

## INTERNATIONAL CO-OPERATION

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AERB places high importance on interaction with IAEA and regulatory bodies of other countries as this helps in better understanding of the issues important to safety and the measures for their resolution. Towards this AERB has formed co-operation arrangements with the regulatory bodies of USA, France and Russian Federation. AERB is also member of CANDU Senior Regulators Group (Canada, Republic of Korea, Romania, Argentina, Pakistan and China) and VVER Regulators Group (Russia, Ukraine, China, Czech Republic, Slovakia, Finland, Iran, Bulgaria, Armenia and Lithuania). AERB also participates in various activities of IAEA. Additionally, India ratified the Convention on Nuclear Safety (CNS) in 2005 and participated in the 3<sup>rd</sup> and 4<sup>th</sup> review meetings of CNS in 2005 and 2008 respectively.

### **International Atomic Energy Agency (IAEA)**

The staff of AERB participate in various Technical and Consultants meetings organized by IAEA on a range of topics: nuclear power plants and fuel cycle activities, emergency preparedness, radiation facilities and transportation of radioactive materials. AERB staff have been participating in IAEA Coordinated Research Programme (IAEA-CRP) on topics like Methodologies for Event Analysis and Safety Significance of Near field earthquakes.

S.D.Soman, one of the past chairmen of AERB and S.K.Sharma, the current AERB Chairman have served as members of the International Nuclear Safety Group (INSAG). INSAG is a group of international experts, constituted by the Director General of IAEA, with high professional competence in the field of nuclear safety, working in regulatory organizations, research and academic institutions and the nuclear industry. INSAG provides recommendations and opinions on current and emerging nuclear safety issues to IAEA, the nuclear community and the public. AERB hosted one of the meetings that

was held during 12-16 March 2007 in Mumbai. On this occasion, a seminar was held wherein seven of the INSAG members from OECD/NEA, Finland, Hungary, Korea, South Africa, Russian Federation and Canada presented technical talks on a variety of current topics of interest. The INSAG meeting provided a good opportunity to Indian Nuclear Scientists and engineers to interact with this group of international experts.

AERB is the national coordinator for IAEA -International Nuclear Event Scale (INES) based reporting of events and IAEA/NEA – Incident Reporting System (IRS). The INES is a means for promptly communicating to the public in consistent terms the safety significance of events reported at nuclear installations. The scale was designed by an international group of experts in 1989 and is being followed by all the countries. The scale is applied to classify events at nuclear power plants and other nuclear facilities and has now been extended also to radiation sources and transport events involving radioactive materials. India adopted INES scale since its inception and has been participating in all INES activities including further development of INES. AERB being the national coordinator participates in biennial meeting of the INES national coordinators. S. K. Sharma, the present AERB Chairman is a member of the INES Advisory Committee.

The IRS is an international reporting system jointly operated by IAEA and NEA. The objective of the system is to improve the safety of commercial nuclear power plants worldwide by providing timely and detailed information on both technical and human factors related to events of safety significance. The system was started in 1980. India has been reporting events of major safety significance at Indian NPPs since inception of the system. India also receives information on the events in other countries through this system. AERB being the national coordinator participates in annual meeting of the IRS national coordinators and S. K. Chande, the present Vice Chairman of AERB is a member of the IRS Advisory Committee. AERB has also conducted topical studies under IRS on violations of operating limits

and conditions, closing the feedback loop from events to definite elimination of the causes and fuel handling events, which led to publication of Topical Reports on these subjects.

### **CANDU Senior Regulators Group**

AERB is a member of the forum for the CANDU Senior Regulators for exchange of information on issues related to safety of PHWRs. Besides India the other countries participating in this forum are Argentina, Canada, China, Pakistan, Romania and South Korea. The CANDU Senior Regulators meeting is held once in a year. India hosted CANDU Senior Regulators meet in November 2005.

The participation in this forum helps AERB in better understanding of events and generic safety issues in CANDU reactors world over, and for arriving at the corrective actions to be taken in Indian NPPs.

