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AERB Newsletter

ATOMIC ENERGY REGULATORY BOARD

CONTENTS

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From the Chairman's Desk

Sharing of information on safety matters and operational experiences enhances effectiveness in implementing and regulating safety. AERB recognises this and endeavors to promote information exchange among stakeholders in the various aspects of use of nuclear energy. This effort was continued during this quarter by way of conducting workshops/discussion meetings on safety related topics.

As per the agreement signed in July 1999 between AERB and DGSNR, the French Nuclear and Radiation Regulatory Organization, AERB hosted discussions on safety in transport of radioactive materials, leak tests of pre-stressed concrete and external flooding hazard at NPPs. AERB also renewed this co-operation agreement with DGSNR for a further period of five years. During the coming years, it is envisaged to hold annual discussions on topics of mutual interest.

The senior regulators of countries operating CANDU type NPPs meet once a year to discuss operating experience and safety related matters. This year AERB hosted this Meeting in India which was participated by an IAEA representative and officials of the nuclear regulatory bodies of Argentina, Canada, China, India, Korea, Pakistan and Romania, the countries where CANDU type Pressurized Heavy Water Reactors (PHWRs) are being operated. Discussions were held on safety significant events, design issues emerging from operational experience and results of periodic safety review of the plants.

A Workshop was organised by AERB on 25 November 2005 to discuss various issues related to design, construction and operation of spent fuel storage pools.

Officers from AERB participated in a seminar held in UCIL, Jaduguda on uranium mining and milling that was attended, among others, by officials from the Canadian Nuclear Safety Commission.

AERB organises a Safety & Occupational Health Professionals Meet every year at one of the units of Department of Atomic Energy (DAE). This year the Meet was held at Heavy Water Plant, Manuguru in November 2005 with the theme for the Meet as 'Process Safety'.

Preservation of food products and sterilization of medical and healthcare products is an important field of application of radiation for societal benefit. Such processing is carried out in gamma irradiators and two such Gamma Radiation Processing Plants, one at Vadodora and another at Ambernath, were commissioned during this quarter. Detailed safety review of the design and operating procedures of these plants was done by AERB before issuance of operating licence.

In the previous issue of AERB Newsletter, an article was published that dealt with health, safety and environmental aspects of Uranium mining and milling. This issue carries an article on health, safety and environmental aspects of Uranium fuel fabrication.

During the year 2005, AERB published seven new safety documents and Hindi versions of fifteen existing documents were brought out. With this, AERB has now issued 13 Safety Codes, 61 Safety Guides and 41 other safety support documents at the end of 2005. ●

(S. K. Sharma)

Press Release :

October 25, 2005

French Nuclear Regulatory Delegation Visits Atomic Energy Regulatory Board

A five-member delegation of the French Nuclear and Radiation Regulatory Organization led by their Director General Dr. A.C. Lacoste visited the Atomic Energy Regulatory Board (AERB) on October 25, 2005. This visit was under the agreement between the two organizations that was signed in July 1999 on Exchange of Information and Co-operation in the Regulation of Nuclear Safety and Radiation Protection. In the present visit, discussions were held on the topics of Safety in transport of radioactive materials, safety and leak tests of pre-stressed concrete containments and flooding hazard at nuclear power plants.

The AERB and Nuclear Safety and Radiation Protection Directorate of the French Republic also renewed the agreement for Exchange of Information and Co-operation in the Regulation of Nuclear Safety and Radiation Protection for a further period of five years.●

Shri S. K. Sharma, Chairman, AERB (left) and Dr. A.C. Lacoste (right), Director General, French Nuclear and Radiation Regulatory Organization renewing the agreement for Exchange of Information and Cooperation in the Regulation of Nuclear Safety and Radiation Protection at Mumbai, on October 25, 2005

November 23, 2005

CANDU Senior Regulators Meet

A meeting of Senior officials of the Nuclear Regulatory Bodies of Argentina, Canada, China, India, Korea, Pakistan and Romania, the countries operating CANDU type Pressurised Heavy Water Reactors (PHWRs), was held in Mumbai from November 14 to 18, 2005. The objective of the meeting is to share information on regulatory matters and operational experience of PHWRs with a view to enhance safety. The meeting was hosted by the Indian Atomic Energy Regulatory Board (AERB) and was organised under the auspices of International Atomic Energy Agency (IAEA). The venue of this annual meeting is rotated among the participating countries. Last year, the meeting was hosted by Romania.

