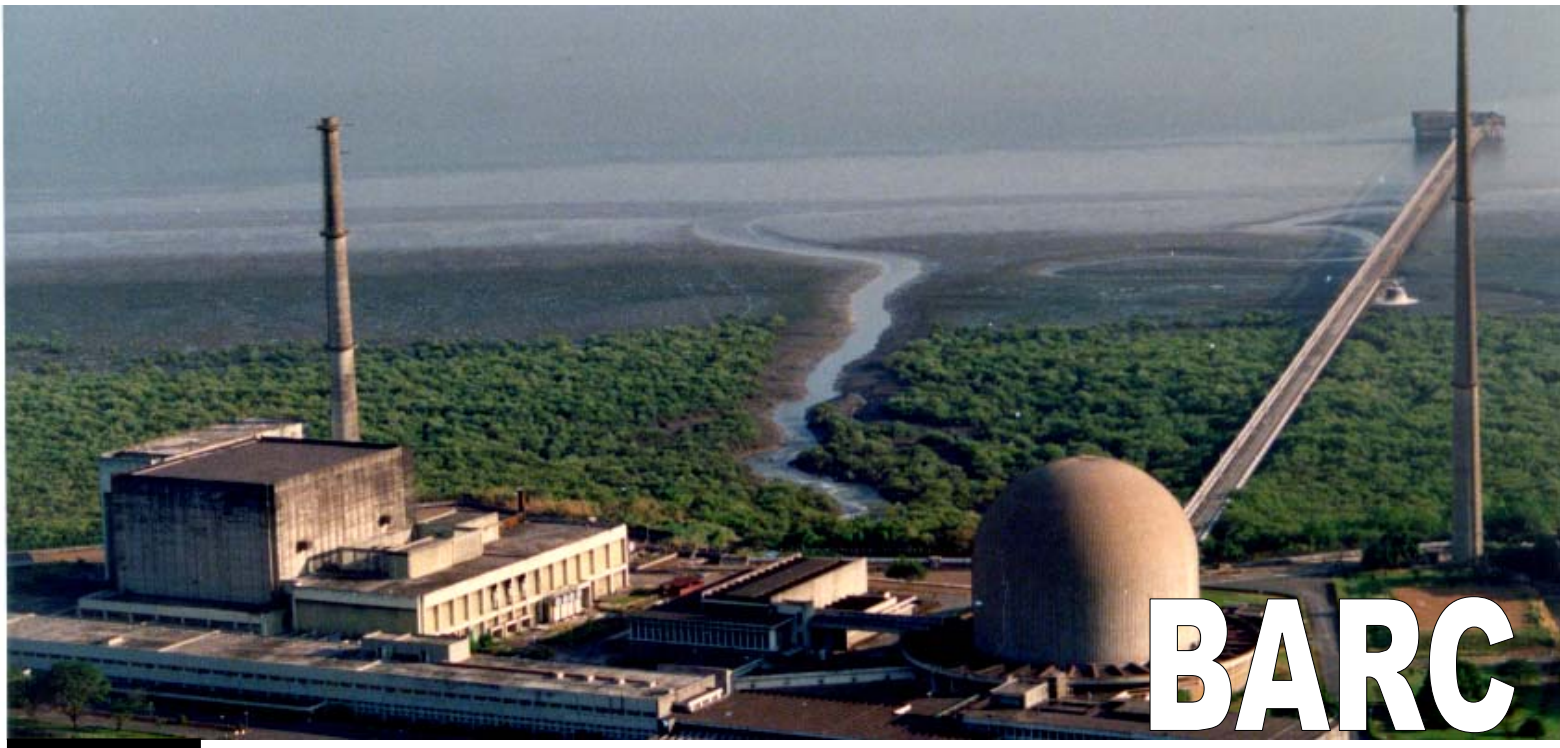
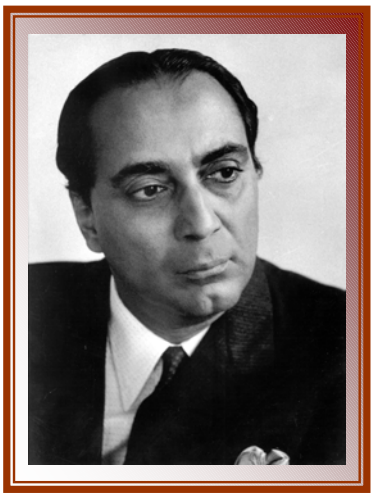


BARC
NEWSLETTER

No. 250
November
2004

BARC OBSERVES FOUNDER'S DAY



BARC Founder's Day was celebrated on October 29, 2004 with exuberance and fond remembrance of its illustrious Founder, Dr Homi Jehangir Bhabha. Dr Anil Kakodkar, Chairman, Atomic Energy Commission & Secretary to Government of India, and Dr Srikumar Banerjee, Director, BARC, addressed the staff members at BARC. Dr Kakodkar distributed the Homi Bhabha Science & Technology Awards, Technical Excellence Awards and Meritorious Service Awards to the recipients of these awards at a well attended function in the Central Complex auditorium. He also gave away the prizes to the winners of the XVI All India Essay Contest in Nuclear Science and Technology. A Founder's Day special issue of *BARC Newsletter* containing award winning papers published during 2003 was also released on this occasion by Director, BARC.

The Founder's Day lecture was delivered by Dr C.R. Bhatia, Former Secretary, Department of Biotechnology, Govt. of India and Ex-Director, Biomedical Group, BARC, as a tribute to Dr Homi Bhabha.

The text of the messages of Dr Anil Kakodkar, Chairman, AEC, and Dr Srikumar Banerjee, Director, BARC, are given in this issue, along with the proceedings of other activities on the special occasion of Founder's Day.