### **VVER Regulators Forum**

AERB has become a member of VVER regulators forum as two VVERs (2x1000 MWe) reactors are being constructed at Kudankulam. The other countries participating in this forum are Russia, Ukraine, China, Czech Republic, Slovakia, Finland, Iran, Bulgaria, Armenia and Lithuania. The participation in this forum helps us in understanding the various regulatory approaches for this type of reactors and the design and operational safety issues in VVER reactors.

### **Nuclear Regulatory Commission of USA (USNRC)**

The US-India dialogue for co-operation in nuclear safety regulation began in July 1994 with the visit of an American delegation led by former U.S. Energy Secretary Hazel O'Leary and a former Commissioner of USNRC, E. Gail de Planque. The officials of the two countries decided to open a nuclear safety dialogue between AERB and NRC. The topics of development of symptom-based emergency procedures, technical exchanges on design issues, fire

safety in Nuclear Power Plants, materials Aging and In-service Inspections were identified for the co-operation. In October 1994, A. Gopalakrishnan, Chairman, AERB along with a team of engineers visited NRC and various nuclear facilities in the US. In February 1995, Ivan Selin, Chairman, NRC and his team visited India.

In March 1998, P Rama Rao, Chairman, AERB and S.V. Kumar, Vice Chairman, AERB visited NRC headquarters. They held discussions with NRC officials on developing and implementing three NRC-AERB nuclear safety projects (i) back-fits and design modifications to existing nuclear power plants (ii) historical information on fire incidents and use of good fire protection engineering practices; and (iii) symptom-based emergency procedures.

A USNRC team led by Shirley Ann Jackson, Chairman of the NRC visited AERB in April 1998 when she addressed "Fire Safety 1998", a conference on fire-safety related topics. She summarized the history of fire protection in nuclear power plants, the associated regulatory frame work and the NRC deliberations for possible improvement.

The nuclear safety co-operation dialogue between AERB and USNRC restarted in February 2003 when Richard A. Meserve, Chairman, USNRC accompanied by a 15-member team visited AERB on invitation from S.P. Sukhtame, Chairman, AERB. Meserve delivered a lecture titled "Advancing nuclear safety through international cooperation" at BARC; he described the key attributes to regulatory effectiveness and how NRC faces the challenges and achieves these attributes.

Between 2003 and now, nine meetings have been held between AERB and USNRC with the meeting venues alternating between India and USA. Some important topics discussed during these meetings include Probabilistic Risk Assessment Technology, License renewal of old reactors, emergency operating procedures, passive systems reliability evaluations and severe accident analysis. It is worth

mentioning that Commissioner Jeffery. S. Merrifield accompanied the USNRC team in 2005 while Commissioner Peter. B. Lyons accompanied the USNRC team in 2006. From USNRC Ashok Thadani and later James Lyons led the technical discussions. S.K. Sharma and S.K. Chande led the Indian expert teams during the meetings. The objective of these meetings continues to be furthering the dialogue regarding nuclear safety between AERB and USNRC. In addition to discussions on technical topics, the visiting teams have also visited some nuclear power plants and other related facilities.

Two young AERB officers were deputed to USNRC for a period of one year for familiarisation with the NRC approaches on risk informed decision making and its applications.

Collaborative work related to joint exercises of benchmarking Computer Codes through analysis of Standard Problems has also been initiated since the beginning of 2007 and work on two such exercises is in progress.

### **Nuclear Safety Authority (ASN) France**

A formal cooperation agreement between AERB and ASN, France, was signed in 1999 for Exchange of Information and Co-operation in the Regulation of Nuclear Safety and Radiation Protection, for a period of five years. This agreement was extended for a further period of five years in 2005. The arrangement now covers cooperation in the fields of radiation protection and safety of transport of radioactive sources and materials in addition to the previously covered areas.