The topics covered in this meeting were performance of the reactors, safety significant events, design issues emerging from operational experience and results of periodic safety review of the plants. Currently there are 42 PHWRs operating in the world of which Canada has 20. India has 13 in operation and 5 under construction. ●

Senior officials from countries operating CANDU type Pressurised Heavy Water Reactors (PHWRs) sharing information on regulatory matters and operational experience of PHWRs at Mumai with a view to enhance safety

Authorisations issued by AERB Board

- Authorisation to the Nuclear Fuel Complex, Hyderabad for construction of Zirconium Oxide & Sponge Project at Palayakayal, Tamilnadu.
- Authorisation for trial operation of the DC Accelerator at the Raja Ramanna Centre for Advanced Technology, Indore at 750 keV and 20 mA beam current using SF_6 or N_2 / CO_2 gas mixture. ●

22nd DAE Occupational Health and Safety Professionals Meet

The 22nd DAE Occupational Health and Safety Professional Meet was held at Heavy Water Plant Manuguru during Nov 21 – 23, 2005. It was jointly organized by Heavy Water Plant, Manuguru and Atomic Energy Regulatory Board, Mumbai with the theme of "Process Safety Management". Dr. Anil Kakodkar, Chairman, Atomic Energy Commission and Secretary, Department of Atomic Energy inaugurated the meet. He presented AERB's Green Site Award for the year 2004 to IRE-OSCOM. Chairman AERB presided over the function and addressed the gathering. This was followed by Endowment Lecture on Chemical Process Safety by Shri R.K.Garg, Former Chairman & Managing Director, Indian Rare Earths Ltd.

The technical session covered the topics such as DAE statistics on Injury/

occupational health, fatal accident cases during the past year, innovative measures taken to make unsafe jobs / conditions / acts safe, near miss incidences - case studies, innovative measures adopted for fire safety. Session on occupational health studies were held for medical officers. The meet had a plenary session on "How the effectiveness of imparting Safety Training is improved at various DAE units". In the Valedictory session prizes for various safety competitions conducted among DAE employees were distributed. A discussion based on feed back; on 'Criteria for Modified Industrial Safety, Fire Safety and Green Site Awards' was also held. ●

▲ Shri R.K.Garg, Former Chairman & Managing Director, Indian Rare Earths Ltd. lighting the lamp during the inauguration function of the 22nd DAE Occupational Health and Safety Professionals Meet in 2005 at Manuguru, Andhra Pradesh. The meet was inaugurated by Chairman, Atomic Energy Commission

◀ Eminent dignitaries proceeding for the inaugural function for the 22nd DAE Occupational Health and Safety Professionals Meet, 2005

Commisioning of Two New Multi-purpose Industrial Gamma Radiation Processing Plants (GRPPs)

Installation of GRPPs for radiation sterilization of medical & healthcare items and for food preservation is on the increase in the country as private entrepreneurs have realized the importance of this technology for societal benefit. Last year one such plant was commissioned by M/s Organic Green Foods Ltd. at Kolkata. This year private entrepreneurs commissioned two such facilities. M/s Universal Medical Ltd. set up a multipurpose gamma radiation processing plant at Vadodora, Gujarat and M/s A.V. Processors Ltd., Mumbai set up a plant at Ambernath, Thane, Maharashtra. Both these facilities are designed for maximum 37 PBq activity of Co-60 source. The processing rate for medical products in these facilities is of the order of 400-500 kg/h while processing rate for food products such as spices is of the order of 1000 -2000 kg/h. Atomic Energy Regulatory Board has carried out detailed safety review of these facilities before according consent for their commissioning. These facilities will be under regulatory coverage of AERB for ensuring radiological safety in their operations. ●

Leakage test of Tarapur Atomic Power Project 3 (TAPP-3), Reactor Building

AERB representatives witnessed the Integrated Leakage Rate Test and Proof Test for Reactor Building Containment of TAPP # 3. These tests have been completed satisfactorily. Application for starting Hot Conditioning of PHT System and Light Water Commissioning of TAPP # 3 has been submitted by NPCIL and is under review by the AERB Safety Committees. ●

Construction clearance for super structure of Nuclear Island Control Building

Clearance for Construction for super-structure of 8 Nos. Nuclear Island Control Building of First Breeder Reactor Project at Kalpakkam (except for Reactor Vault and Spent Subassembly Storage Bay) on a common raft and certain other safety related buildings was issued on December 15, 2005. ●