Contents

Address by
Dr Anil Kakodkar
Chairman, Atomic Energy Commission

Dear Colleagues,

It is our cherished tradition that on the occassion of the birth anniversary of Dr Bhabha, we pay homage to our founder father by way of recalling his vision and the steps that we have taken in converting that vision into a reality. In the Golden Jubilee Year of our Department, we have launched the commercial domain of the second stage of the Three Stage Programme envisaged by our Founder. This historic event took place at Kalpakkam last Saturday, in the august presence of our honourable Prime Minister. The event was marked by the start of construction of the first 500 MWe nuclear plant based on the fast breeder reactor. It is worthwhile to restate some portions of what our Prime Minister said during the occasion and I quote,

"Our nation owes a debt of gratitude to the founders of our nuclear programme. Dr. Homi Bhabha, the father of India's atomic energy programme, was a great visionary. He laid the foundations of this national treasure of self-reliant development, nurturing a whole generation of outstanding scientists and engineers."

Further, he said, "The activities of the Department of Atomic Energy range from fundamental scientific research to developmental applications of use to the common man – in the fields of health, industry, food preservation and water desalination projects. It is a matter of deep satisfaction that our scientists have mastered practically all the aspects related to the release of nuclear energy. This has contributed to our nation's security and well being in a fundamental sense. Energy Security is an issue of vital importance, particularly in the context of the accelerating pace of our economic growth. If we succeed in instituting an optimal mix of energy resources in which nuclear energy is an important component, we will be able to ensure our energy security. India's low per capita energy consumption currently cannot for long go hand in hand with our quest for an accelerated pace of economic growth. Energy Security is therefore a national imperative. We must break the constraining limits of power shortages, which retard our development. Nuclear energy is not only cost effective, it is also a cleaner alternative to fossil fuels. We are determined as a nation to utilise its full potential for the national good. It can also be a much needed cushion against fluctuations of prices of petroleum products."

He went on to say, "It is a matter of national pride that India has developed comprehensive capabilities in the entire gamut of fuel cycle operations. India is also among the select group of countries which have the ability to recover plutonium from irradiated nuclear fuel and use it to produce power in thermal as well as in fast reactors. This path will ensure for us a large quantum of nuclear power on a sustainable basis. Ladies and gentlemen, India is uniquely placed to utilise technologies required for launching the third stage of our nuclear power programme based on the utilisation of thorium. The technology roadmap prepared by the Department of Atomic Energy for this purpose will receive our Government's fullest support. Fast breeder reactor technology is of crucial

importance in enhancing our nuclear power capacity. By launching its commercial applications, we are indeed entering a new and more advanced stage of nuclear energy production, a technology mastered only by a very small group of countries. The Department of Atomic Energy has been able to consolidate and strengthen our indigenous capabilities in the face of externally imposed limitations and constraints. These have, however, spurred us to greater levels of achievement. The founding principles of 'Atoms for Peace" were subverted by restrictions derived from an ineffective non-proliferation regime. Despite these limitations, our scientists to their great credit have excelled time and again in demonstrating our indigenous capabilities measuring to the highest standards in the global nuclear industry."

Finally he said, "The nation expects that the Department of Atomic Energy, as one such center of excellence, will continue to be at the cutting edge of scientific pursuit, national dedication and social commitment. The nation is proud of your achievements and is grateful for your contribution. However, we have a long and arduous journey ahead of us and many milestones to cross. It is my sincere hope that the Department will live up to our expectations. In this task, the Department can count on the sustained support of our government and the people of our country."

Dear colleagues, as all of you are aware, we have utilised the Golden Jubilee Year for a comprehensive stocktaking of our achievements and chalking out of a roadmap for the future. The exercise of developing our collective vision involved nearly 1500 young scientists and their mentors. Through this exercise we have now identified our collective vision. The Vision document was released by the Hon'ble Prime Minister and is available in DAE website and I suggest all of you to go through it and accelerate work in your area of expertise. We have also completed a study on the growth of electrical energy in India over the next fifty years and the role nuclear power can be expected to play. This report was also released by Hon'ble Prime Minister and is available on our website. Since all our estimates for an appropriate energy mix for India's sustainable development in the coming decades include nuclear power in a significant proportion, we have to quickly build upon our half a century of accumulated national capabilities. The threatening rise of oil prices this summer has once again made a compelling argument about cost effectiveness of nuclear power. Quite independently, the prevailing low interest rates also favour investments in nuclear power.

In a nutshell, the future course of our programme would aim at the following:

- Shift to a large-scale construction programme on Fast Reactors and their associated Fuel Cycles as early as possible as we will soon reach the full potential of PHWR programme.
- Develop Fuel Cycles with short doubling time.
- Demonstrate technologies for large scale thorium utilisation.
- Develop technologies to support faster growth of thorium systems.
- Develop technologies for co-generation of electricity, hydrogen and water.
- Work on Fusion technologies.

Our vision also encompasses a strong emphasis on nurturing domestic education - research linkages as well as on research - technology linkages covering a broader mandate of scientific research with special emphasis on nuclear energy and radiation.

Time has now come when we start looking at nuclear energy not just as a source of electricity but rather as a primary energy source to provide water as well as hydrogen in addition to electricity and cover a broader spectrum of human necessities.

During the year, all our commercial industrial activities which have evolved out of indigenous R&D have performed profitably with fullest possible capacity utilisation. Collectively they paid a dividend of around Rs.550 crores out of which Rs.520 crores came from Nuclear Power Corporation alone. Kakrapar Unit-II was recognised as one of world's best power reactor by CANDU Owners' Group and the Station Director of Kakrapar was awarded the Nuclear Excellence Award by WANO.