AERB team visited France to witness Emergency Preparedness Exercise in Flamanville in October 1999. In May 2000, S.P.Sukhatme, Chairman, AERB visited Emergency Control Centre at IPSN and St. Laurent NPP. AERB team again visited France to exchange experience on transport of radioactive materials, civil engineering aspects, seismic issues and fire safety in December 2000. The team also

visited Cruas-Meysee NPP and Aube radioactive waste repository. In February 2001, AERB team visited Transportation Cask Test Facility at Cesta.

In 2001 A. C. Lacoste, Director General, ASN and his team visited AERB for discussions and exchange of ideas on licensing of NPPs, periodic safety review and life cycle management of nuclear facilities. In October 2005, French Delegation lead by A.C.Lacoste discussed issues related to flooding and tsunami, safety of pre-stressed concrete containment and safety in transport of radioactive materials.

A five-member ASN delegation led by Olivier Gupta, Head of the Direction of Nuclear Power Plants of ASN visited AERB in 2007 when a seminar on 'Pressurized Water Reactors' was organized. The seminar resulted in better appreciation of Regulatory practices and safety review approach followed in the two regulatory bodies, safety objectives and approaches for new reactors and design assessment of reactors with evolutionary new features. In 2008, AERB received Computer Code ASTEC (Accident Source Term Evaluation Code) from France.

In May 2008, ASN team led by Guillaume Wack, Head of the Nuclear Power Plants Department visited AERB for a seminar on reactor safety which included presentations on concrete containment, reactor pressure vessels and periodic safety review of NPPs.

### **Federal Nuclear and Radiation Safety Authority of Russia**

AERB and ROSTEKHNADZOR, the Federal Nuclear and Radiation Safety Authority of Russia entered into an agreement in February 2003 for cooperation in the field of safety regulation in the process of use of nuclear energy for peaceful purposes. The first workshop between AERB and ROSTEKHNADZOR was held in February 2005 to discuss regulatory practices for ensuring safety of the plant personnel, public and the environment, regulatory experience and current safety norms.

The second workshop on Information Exchange on Nuclear Safety between AERB and ROSTEKHNADZOR, was held during March 25-27, 2008 at Mumbai. A three member delegation from the Russian Federation, led by 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, and on the experience on safety review of control and instrumentation, pre-stressing system for primary containment and reactor pressure vessel of the Kudankulam VVER type reactors.

### **Convention on Nuclear Safety**

The Convention on Nuclear Safety (CNS) was adopted in Vienna on 17 June 1994 by a Diplomatic Conference convened at the International Atomic Energy Agency, Vienna. Its aim is to legally commit participating States operating land-based nuclear power plants to maintain a high level of safety. The Convention obliges Contracting Parties to submit national reports on the implementation of their obligations ( Legislative and regulatory framework, regulatory body, siting, design, construction, operation, availability of adequate financial and human resources, the assessment and verification of safety, quality assurance and emergency preparedness) in the country for “peer review” at meetings of the contracting parties. The Convention entered into force on 24 October 1996. All countries with operating nuclear power plants are now parties to the Convention. India ratified the Convention on March 31, 2005 and attended the 3<sup>rd</sup> Review Meeting of the convention as observer. For the 4<sup>th</sup> Review Meeting, the first National Report on India was submitted for review by the Contracting Parties to the Convention on 24<sup>th</sup> September 2007. A total of 143 questions were raised on India's report that were answered in writing prior to the 4<sup>th</sup> meeting. The preparatory committee for India's participation in fourth Review Meeting was

headed by S.K. Sharma, Chairman, AERB. National reports of 12 countries (Argentina, Canada, China, Czech Republic, France, Finland, Japan, Korea, Pakistan, Romania, Russia, and USA) were reviewed by experts in AERB, NPCIL and BARC and sixty questions were raised. The Fourth Review Meeting of the Convention was held at IAEA headquarters, Vienna, Austria from April 14-25, 2008. An 18 member Indian delegation led by S.K. Sharma, Chairman, AERB and comprising of experts from AERB, NPCIL and BARC attended the meeting. The interactions with other contracting parties during the review meeting were extremely useful for India and AERB. The Indian report and its oral presentation at the review meeting was highly appreciated by the participants and a number of good practices followed in India were included in the meeting report.

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