Industrial Safety Inspections Carried out in 2005.		
Sl. No.	Units	Number of Inspection
1	Indian Rare Earths Limited, - Chhatrapur, Cochin, Chavara, Manavalakurichi	6
2	Uranium Corporation of India Limited, Jharkhand	2
3	Nuclear Power Plants - Tarapur, Kaiga, Kota, Madras, Kakrapar (Operating)	7
4	Nuclear Power Projects - Tarapur, Kaiga, Kota and Kudankulam (Under construction)	6
5	Nuclear Fuel Complex, Hyderabad	4
6	Heavy Water Plants- Kota, Manuguru, Baroda, Hazira, Thal, Tuticorin, Talcher	5
7	Variable Energy Cyclotron Centre, Kolkata	1
8	Raja Ramanna Centre for Advanced Technology, Indore	2
9	Prototype Fast Breeder Reactor, Kalpakkam	1
10	Rajasthan Aomic Power Project Cobalt Facility, Kota	1
11	Fast Breeder Test Reactor / Kalpakkam Mini Reactor	1
12	Electronics Corporation of India Limited, Hyderabad	1
13	Special Regulatory Inspection*	4
14	Task Force for Fire hazard Analysis of TAPP 3&4 electrical system.	1
	Total	**42**

* Special Regulatory Inspections were carried out at the construction sites of Nuclear Projects at Tarapur 3&4, Kaiga 3&4, Rajasthan 5&6 and Kudankulam with emphasis to look into the following aspects:

- work practices while working at height
- availability of safety personnel as per AERB notification
- provision of minimum safety measures as per AERB notification
- availability of list of identified major jobs and their approved work procedure, job hazard analysis for identified jobs and availability of checklist based on job hazard analysis. ●

INSPECTIONS CARRIED OUT IN 2005 BY THE NUCLEAR PROJECTS SAFETY DIVISION, AERB			
Sl. No.	Projects	Duration of Inspection	
		From	To
1	Tarapur Atomic Power Projects-3&4	10-Jan	14-Jan
2	Kudankulam Atomic Power Projects	02-Feb	05-Feb
3	Kaiga Generating Station -3&4	07-Feb	09-Feb
4	Rajasthan Atomic Power Projects -5&6	14-Mar	17-Mar
5	Tarapur Atomic Power Projects-3&4	12-Apr	16-Apr
6	Kudankulam Atomic Power Projects	31-May	03-Jun
7	Rajasthan Atomic Power Projects -5&6	29-Aug	01-Sep
8	Tarapur Atomic Power Projects-3&4	12-Sep	16-Sep
9	Kaiga Generating Station -3&4	20-Sep	23-Sep
10	Demonstration Fast reactor Fuel Plant, Kalpakkam	25-Oct	26-Oct
11	Fast Breeder Reactor Project, Kalpakkam	27-Oct	28-Oct
12	Kudankulam Atomic Power Projects	21-Nov	24-Nov
	Total number of inspections = 12		

Restart of Unit I of Madras Atomic Power Station

Unit I of Madras Atomic Power Station (MAPS) which is operating since 1984 was shutdown in August 2003 for 'En-masse coolant channel replacement (EMCCR) and some other safety up-gradation activities. The old pressure tubes made of Zircalloy-2 were replaced by pressure tubes made of Zr-2.5% Nb as this material has superior properties such as low hydrogen pick-up, low creep rate, high strength etc. The other major up-gradation activities were retrofitting of high pressure emergency core cooling system, provision of supplementary control room, segregation of control cables & power supply cables of safety related components, installation of uninterrupted power supply in lieu of motor generator sets. All steam generators system and all inlet and outlet feeders (2-5 meters length) of Primary Heat Transport have been replaced because thinning in elbows of some outlet feeders were observed. In 1989, owing to the failure of moderator inlet manifold, the plant was allowed to operate at only 75% of its full power. During this outage, the design flow pattern was restored with the installation of sparger channels in place of manifold and it would now be possible to operate the unit at full power.

All these activities were reviewed and monitored by a committee constituted by AERB. In addition NPCIL/MAPS also carried out ageing management related work on safety related structures, systems and components. Seismic re-evaluation of both units was also done and appropriate modifications were incorporated.

AERB carried out special regulatory inspections to ascertain completion of all safety related activities, satisfactory commissioning of all systems and preparedness of the unit for restart. Thereafter, AERB granted permission for restart of this unit based on the recommendations given by the safety committees involved. ●

Meeting of senior regulators of countries operating Candu-Type Reactors

AERB organized a meeting of the senior officials of Nuclear Regulatory Bodies of Argentina, Canada, China, India, Korea, Pakistan and Romania where Annual Reports, recent developments and feedback of operational experience were discussed. The participating countries also made presentations on Probabilistic Safety

(Contd. on page 6)

SAFETY ASPECTS IN NATURAL URANIUM FUEL FABRICATION

J. Prasad, M. K. Pathak, Industrial Plants Safety Division, AERB

1.0 Introduction

The Department of Atomic Energy established the Nuclear Fuel Complex (NFC), Hyderabad to cater to the requirements of nuclear fuel for Nuclear Power Plants in the country. Presently NFC makes natural uranium fuel, Zr-Nb coolant tubes and Zircaloy cladding tubes for Pressurised Heavy Water Reactors and an array of enriched uranium fuel bundles, Zircaloy fuel cladding tubes and some of the core components for Boiling Water Reactors (BWRs). In addition, the fuel plants at NFC are also processing depleted uranium (DU) and deeply depleted uranium (DDU) for fabrication of fuel for Indian PHWRs.