Unit-2 of Madras Atomic Power Station (MAPS-2) restarted in July 2003 after completion of *en masse* coolant channel replacement and system upgradation jobs which included replacement of steam generators and installation of moderator sparger. This resulted in the Unit's power being restored to its rated value 220 MWe.

Both the Units of the Tarapur Atomic Power Station (TAPS-1 and TAPS-2) completed their refueling outages in 20 days and 29 days respectively. NAPS-2 accomplished its annual shutdown in a record time of 19 days.

Construction programme for nuclear power reactors is progressing well ahead of schedules and we expect one of the 540 MWe PHWR Units to be made critical this year.

Mixed carbide fuel in FBTR continues to perform well. Successful completion of reprocessing of this fuel marks yet another important milestone in our march towards second stage of our power programme.

The Heavy Water Board exported 6 MT of heavy water to South Korea and 30 MT of heavy water to China.

In the field of safety, Heavy Water Plant - Tuticorin crossed an all time high record of 11 years of continuous working without any reportable and disabling injury, that is equivalent to 13.5 million man-hours. The trend was maintained and the plant completed 4380 days of safe operation.

Exploratory and evaluation drilling resulted in augmentation of additional resources of uranium at Wahkyn in Meghalaya; Rohil-Ghateshwar in Rajasthan; Gogi in Karnataka and Koppunuru in Andhra Pradesh.

In addition to uranium ore production at Jaduguda, Narwapahar, Bhatin and Turamdih mines (all in Jharkhand), the Uranium Corporation of India Ltd., that is engaged in mining and processing of uranium ore, took up the work to develop mines at Banduhurang (Jharkhand), Bagjata (Jharkhand), Lambapur (Andhra Pradesh) and Domiasiat (Meghalaya).

Programme on Accelerator Driven Systems is picking up as a coordinated national programme. Soon we should see an active involvement of our Universities in addition to DAE Units and other laboratories through BRNS and UGC-DAE Consortium linkages. This development is important for us as a means of supporting growth with thorium systems as well as for minimisation of long lived wastes through transmutation.

In the area of Radiation Technologies and Application, DAE is working in close cooperation with other organisations of the Government of India to widen the reach of these technologies for the benefit of the common man. Remarkable progress was achieved in applications of Radioisotopes and Radiation Technology in the areas of nuclear agriculture, food preservation and industry. A state-of-the-art telecobalt system for use in hospitals has been developed through collaborative efforts of BARC, TMH and an Industry. The system is under evaluation at ACTREC. Similarly, development of medical LINACS is being pursued.

Considerable progress has been made in popularizing radiation processing plants in the country for both medical products as well as agricultural commodities. The first totally private radiation processing plant named "VIKIRAN" has been inaugurated in Kolkata on August 21, 2004. A number of private entrepreneurs have signed

MOU with BRIT for setting up similar facilities and they are in different stages of progress. Construction has started for some of them.

Radiation Processing Plant, Vashi, has shown improved performance and is generating good revenue now.

A number of Blood Irradiator Units have been sold to cancer hospitals in the country and agents are being appointed for increasing our reach into the market. Some spot excess of radioactive cobalt-60 has been exported to Canada.

Our cancer related activities are expanding to scale new heights in terms of research, high quality service, training, societal outreach and international collaborations. The telemedicine linkages with Regional Cancer Centres and several remote areas would soon take cancer related services closer to the doorstep of patients in remote and rural areas.

Three industrial Nd:YAG lasers made at CAT were supplied to other DAE units. Two of these lasers were in use for decanning of irradiated fuel bundles in hot cells in BARC.

Indigenously developed high power continuous wave carbon dioxide (CW CO_2) laser was utilised at CAT for profile cutting of steel sheets for Indus-2 and DC accelerator magnets. A 90W diode pumped solid state laser was developed at CAT for material processing applications. 16W laser power in green was obtained by frequency doubling of a Q-switched Nd:YAG diode pumped laser. Another important development was the design, building and commisioning of a Table Top Terrawatt Nd:glass laser system. This will be used for studying laser-plasma interaction at ultrahigh intensities.

CAT also developed and designed a fibre optic distributed temperature sensor, for use in multipoint temperature monitoring of systems.

A new technique for transport, acceleration and sorting of microscopic objects using laser light was developed.

The construction of a 2.5 GeV, Indus-2 made significant progress, with the work on the development of different subsystems and infrastructure facilities making head way. To supplement Indus-1 and Indus-2 programme, a grazing incidence X-ray reflectometer, set up on a 3kW X-ray generator, was developed.

The Electron Cyclotron Resonance (ECR) facility at VECC has widened the range of heavy ions available for experiments. ECR-2 Ion Source was connected to cyclotron. It was in use for injecting high charge state heavy ion beams. The work on setting up a Superconducting Cyclotron has made good progress with the closing of the cryostat. Developments in Radioactive Ion Beam Facility are progressing well.

SST-1, one of the world's first Superconducting Steady State Tokamaks, with elongated diverter plasmas with 1000 second operation capability, is getting ready at the Institute for Plasma Research, Ahmedabad. We are looking forward to the visit of European Commission team for discussions in connection with India's participation in the ITER programme.

Discovery of a new pulsar using GMRT is an excellent example of closing the Research-Technology-Research cycle indigenously.

We have now major international collaboration arrangements in the area of basic research. As an Observer at CERN, our participation in terms of supply of equipment and systems for LHC as well as its detectors - CMS and ALICE - continues to grow. Development work on GRID is also progressing fast. Indian scientists are also actively involved in STAR experiments at BNL-USA. Discussions are in progress in the context of Linear Collider development as well as with GSI on advanced nuclear physics research.

