in most of the cases, it was noted that these documents, like any other document, are kept in plant management's office. The intent of having Job Hazard Analysis is to familiarize the workers directly associated with the jobs of the various hazards that may

(Contd. on page 16)

Home Page

Personnel Joined (January – June, 2012)

Sl. No.	Name	Designation	Date of Appointment
1.	Smt. Y. V. S. Swaroopa Lakshmi	SO(D)	02/01/2012
2.	Kum. Swati V. Burewar	SO(E)	16/01/2012
3.	Shri L. R. Surywanshi	TO(D)	31/01/2012
4.	Kum. Mansi Garg	SA(B)	01/02/2012
5.	Dr. R. Dhayalan	SO(D)	07/02/2012
6.	Shri M. N. Parihar	SO(D)	20/02/2012
7.	Shri V. V. Bhatkande	TO(D)	20/02/2012
8.	Smt. Sangeeta R. Nakhwa	AO-III	23/02/2012
9.	Shri H. G. Desale	SO(D)	28/02/2012
10.	Shri N. S. Malkar	SA(C)	20/03/2012
11.	Shri Rakesh Kumar	TO(D)	02/04/2012
12.	Smt. M. R. Priya	SA(B)	09/05/2012
13.	Shri A. J. Gaikwad	SO(H)	23/05/2012
14.	Shri K. V. Arbind Krishnan	SO(C)	04/06/2012
15.	Shri Ramesh Tadicherla	SO(C)	04/06/2012
16.	Shri Tejaswi Abbrui	SO(C)	04/06/2012
17.	Shri Narendra Khandelwal	SO(D)	14/06/2012

Personnel Transferred / Retired (January – June, 2012)

Sl. No.	Name	Designation	Date of Transfer/ Retirement
1.	Dr. S. K. Gupta	Director, SADD	31/01/2012
2.	Shri Y. V. Sudhakar	Asstt. Accountant	Transferred to DAE
3.	Shri P. S. Nair	SO(H)+, OPSD	30/04/2012
4.	Shri Ajay Kumar Gocher	SO(C), RSD	Transferred to RR Site, Kota
5.	Dr. K. V. Subbaiah	SO(H), SRI	31/05/2012

industrial safety. Even for departmental or supervisory staff when found clearly responsible for a particular accident/lapse, should be appropriately punished.

AERB is following up with the plant management for implementation of these valuable recommendations in a time bound manner and is hopeful that with the unstinted support from plant management and continued efforts of the safety supervisors, achieving and sustaining 'zero accident' status would not be a farfetched goal.

Awards



Shri Rajib Lochan Sha, Scientific Officer (D) from the Radiological Safety Division of AERB, was awarded Ph.D. Degree in Physics by the Osmania University, Hyderabad on April, 2012 for his thesis entitled, "Dose Evaluation and Quality Assurance in High Dose Rate Intracavitary Brachytherapy of Gynecological Cancer". The objective of this study was to improve the quality of treatment in Gynecological cancer by introducing some novel techniques in QA program taking into consideration the national and international recommendations. This work was carried out under the guidance of Professor P. Yadagiri Reddy, Professor, Osmania University, Hyderabad.

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Strengthening Industrial Safety in DAE units

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arise at different stages of job. Based on the exercise, appropriate preventive measures should be provided.

Coordination between Mega Contractor/Sub Contractor with departmental staff

Very often it has been observed that there is very little interaction of the mega contractor/sub contractor with the departmental staff. Several instances have been quoted where the departmental staff are unaware of the various activities taking place at the site. This is one area where sufficient attention is required and involvement of corporate office in this matter is warranted for making things more streamlined. Safety personnel should have the liberty to bring any safety related deficiency to the notice of the top management.

Learning from Near Misses

Near Miss cases are indicators of what is next in the store. Each and every near miss cases, no matter how minor it may be, should be analyzed and reported. If it is related to any unsafe condition, steps should be taken immediately to rectify the deficiency. If required, the work may be stopped to implement the preventive measures. If it is noted that the near miss is due to unsafe act, the concerned worker must be trained and educated of the consequence. Behavior based safety approach should get integrated with the traditional safety management approach.

Imposing of penalty

Generally this is the last recourse but if required, stringent steps of imposing penalties may be thought of. Steps like barring of contractor from bidding next time may be considered as one of the options if serious deficiencies are noted in the implementation of