NFC also produces special materials like Niobium used in coolant tubes of Pressurised Heavy Water Reactors (PHWRs) and various stainless steel components. A new plant for making zirconium oxide powder and reactor grade zirconium sponge is under construction at Palayakayal, in Tuticorin district of Tamilnadu to cater to the enhanced fuel requirements in future owing to the rapid expansion of nuclear electricity generating capacity in India.

2.0 Fuel Fabrication

The raw material for production of Uranium Oxide (UO_2) powder at NFC is Magnesium di-uranate (MDU). MDU received from Uranium Processing Plant, Jaduguda of Uranium Corporation of India Ltd., is dissolved in nitric acid to generate uranyl nitrate. The uranyl nitrate so generated is purified by the solvent extraction process using Tri-butyl phosphate (TBP) & kerosene to obtain pure uranyl nitrate. Pure uranyl nitrate is treated with ammonium hydroxide to precipitate Ammonium di-uranate (ADU). ADU is then dried and calcined to obtain U_3O_8 which is reduced to UO_2 with cracked ammonia and stabilised with limited supply of air to get sinterable UO_2 powder. The UO_2 powder is then precompacted, granulated, final compacted and sintered at high temperature. These sintered pellets are then ground to desired dimensions, washed and dried for loading in zircaloy cladding tubes.

For making zirconium fuel tube, starting material used earlier was zircon sand coming from Indian Rare Earths Limited. Zircon sands were fused with caustic soda flakes, leached and filtered in filter press and dried to produce dry frit. Presently dry powder of Zr compound is directly procured and is dissolved in HNO_3, extracted with TBP & kerosene to remove impurities like Hafnium, precipitated by NH_4OH, calcined, ground and blended to produce reactor grade ZrO_2 powder. The ZrO_2 powder is converted to reactor grade Zr sponge by briquetting, oxide chlorination, reduction by magnesium and vacuum distillation by the Kroll's process.

Different zircaloy products like fuel tubes and structural components are manufactured from zirconium sponge after melting of ingots, piercing & extrusion, cold pilgering and finishing operations. For making PHWR fuel, natural uranium oxide pellets are loaded in Zr-4 fuel tubes and after various welding operations and helium leak detection, the fuel pins are assembled to form fuel bundles.

3.0 Waste Management Issues

The production of nuclear fuel involves many chemical and metallurgical processes. As a result, large quantities of inactive chemical effluents as well as uranium bearing low-level radioactive solid, liquid and gaseous effluents are generated. Uranium is recovered to the maximum possible extent ensuring that its concentration in the effluent is below permissible levels before final disposal of the waste.

3.1 Solid Waste:

Solid low activity Uranium wastes in the form of Uranyl Nitrate Raffinate Cake (UNRC) consisting of magnesium, silica, iron and traces of uranium constitutes the major solid process waste. These are being stored inside the plant premises. At new uranium oxide fuel plant, a treatment facility of UNRC is coming up to recover uranium from this stored solid waste material.

Other solid wastes are the contaminated HDPE bags, hand gloves & cotton maps etc. which are decontaminated in a fully mechanized decontamination unit.'High Efficiency Particulate Air (HEPA) filters' are used for final filtration of plant ventilation exhaust air. These filters recover the Ammonium-di-uranate and U_3O_8 particulates which can be used for the recovery of uranium. Sufficient numbers of used HEPA filters have got accumulated in NFC. AERB has recommended for submission of a plan for disposal of HEPA filters.

3.2 Liquid Effluents:

The active liquid effluents namely, Ammonium Nitrate obtained after ADU precipitation is chemically treated with Ferric chloride and Tri-sodium phosphate to coagulate uranium and then allowed to settle to reduce the uranium content in the liquid below the limit specified. After the uranium content in the liquid ammonium nitrate comes to a safe limit as stipulated by AERB, it is sold to the interested customers.

3.3 Gaseous Emissions:

The gaseous exhaust carrying particulate matter is passed through a series of primary filters, electrostatic precipitators and HEPA filters for the removal of radioactive and other dust particles and then let out through tall stacks so that the radioactive releases are well below the permissible limits.