As a designated member of the Board of Governors of the International Atomic Energy Agency (IAEA) since its inception, India continued taking active part in policy management and programmes of the agency. India continued to offer training facilities, fellowships, scientific visits, etc. to foreign scientists and provide the services of its scientists for expert assignments to other countries both through IAEA and to countries with which we have entered into bilateral agreements for cooperation in the field of peaceful uses of atomic energy.

Nearly 470 scientists from India participated in international symposia, workshops, conferences and meetings. Over 200 scientists from abroad participated in scientific conferences, symposia, meetings, workshops and training programmes in India.

We are looking forward to the visit of Director-General, IAEA, to India in the next month.

Sad demise of Dr Raja Ramanna, a doyen of Indian Atomic Energy Programme is an irreparable loss. He was always available as a Mentor to all of us and was holding our hands at all times. We all witnessed his sharp intellect during the collective vision exercise that we had recently. That was his last visit to Trombay. The real homage that we can pay to him is to carry the work forward and realise our collective vision. For this purpose, as we discussed during the vision exercise, we have to put in place new mechanisms that enable new ideas to be taken forward, nurturing of young talent and reaching out the benefits of our research to the society at large.

Together let us solemnly resolve to excel in all our endeavors and make our founder's vision a long lasting reality.

Address by Dr Srikumar Banerjee Director, BARC

Dr Kakodkar, Chairman, Atomic Energy Commission, Senior Members of DAE Family present here and Dear Colleagues,

It is indeed a matter of great pleasure and proud privilege for me to extend a warm welcome to all of you to celebrate the 95th birth anniversary of Dr Homi J. Bhabha – the legendary founder of this great institution, Bhabha Atomic Research Centre. As a mark of our collective salutation and admiration to Dr Bhabha, every year we gather on this auspicious morning to celebrate his birthday by taking stock of our achievements during the previous year and rededicating ourselves to accelerate our developmental efforts for utilisation of nuclear science and technology for:

(a) improving the quality of life of our people;

(b) staying at the forefront of nuclear science and technology in order to retain the place of honour and dignity for India amongst the world community; and

(c) for enhancing the national security.

For improving the quality of life, our primary mandate is:

to provide energy security by way of generation of nuclear power that is safe, reliable, economical and eco-friendly, and

(i) to utilise radioisotopes and spin-off technologies in non-power sector, namely in nuclear desalination, agriculture, food preservation, isotope hydrology and industry.

I am extremely happy to announce that last year has been yet another successful year in our developmental efforts to exploit nuclear science and technology, as we march forward to achieve our cherished goals. The list of developmental activities carried out and achievements made at our Centre during the last year is too long to narrate and, therefore, I will attempt to give a flavour of them by selecting a few illustrative examples.

BARC continues to provide R&D support to NPCIL. For 500 MWe PHWRs, a test facility which would be used for calibration, pre-commissioning and testing fuelling machine heads has been commissioned. RAM assembly of fuelling machine which has been tested for approximately 150 channel operation is under long term testing.

In the area of control and instrumentation of 500 MWe PHWRs, noteworthy developments have been in coolant channel temperature monitoring system, process control system for primary heat transport and steam generators featuring state-of-art Ethernet based communication on fibre optic lines. Full computerisation of the reactor protection system and installation of programmable digital comparator for process control are also important developments for 500 MWe reactors. Software verification and validation of these systems comply with current AERB guidelines. A reactivity meter based on Kalman filtering technique has been developed and experimentally validated for application in thermal reactors.

The inclined fuel transfer machine for 500 MWe PFBR has been designed. This machine will be used for exchanging fuel between the reactor and the fuel storage area. A similar design has also been adopted for transferring fuel for AHWR.

Several activities have been initiated in connection with the development of AHWR. Subsequent to peer review of the detailed project report by NPCIL, the issues raised by the reviewers have been addressed. Detailed engineering and design validation of AHWR are being carried out. Several experiments currently under progress include tests on advanced accumulator and passive containment coolers and establishing two phase natural circulation related characteristics under high pressure and high temperature. Several advanced safety features of AHWR arise out of passive components and systems. The design of a passive valve which will automatically divert steam to isolation condenser following a reactor trip has been completed. A number of instruments with associated software were developed to measure void fraction in two phase flow. Design of fuel handling and storage system for AHWR has been brought to an advanced stage. Preparations are under way for pre-licensing appraisal by AERB. Under the IAEA sponsored International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO), a case study shows high potential for the AHWR design to meet the IAEA requirements for sustainable development of nuclear energy.

The other innovative reactor being developed at BARC is the High Temperature Reactor, which is being designed to operate at a temperature of about 1000ºC. Development of fuel and structural materials suitable for operating at such high temperatures will be of primary concern for this work. Design of a test set up for a passive power regulation system has been completed. To study the thermal hydraulics and the corrosion compatibility behaviour of lead and lead-bismuth based liquid metal coolant to be used in this reactor, natural circulation driven liquid metal loops of different scales are being

set up. Analytical and experimental work are in progress for the development of liquid metal heat pipes.

CIRUS reactor, which has recently been refurbished, is in operation with an average availability factor of about 80%. A desalination unit of 30 tonne per day capacity, based on low temperature vacuum evaporation process, has been integrated with the CIRUS reactor to demonstrate utilisation of low temperature waste heat for desalination of sea water. APSARA shielding corner cavity has been extensively utilised for studying neutron attenuation through models of various shielding materials. These experiments are providing vital information for optimising the shielding design for 500 MWe PFBR. Experiments for evaluating radiation streaming through various types and sizes of ducts embedded in solid concrete models have also been conducted for AHWR design.