3.4 Waste disposal during the use of DU and DDU

While using DU and DDU, the radiological hazard of the waste need careful consideration. The wet process for powder production using dissolution in nitric acid was initially tried. This produces more Cs 137 than permissible limit (>1500 Bq/lt) in the generated liquid effluents and also high silica content (> 600ppm), which intensifies the disposal problem. Later, powder production was carried out through dry route of calcination, reduction, stabilization, pre-compaction, granulation and final compaction, sintering and center-less grinding. The dry route has the advantage of minimising generation of liquid effluents in the process. The exhaust gases generated during calcination are passed through a water spray type scrubber. The off gases are then passed through HEPA filters before being let out through the stack. The scrubber water is recycled to minimise generation of liquid effluents. The concentration of impurities/radio nuclides in the scrubber water are analysed periodically. When the concentration exceeds the stipulated limit, the water is treated by polymer treatment process to reduce the radionuclide contents and is discharged to garden water system after appropriate dilution, if required. While carrying out the above operations air activity is measured in all relevant operating areas.

The discharge limits on concentration of impurities/radionuclides in the scrubber water and the limits and dilution requirements for its release to garden water system are established as per stipulation of AERB.

4.0 Industrial and Radiological Safety

The industrial and radiological hazards, which arise in the fuel fabrication process, pose a challenge for handling and disposal of substances. The hazards can be summarized as follows:

4.1 Industrial Safety

Chemicals like TBP, kerosene, nitric acid and ammonium hydroxide are used in natural uranium fuel fabrication. In addition gases such as LPG, ammonia, chlorine are used in various operating processes in NFC. The use of these constitutes potential fire hazard and explosion hazard as well as chemical toxicity. Being pyrophoric in nature, Zirconium handling constitutes another major fire hazard. Apart from the use of hazardous materials there are process hazards like potential red oil explosion as well as explosion hazard in Zirconium plant. Higher noise levels are observed in some of

the areas such as in fabrication plant, blasting area, compressor house. AERB had insisted for reduction of noise level, use of suitable earmuffs and audiometry test for workers exposed to high noise levels as per the Atomic Energy, (Factories), Rules, 1996.

4.2 Radiological Safety

Air Activity

The fuel plants handle two types of uranium, which have different retention time in lungs, if inhaled. The potential for internal exposure to the workers is more because of the use of uranium with higher retention time in lungs. The external exposure is mainly contributed by low level gamma radiation emitted by uranium. The internal radiation exposure can be controlled by maintaining air activity below one Derived Air Concentration(DAC) level inside the plant. Air activity levels above DAC is observed in few areas of NFC such as Ceramic Fuel Fabrication Plant (CFFP) which is of major concern in nuclear fuel fabrication, however, the following measures are taken to reduce the air activity levels

Container concept

UO_2 powder from stabilization furnace is transferred to hopper of roll compaction press in stainless steel containers. Stainless steel container with UO_2 powder is lifted and positioned on the hopper of roll compaction press. This system has replaced powder transfer through vacuum system resulting reduction in air borne activity.

Revamping of ventilation system

Separate primary ventilation system has been provided in Roll press and centerless grinding area of CFFP with arrangements of pre-filter and HEPA filter to reduce air activity levels. Secondary ventilation system provides 10-12 air changes/hour inside the room.

AERB safety committee for NFC has directed that if air activity levels exceed DAC value in two consecutive shifts, corrective actions are to be taken and if it exceeds DAC value in three consecutive shifts, operation is to be stopped and it will be treated as safety related unusual occurrences. Unusual occurrence report is to be submitted to AERB.

4.3 Radiological hazard control during processing of DU and DDU

Processing of DU and DDU need some special care as they contain small quantity of radionuclides such as ^{90}Sr, ^{106}Ru , ^{137}Cs which are beta emitters. The derived air concentration (DAC) values during processing of natural uranium, DU and DDU are specified in the following table.

In order to meet these DAC levels for DU and DDU, guidelines have been specified by AERB on the amount of input radiological substances as follows:

(Micro curie of gamma emitting fission products/gm. of U)/0.2 +
(microgram of Pu / gm. of U)/0.3 ≤ 1

Following precautions have been taken while processing of DU & DDU through dry route.

i) Container concept has been used for handling radioactive material.

ii) Ventilation system is provided in dry area with 10 air changes per hour to control the air borne contamination. Air activity is controlled by providing a secondary ventilation system in addition to the primary system.

iii) Powder transfer room is maintained under negative pressure with respect to atmosphere of around 30 mm WC.

iv) Vacuum charging system is used for transferring DU and DDU from packed containers to calcination bunkers.

v) Sludge generated during grinding is collected and stored in stainless steel drums. These drums are stored in a shed for natural evaporation of water. Thereafter they are sent to BARC for further processing.