DHRUVA reactor continues to be the major contributor for radioisotope production and has served as a national facility for neutron beam research. A number of research scholars from various academic institutions in the country participated in neutron beam research under the aegis of the Inter-University Consortium for DAE Facilities (IUC-DAEF).

Quality assurance activities related to fuels and reactor core components as well as in-service inspection of PHWR coolant channels, BWR core channels and primary heat transport system piping have been continued.

To achieve high burn ups in PHWR fuel, fission gas release, clad corrosion, hydriding and deterioration in clad mechanical properties are being assessed by post-irradiation examination of fuel bundles from KAPS with a burn up of about 15,000 MWD/T. As a part of life management of pressure tubes, garter spring repositioning, in-service inspection using BARCIS, sliver sampling and analysis for hydrogen content were carried out on a large number of pressure tubes of RAPS-1 reactor, and based on the data generated, RAPS-1 was rehabilitated for power generation. Scrape sliver samples obtained from the pressure tubes of NAPS-1 were analysed for safety assessment.

Prototype experimental mixed oxide fuel cluster of PFBR fuel design has been fabricated and is presently under irradiation in FBTR. This fuel has already seen a burn up of the order of 25,000 MWD per tonne. In order to operate FBTR at high power, a hybrid core of mixed carbide and MOX fuel with the composition, UO_2 – 45% PuO_2 is envisaged. Thermo physical properties of this high plutonium MOX fuel and fuel clad compatibility have been found to be satisfactory for use of this fuel in FBTR.

As a part of our efforts to develop high burn up in PHWRs, MOX fuel bundles containing about 0.4% plutonium have been designed and about 50 bundles were fabricated. Some of these have already been loaded in Kakrapar Atomic Power Station Unit 1. This is the first time MOX fuel bundles have been loaded on such a large scale in any commercially operating PHWR anywhere in the world. Fabrication of natural uranium fuel clusters for AHWR critical facility is in progress and the required number of 65 clusters will be delivered by December this year.

Th-230/Th-232 isotopic ratio was determined for the first time using thermal ionization mass spectrometry in unirradiated and irradiated thoria samples. This ratio is important to calculate the contribution of Th-230 towards U-232 build up.

During the year, one of the major achievements in the technology development area has been the design and development of 1 kW cryo-distillation unit. The plant consists of cold box with components such as a pair of turbo expanders, heat exchangers, gas purifiers and sensors for monitoring of temperature, pressure and vibration. The turbo expander is designed to operate at a speed of around 2,40,000 RPM. Currently, the refrigerator is undergoing initial testing for cool down time, turbine speeds, vibration, etc.

In the area of remote handling and robotics, important achievements include the development of a mobile robot 'SmartNav' for remote surveying and inspection, development of a prototype Micro-arrayer for DNA analysis, and system for remotised rocket fuelling and missile fuelling for INS-TUNIR. The installation of 10 MeV - 10 kW Radio Frequency Electron Linac has been completed at the Electron Beam Centre, Kharghar, Navi Mumbai. The 500 keV accelerator is in continuous use for surface curing applications. High power pulse electron accelerator KALI-5000 has been commissioned at an energy of 650 keV and an electron beam power of 40 GW. High power microwaves having frequency in the range of 3-5 GHz and power 1-2 GW have been generated.

BARC technology for B-10 enrichment based on exchange distillation and ion exchange process was transferred to Heavy Water Board. The plant set up in Talcher has been able to produce over 90% enriched B-10 suitable for detector applications. A bench scale thermal denitration experimental facility has been commissioned. This has a capacity of 10 LPH feed and comprises solid circulation, electrical heating, feed spraying and off-gas treatment systems. The development of this technology will ensure treatment of both product and waste nitrate streams in the nuclear fuel cycle.

A fluorine electrolyser of 6000 amps current rating has been successfully commissioned and integrated with the fluorination plant. Developmental work for improvement of specific energy consumption in the electrolytic cell is continuing.

More than 25 MoUs have been signed with various organisations for technology transfer. Ultra-filtration polysulfone membrane technology has been provided to a total of 12 parties for manufacturing of Domestic water purifier. Some of them have already launched their products in the market. A fluoride detection kit for use by the general public for detection of fluoride contamination in ground water is a notable example of spin off technology.

Setting up of a demonstration unit of Electron Beam Welding facility for industrial use in the MIDC, Mhape, marks a beginning of a new pattern of technology transfer through user interactions.

Acceptance of BARC technology for RF control system for superconducting Linacs of Australian National University, Canberra, is a recognition of our expertise in hi-tech areas.

Four types of analog pulse amplifiers have been successfully designed and fabricated into application specific integrated circuits in collaboration with M/s. Semiconductor Complex Ltd., Chandigarh.

500 pieces of silicon strip detectors have been fabricated and tested for Pre-shower Detector System under CERN-India collaboration.

High quality machinable glass ceramic, magnesium aluminium silicate, and lithium zinc silicate glass ceramic-to-metal seals with Cu, as well as stainless steel withstanding a vacuum of 10^{-6} Torr, have been successfully developed.

An online diagnostic system for detecting blade vibrations in steam turbines of power plants has been developed. The detection method has been tested and validated in the turbines of nuclear and thermal power plants. We have been approached by many organisations for incorporating this system in their plants.

An online fatigue and creep damage monitoring system has been developed and installed at Heavy Water Project, Tuticorin and NTPC plant, Dadri.

A micro-controller based personal dosimeter has been developed as an import substitute to direct reading dosimeter.

Waste management facilities at Trombay, Tarapur and Kalpakkam were operated safely to provide treatment, discharge and disposal of the

waste generated at these sites. At WIP, Trombay, work on replacement of process pots and susceptors has been completed and system is being tested before resuming radioactive operation. The process developed to condition the liquid waste from KARP in cement matrix has been implemented on plant scale. The facilities at CWMF, Kalpakkam, have been augmented for the disposal/storage of pressure tubes and end fittings from the campaign of En-masse Coolant Channel Replacement (ECCR) at MAPS-1. Joule Heated Ceramic Melter of Advanced Vitrification System at SSSF, Tarapur, has been cold commissioned successfully.

M/s. Larsen and Toubro have launched the commercial production of medical instruments developed at BARC for the diagnosis for peripheral vascular diseases and cardiac monitoring.

A cobalt-60 teletherapy machine for cancer treatment has been developed and installed at Advanced Centre for Treatment, Research and Education in Cancer (ACTREC), Kharghar, Navi Mumbai. The cost of this machine is half that of the equivalent imported machine.

Quality assurance tests have been conducted on I-125 seed sources produced by BARC and these sources are undergoing clinical trials for the treatment of ocular cancer in Sankara Netralaya, Chennai.

A modified surgical gamma probe for sentinel node detection based on CsI detector has been developed as import substitute with improved specifications and data storage capability. Two units have been fabricated and one of them has been given to Rajiv Gandhi Cancer Hospital, New Delhi, for technical evaluation.

A digital medical imaging system developed indigenously has been installed in BARC hospital. A dose reduction by more than an order of magnitude with picture quality comparable with the best-imported systems can be achieved in this system.

A Nisargruna bio-gas plant of 1 tonne per day capacity has been installed at INS, Kunjali, Colaba, for the Indian Navy. The designs are ready for 25 tonnes per day and 5 tonnes per day plants proposed to be installed by Thane Municipal Corporation.

Under tripartite agreement MoU among M/s Jupiter Agro Inputs, Krishi Vigyan Kendra, ICAR, Vadodara and BARC, over 70,000 kg radiation hygienized sludge was provided as a manure for testing in large-scale field trials in various agriculture farms around Vadodara. These trials have shown that irradiated sludge, besides being an excellent fertilizer, is also a good soil conditioner.

As a result of our petition, the Ministry of Agriculture, Government of India, has amended Plant Quarantine (regulation of import into India) Rules in February 2004 to include irradiation as a quarantine measure. This will facilitate use of radiation processing in overcoming quarantine barriers for export and import of fruits, vegetables and other plant materials.

KRUSHAK (Krushi Utpadan Sanrakshan Kendra) irradiator at Lasalgaon is being successfully operated and maintained, and during 2003-2004, 317 tons of onion and other agricultural commodities were processed at KRUSHAK. BARC has signed an MoU with Hindustan Agro Cooperative Society Limited, Rahuri, for using this plant as a business incubator.

The crop improvement programme of Nuclear Agriculture and Biotechnology Division continued to make excellent progress. Two new varieties of Trombay Groundnut viz., TG-37A and TPG-41, were recommended for release by the Ministry of Agriculture for commercial cultivation. The former has been recommended for Rajasthan, Punjab, Haryana and UP during Kharif season and the latter has been recommended for all India cultivation in Rabi/ Summer season. A new mungbean variety TM-99-37 was also identified or release. It is high yielding, matures early and

is tolerant to yellow mosaic virus disease. State Seed Committee of Maharashtra has released soyabean variety TAMS-38 for commercial cultivation in Vidarbha region.

A fast and sensitive method has been developed for DNA based detection of blast fungus in rice seeds. A DNA marker for stem rust resistance in wheat has been developed which will help selection of plants in wheat improvement programme.

A strain of TBP biodegrading bacterium has been isolated. A highly radio resistant bacterium has been genetically engineered for bio precipitation of uranium from radioactive wastes.

Bacterial non-specific acid phosphatase proteins and their mutants were obtained by recombinant DNA technology. Their detailed three-dimensional structures were illustrated using single crystal X-ray diffraction methods.

MAT-LAB facility for ultra high purification for gallium and arsenic has been commissioned. The capabilities for producing 6N and 7N purity materials for miscellaneous electronic and semiconductor applications has been demonstrated. The facility for studying single oxygen initiated chemical reactions has been established. It will be useful for various biological and pharmaceutical applications.

Important developments in material processing include demonstration of the possibility of direct electrolytic decomposition of solid oxides of reactive and refractory metals in a new type of electrolytic cell and preparation of amorphous carbon, carbon composites and pyrocarbon coatings which are required for high temperature reactors. Production of ultra pure zirconium crystal bar directly from zirconium bearing mill scrap has been standardised and this technique is expected to find extensive applications in production of low oxygen zirconium alloys. Development of all material components of the solid oxide fuel cells, namely, cathode, electrolyte and interconnect materials have been pursued with significant success. The challenge of producing monolithic blocks of silicon carbide, boron carbide and certain refractory metal borides have also been successfully met. Several new organic solvents have been synthesised for both the front and the back end of the nuclear fuel cycle. Amongst the few that have been recently developed are CMPO and DNPPA, TOPO and TAPO for the front-end, and TEHDGA for the back-end applications. In the quest of new cladding alloys suitable for high temperature, high burn up and partial boiling conditions, a series of Zr-Nb-Sn-Fe based binary, ternary and quarternary alloys have been made and these alloys are subjected to different annealing and thermo mechanical treatments. Characterisation of microstructure, texture, mechanical properties and corrosion behaviour of some of these alloys has been completed. Zirconium based multi component bulk metallic glass has been successfully synthesised and characterised.