5.0 Conclusion

Nuclear Fuel Complex is periodically inspected to check the compliance with the provisions mentioned in statutes namely the Atomic Energy (Radiation Protection) Rules, 2004, the Atomic Energy (Factories) Rules, 1996 and the Atomic Energy (Safe Disposal of Radioactive Wastes) Rules,1987. AERB has been continuously reviewing the industrial and radiological safety status of NFC and has appropriately recommended the plant management to take control measures to reduce air activity levels in various plants. According to recommendation of AERB, Hazard and Operability Study (HAZOP) have been carried out in zirconium oxide plant, old and new zirconium sponge plant and natural uranium oxide fabrication plant (oxide). AERB has pointed out from time to time through regulatory inspections and safety reviews by NFC Safety Committee and Safety Review Committee for Operating Plants (SARCOP) about the safety issues related to controlling of air activity levels in roll compaction area, management of non-process effluent (hand wash, change room wash etc), handling and storage of drums containing uranium bearing wastes, isolation of cooling water for uranium oxide plant and CFFP etc. NFC has already resolved most of the safety issues and appropriate actions are on hand to address the rest of the issues which leads to a safe and environment friendly installation.

Parameter	U_{nat}	DU	DDU
DAC (a) Bq/m^3	1.3 (U_{nat})	1.0 (U_{nat} + Pu)	1.3 (U_{nat} +Pu)
DAC (b) Bq/m^3			
^{90} Sr	N/A	100/280	100/280
^{106}Ru	N/A	240	240
^{137}Cs	N/A	1240	1240

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Meeting of senior.....

Assessment for CANDU type reactors.

Special presentations on Feeder pipe thinning and cracking (Canada, India), Regulatory requirements for secondary side inspections (Korea), Status of main safety issues and design changes for TQNPP (China), Periodic Safety Review updates (India, Korea), Regulatory effectiveness (Romania), Feedback from Convention on Nuclear Safety – Issues specific to PHWRs (Argentina, Canada) were made. ●

French Nuclear Regulatory Delegation Visits Atomic Energy Regulatory Board

A five-member delegation of DGSNR, the French Nuclear and Radiation Regulatory Organisation, visited AERB on October 25, 2005. During the visit technical presentations were made by AERB on the tsunami event of 26th December, 2004 and by DGSNR on the flooding event at Le Blayais Nuclear Power Plant in France. AERB and DGSNR also had discussions on the topics of safety and leak tests of pre-stressed concrete containments and safety in transport of radioactive materials. The presentations were followed by very useful discussions.

AERB and DGSNR renewed the nuclear safety cooperation agreement for another 5 years. It is envisaged that during the coming two years, two discussion meetings would be held wherein exchange of information would take place on regulatory aspects of light water reactors and fast breeder reactors. ●

Workshop on Issues Related To Design, Construction, Operation And Maintenance Of Spent Fuel Storage Pools

Various DAE units have now accumulated significant experience with spent fuel storage pools (SFSPs) pertaining to design, construction as well as operation and maintenance. In order to prove an effective exchange of this experience, a workshop was organized on 25th November 2005 at AERB auditorium with the objective to arrive at recommendations for optimized standard designs of SFSPs as well on desirable improvements in existing pools, wherever feasible. Design consultants, experts from DAE units, contractors involved in engineering of SFSPs and AERB staff participated in the workshop. Eight presentations were made in two technical sessions followed by a panel discussion on the identified issues. Important recommendations of the workshop were as follows:

- Concrete tank-in-tank design with liner and provision for partitioning of the pool if required, may be adopted as a standard design for SFSPs.
- Design loading should be finalized in the beginning.
- A simple design of leak detection system to detect only gross leak from the pool is preferred than the complex local/ zonal leak detection and location systems.
- Advantage of achieving higher grades of concrete in practice and that of the use of higher strength reinforcing steel, now available in the Indian market, may be taken in the design to ease congestion and improve constructibility.
- Bore-hole monitoring facilities around SFSPs should be a standard design feature.
- A/c & ventilation of SFSP buildings should be designed for adequate operator comfort, in addition to the prevention of contamination spread.
- Disposable I-X resin cartridges are preferable compared to re-generable resin beds for maintaining water chemistry as these provide considerable saving of manRem.
- There is a need for improvement/ development of underwater/remote repair techniques and appropriate pool water polishing unit.
- Guidelines on aspects like bore-well monitoring, leak detection, deployment of single failure proof cranes, and security needs to be added in the relevant safety guides. ●

Regulatory Framework of Canada and India on Uranium mining and milling

Uranium Corporation of India Limited & Bhabha Atomic Research Centre organized a meeting on "Radiation and Environmental Safety in Uranium Mining" at Jaduguda during November 28-30, 2005. At this meeting, the Canadian Nuclear Safety Commission (CNSC) and the Atomic Energy Regulatory Board (AERB) discussed various aspects of regulatory practices with emphasis on uranium mining and milling. Areas focused at the meeting were on licensing requirement, licensing procedure, safety evaluation procedure, radiation dose monitoring and dose limits, radioactive waste management, environment protection program etc. It was observed that there were no appreciable differences between Canadian and Indian regulatory requirements for uranium mining and milling. However, as per the directives of the two countries there are some differences, which are brought out below.

- Though both in India and Canada, five years cumulative dose limits for radiation workers is 100 mSv, maximum permissible dose in any given year is 50 mSv in Canada and 30 mSv in India. For pregnant radiation workers, radiation dose limit to the surface of the woman's lower abdomen for the remainder of the pregnancy is 4 mSv in Canada whereas in India, it is 2 mSv.
- Licensed Dosimetry Services are available in Canada for measurement of radiation dose and they are required to be used where there is a reasonable probability that a worker may exceed an effective dose of 5 mSv/year. In India, there are dedicated Health Physics Units of Health and Safety Group of Bhaba Atomic Research Center (BARC) who provide dosimetry services for the radiation workers of uranium mining and milling facilities.
- National Dose Registry is maintained since 1950 by Canadian Government for all radiation exposures including those received by non-CNSC licensees such as doctors and dentists and this information is also available in a website. In India the dose records for radiation workers engaged in the uranium mining and milling activities are maintained by the Health and Safety Group of BARC and are subjected to verification by AERB.
- Private parties are involved in the mining and milling of uranium in Canada. As a part of environment protection programme, before regulatory clearance of uranium mines or mills, CNSC asks for financial guarantee for decommissioning of the nuclear facilities. Till date, in India uranium mining and milling is being carried out by the Uranium Corporation of India Limited, a Government of India Enterprise under the control of the Department of Atomic Energy and as such financial guarantee for decommissioning of the facilities is not a concern to AERB. However, AERB asks and carries out appropriate review for decommissioning of all nuclear facilities. ●

(Reported by Shri R. Bhattacharya, Shri Sekhar Bhattacharya & Shri N. M. Chodankar, IPSD AERB)

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Documents Published.....

to ionizing radiation during all design basis events. Requirements for design, protection of plant personnel and public during operational states and accident conditions, determining radiation dose rates during operational states and potential doses during accident conditions, and monitoring of radiation under operational states and under accident conditions are covered in this guide. ●

Radiation Protection for Nuclear Facilities (AERB/NF/SM/O-2 (Rev. 4))

This manual is an updated version incorporating the current ICRP recommendations and international developments in the field of radiation protection and AERB safety directives, and provides necessary information intended to assist the facilities to fulfill the requirements stipulated in code of practice on safety in nuclear power plant operation. It addresses the technical and organizational aspects of occupational exposure control in situations of both normal and potential exposure. The intention is to provide an integrated approach to the control of normal and potential exposure due to external and internal irradiation from sources of radiation. ●

Guidelines on Pre-Employment Medical Examination and Fitness for Special Assignments (AERB/SG/IS-4)

The guidelines lay down the requirement for the medical examination of the personnel to be recruited in various units of Department of Atomic Energy. These examinations help to determine the fitness of the individual for the particular job that the person would be assigned and to get baseline data on some physiological aspects, which would assist in determining the development in relation to occupation if any. It also describes the fitness criteria for some special assignments such as working as height, etc. ●

AERB Day Programme

The 'AERB Day' Programme was celebrated on November 19, 2005 in the multipurpose hall of Training School Hostel, BARC Anushaktinagar. Around two hundred AERB staff and their family members attended the function. Secretary, AERB Staff Club briefed them about the various activities conducted in the year 2004 and President, AERB Staff Club, delivered the welcome address. This was followed by prize distribution to the winners of cultural and sports tournaments conducted by Staff Club in the year 2004. Cultural programme in the form of dances, songs, instrumental music was presented by the staff and their family members. ●

Name and date for Joining/ Retirement

Name	Designation/division		Retired/Joined	Date
Shri Arun Kumar	SO/F	RSD	Retired	October 31, 2005
Shri J. Arunan	SO/F	OPSD	Joined	November 7, 2005

CORRIGENDUM

The following corrections may please be noted for Table 2 at page 8 of AERB Newsletter Vol. 18 No. 2-3,

- individual effective dose (mSv) for Narwapahar mine should be read as 6.71 (instead of 5.3) for the year 2002 and 5.93 (instead of 7.41) for the year 2004 and 6.85 instead of 16.85 for the year 2003
- individual effective doses (mSv) for Bhatin mine should be 5.31 (instead of 6.71) for the year 2002 and 7.41 (instead of 5.93) for the year 2004.