Alloy 625 which is used in heavy water plants for ammonia cracker tubes, super heater tubes, etc., are required to meet the design life of 100,000 hours. In-service degradation of this material has been studied in detail to identify the temperature regime for safe operation.

In order to meet the design life of 100 years for AHWR, development of stainless steel resistant to sensitisation and inter- granular corrosion is essential. A thermo mechanical processing which results in increase in the fraction of random grain boundaries has been developed for making austenitic stainless steels resistant to sensitisation and inter-granular attack.

As you are aware, the 128 processor ANUPAM ARUNA Parallel Supercomputer was commissioned in 2003. Using this Supercomputer, ab-initio molecular dynamic studies have been carried out for the first time in India on a large complex system, namely, Buckminster Fullerene doped with heteroatoms.

R&D activities in physical sciences reached a new height during the year. The indigenously built FOTIA facility was operated at 4.75 MV using SF_6 gas which is nearly 80% of the design value of terminal voltage. In the area of basic nuclear physics, fusion cross section measurement work was carried out using stable He-4 from pelletron and unstable He-6 and He-8 beams from Grand Accelerateur National D'ions Lourds (GANIL) facilities. A Stimulated Brillouin Scattering (SBS) - Compressed Nd:YAG Oscillator producing a high power laser chain giving 150 mJ energy in 300-800 ps duration at 1.064 micron has been installed in laser shock laboratory.

Today, PHWR technology is established on a firm footing and the primary responsibility of expanding the nuclear power programme is resting with NPCIL. BARC is committed to provide the R&D support to NPCIL in their endeavour for the growth of contribution of nuclear energy towards the overall power production in the country. As you are all aware, the Hon'ble Prime Minister, Dr.Manmohan Singh, formally launched the second phase of our 3-stage nuclear power programme during his visit to Kalpakkam on 23rd October, 2004. BARC has specific contributions to make towards the success of the Prototype Fast Breeder Reactor being constructed at Kalpakkam. Our responsibilities include supply of mixed oxide fuel, boron carbide control rod material, fuel handling system and the detector system with the associated electronics. These items are of vital importance which are to be supplied within the stipulated time-frame to make the project successful. BARC is also joining hands with IGCAR for developing spent fuel reprocessing and waste management for closing the fast reactor fuel cycle. This activity is also essential for making the fast reactor programme sustainable in the long run. With the induction of AHWR, we will be gaining experience in technologies associated with thorium which are so vital for our third-stage of nuclear power programme. The challenges in these technology developments are enormous and through the participation of our younger colleagues, we will certainly meet these challenges in due course. With the development of High Temperature Reactor, we would like to demonstrate nuclear energy as a primary heat source which can be deployed not only for power production but also for production of hydrogen at low cost. Hydrogen energy has a significant role to play in the future. With hydrocarbon fossil fuel becoming costlier every day and eventually becoming extinct in the foreseeable future, hydrogen is certainly becoming an important carrier of energy, particularly in transport sector. The economy based on hydrogen energy will be successful only if hydrogen can be generated at low cost. The programme on water splitting offers a great challenge to basic scientists and realisation of a project for hydrogen production at low cost is a demanding task for the engineers. BARC has the right combination of scientists and engineers who can shoulder such a responsibility.

In conclusion, I would like to emphasise that we have plenty of challenges for the future. With the synergistic effort of all of us in BARC – the scientists, engineers, technicians and administrators, I am sure we will be able to rise to the occasion to meet the future challenges in a manner consistent with the tradition of BARC.

Dear colleagues, finally, let us rededicate ourselves on this auspicious day for sustaining our developmental efforts for taking India to a position of super power through building a vibrant economy based on utilisation of nuclear science and technology for long term energy security, food security and health care as a mark of our collective homage to our founder, Dr Homi J. Bhabha.

Jai Hind.

CHAIRMAN, AEC, PRESENTS DAE AWARDS TO STAFF

The Department of Atomic Energy instituted an Award Scheme in 1993 for its personnel, which recognises exceptional contributions and meritorious achievements in Science & Technology. This indeed is a part of the tradition in DAE, that is, to nurture excellence and foster creativity at all levels in its staff engaged in Research, Development and Engineering in the frontiers of Science and Technology.

The Award Scheme has three segments:

1. Homi Bhabha Science & Technology Award
2. Technical Excellence Award
3. Meritorious Service Award

Homi Bhabha Science & Technology Award

This is the most prestigious among the three awards. It consists of a citation, a medal and a cash award of Rs. 50,000/-. This award is given to a maximum of two Engineers or Scientists who have made outstanding contributions towards advancement of science and technology based on original research in the frontier areas of science and frontline development in engineering and technology, which would reflect excellence commensurate with national and international standards.

The awards for the year 2004 went to: :

1. Dr Akhilanand Pati Tiwari,
   Reactor Control Division, BARC; and
2. Dr (Ms) K. Indira Priyadarsini,
   Radiation Chemistry & Chemical Dynamics Division, BARC.

Dr Akhilanand Pati Tiwari was conferred the Homi Bhabha Science & Technology Award for the year 2004 for his outstanding contributions in the fields of modeling, control and simulation of nuclear reactors and associated Control and Instrumentation systems.

Dr Akhilanand Pati TiwarI receiving the Homi Bhabha Science & Technology Award 2004 from Dr Anil Kakodkar, Chairman, Atomic Energy Commission

One of the significant contributions of Dr Tiwari is design, development and installation of a test set-up of the Liquid Zone Control System (LZCS) of 540 MWe Pressurized Heavy Water Reactor right from the initial stage of conceptualization. This facility was set up for the first time in India to study the behaviour of the liquid zone control system which forms the main reactivity control system for power control. The derived information was made available to Nuclear Power Corporation of India Limited (NPCIL) for the incorporation of algorithms in the regulating system. This facility has also helped to arrive at the operator interfaces required in the control room for the reactor power regulations in Tarapur Atomic Power Station 3 & 4.