Shri A. NAGARATNAM passes away

Shri A Nagaratnam, former Chairman of the Safety Review Committee for Application of Radiation (SARCAR) of AERB, passed away on November 28, 2005. He had served DRDO in various capacities during 1952-97 and was also associated with the Institute of Nuclear Medicine & Allied Sciences (INMAS), Delhi, since its inception. At INMAS, he nurtured a strong school of scientists in the field of radiological protection.

Thereafter as Director, Defence Laboratory, Jodhpur, he established advanced facilities for radioisotope applications in defence. It is a tribute to his professional standing that even after retirement, he continued to serve DRDO in various assignments for ten years as Emeritus Scientist and Consultant to DRDO. His areas of interest were medical and industrial applications of radiation, radiological protection and scientific problems of desert warfare.

Shri Nagaratnam contributed significantly to the Government of India publication "Nuclear explosions and their effects". He was the author of a monograph on radiological protection and has published over 150 research papers. He was an elected Fellow of the Institute of Physics, UK and a Fellow of the Indian College of Nuclear Medicine. He received many awards and honors during his long professional career including the Life Time Achievement award of INMAS and Dr. K.G. Vohra memorial award of IARP.

Shri Nagaratnam made tremendous contributions to AERB's activities related to the application of radiation in medicine, industry and research. His tenure as Chairman SARCAR was marked by his deep commitment to safety, his passion for information collection and analysis and his outstanding skill in writing technical reports. As Chairman of the Standing Committee for Review and Revision of Radiation Safety Documents, he was responsible for bringing out several important safety codes and guides. Even after the completion of his tenure in these committees, he took keen interest in the Board's activities through correspondence with the staff members on various issues concerning radiological safety. In his demise AERB has truly lost one of its eminent guides. ●

Documents published by AERB during 2005

1. Site Considerations of Nuclear Power Plants for Off-Site Emergency Preparedness (AERB/NPP/SG/S-8)
2. Safety Systems for Pressurised Heavy Water Reactors (AERB/NPP-PHWR/SG/D-10)
3. Radiation Protection Aspects in Design for Pressurised Heavy Water Reactor Based Nuclear Power Plants (AERB/NPP-PHWR/SG/D-12)
4. Establishing and Implementing Quality Assurance Programme for Nuclear Power Plants (AERB/NPP/SG/QA-6)
5. Guidelines for Pre-employment Medical Examination and fitness for Special Assignments (AERB/SG/IS-4)
6. Safety Guidelines on Accelerators (AERB/SG/IS-5)
7. Radiation Protection for Nuclear Facilities (AERB/NF/SM/O-2) (Rev. 4)

The following existing safety documents were published in Hindi.

1. Code of practice on Quality Assurance for safety in Nuclear Power Plants (AERB/SC/QA)
2. Code of practice for safety in Nuclear Power Plant Operation (AERB/SC/O)
3. Preparation of Site Emergency Preparedness Plans for Nuclear Installations (AERB/SG/EP-1)
4. Preparation of off-site Emergency Preparedness Plans for Non-nuclear Installations (AERB/SG/EP-4)
5. Safety Guide for Preparation of Safety Report of Industrial Plants other than Nuclear Power Plants in the Department of Atomic Energy (AERB/SG/IS-2)
6. Regulatory Consents for Nuclear and Radiation Facilities: Contents and Formats (AERB/SG/G-7)
7. Code of Regulation of Nuclear and Radiation Facilities (AERB/SC/G)
8. Code for Transport of Radioactive Materials (AERB/SC/TR-1)
9. Preparation of Site Emergency Preparedness Plans for Non-Nuclear Installations (AERB/SG/EP-3)
10. Radiological Safety In Design and Manufacture of X-ray Analysis Equipment (AERB/SS-5)
11. Loss of Coolant Accident Analysis for Pressurised Heavy Water Reactor (AERB/SG/D-18)
12. Procedure for Forwarding, Transport, Handling and Storage of Radioactive Consignments (AERB/SG/TR-3)
13. Fuel Design for Pressurised Heavy Water Reactors (AERB/NPP-PHWR/SG/D-6)
14. Regulatory Inspection and Enforcement in Nuclear and Radiation Facilities (AERB/SG/G-4)
15. Preparation of Off-site Emergency Plans for Nuclear Facilities (AERB/SG/EP-2)

Total number of safety documents published by AERB so far is 115 and other 80 safety documents are under different stages of preparation.

Abstract on documents published in the last quarter of 2005

Radiation Protection Aspects in Design for Pressurised Heavy Water Reactor Based Nuclear Power Plants (AERB/NPP-PHWR/SG/D-12)

This guide deals with provisions to be made in the design of pressurized heavy water reactor based nuclear power plants to protect site personnel and the public from undue exposure

(Contd. on page 7)

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