Dr Tiwari has carried out the design of spatial controller for suppressing Xenon-induced oscillations in large reactors. He has successfully applied modern approaches of state feedback, periodic output feedback, singular perturbations and stochastic observers to control of large reactors. An important aspect of his work is the extension of the prompt jump approximation to space-time kinetics problems. He has also applied the Kalman Filtering Technique to various control and instrumentation problems, e.g., improvement of response characteristics of vanadium Self Powered Neutron Detector (SPND), improvement of level measurement accuracy in LZCS and development of Reactivity Meter. He has validated the technique from data

collected with APSARA Reactor and LZCS test set up.

Dr (Ms) K. Indira Priyadarsini was conferred the Homi Bhabha Science and Technology Award for the year 2004 for her outstanding contributions in the fields of Radiation and Photo Chemistry of antioxidants, radioprotectors,

Dr (Ms) K. Indira Priyadarsini receiving the Homi Bhabha Science & Technology Award 2004 from Dr Anil Kakodkar, Chairman, Atomic Energy Commission

anticancer drugs and laser dyes.

Dr Priyadarsini's major work has been in the area of understanding the molecular mechanisms involved in the free radical reactions of antioxidants and radioprotectors. She evaluated the chemical kinetics and physico-chemical properties of antioxidant molecules in homogeneous aqueous solutions, membrane and protein models and in vitro cellular systems with the help of nanosecond pulse radiolysis, millisecond stopped-flow spectrometer and time-resolved fluorescence techniques. An excellent correlation was achieved between these results and in vivo biological experiments. Estimation of free radical lifetimes, spectroscopic assignments and energetics for free radical reactions provided a tool for understanding the site specificity of free radical attack on antioxidants. Such studies have thus opened a new strategy in the development of synthetic antioxidant substances with improved efficacy. Curcumin from turmeric is one such extensively studied natural antioxidant, which led to development of new synthetic (metal complexes and selenium derivatives) antioxidant enzyme mimics. These studies are now being extended to herbal formulations and phytochemicals.

Technical Excellence Award

This Award, is conferred on a maximum of two Engineers or Scientists who have made outstanding contributions and special efforts towards:

(a) Development of a new or improved equipment or machine, material or process for a device with proven results, meeting the immediate or futuristic user needs and bringing credit to the respective Unit or leading to import substitution, technology transfer, etc.

(b) Practical constructive ideas and suggestions leading to better utilisation of human resources, materials, processes, devices, etc., resulting in higher efficiency and significant financial saving to the Government; or

(c) Handling of emergency or crisis situations exhibiting rare alertness and skill thereby averting accident/serious plant situation; or

(d) Highly efficient planning and execution of important assignment in multidisciplinary and multiorganisational time-bound projects of vital interest to the nation, and excellence in troubleshooting or overcoming hurdles or expeditious implementation of ongoing projects.

The Award consists of a citation, a medal and an amount of Rs. 20,000/-

The awards for the year 2004 went to:

1. Mr Aswathnarayan Rama Rao, Reactor Engineering Division, BARC; and
2. Dr Lalit Varshney, Radiation Technology Development Section, BARC.

Mr Aswathnarayan Rama Rao was conferred the Technical Excellence Award for the year 2004 for his exemplary contributions in the area of vibration diagnostic systems for rotating machines, structures and dynamics components.

Mr Aswathnarayan Rama Rao receiving the Technical Excellence Award 2004 from Dr Anil Kakodkar, Chairman, Atomic Energy Commission

Mr Rama Rao, during his distinguished professional career, has contributed significantly in the field of vibration diagnostic systems. He has developed an innovative non-intrusive technique for in-situ detection of vibration of turbine blades. The technique has been successfully tested on the turbines of Madras Atomic Power Station (MAPS) and Kakrapar Atomic Power Station (KAPS). The results have been independently verified by analytical model studies conducted by Indian Institute of Technology (IIT), Delhi and Bharat Heavy Electricals Limited (BHEL).

Another major contribution of Mr Rama Rao is the development of a non-intrusive technique to detect channels with premature contact between pressure tube and calandria tube for Pressurized Heavy Water Reactor (PHWR) coolant channel life management program. The technique has helped in reducing the reactor down time without compromising on the safety of the reactor.

Considering the expertise of Mr Rama Rao in the area of vibration diagnostic systems, German Safety Institute invited him as a vibration expert for developing diagnostic for detecting defective wheels and suspension in fast German trains running at 270 kmph. Based on his work, on-board health monitoring systems have been installed in the coaches of the fast trains by German Railways. The Konkan Railway Corporation has also installed the stationary system for monitoring the health of the coach based on the vibration diagnostic system developed by Mr Rama Rao.

Mr Rama Rao has also developed an Acoustic Topography technique for detecting structural defects in planar structures. He diagnosed a serious vibration problem in the shaft of Folded Tandem Ion Accelerator (FOTIA) facility. He has put significant efforts in design qualification of newly installed sparger tube at MAPS. He has guided activities to qualify the pipe inspection gauge designed by Control Instrumentation Division for Indian Oil Corporation (IOC).

Dr Lalit Varshney was conferred this Award for his significant contributions in the areas of developing application of radiation technology and studying radiation effects on polymers and pharmaceuticals.

Dr Lalit Varshney receiving the Technical Excellence Award 2004 from Dr Anil Kakodkar, Chairman, Atomic Energy Commission

One of the outstanding contributions of Dr. Lalit Varshney has been the development of a technology for radiation processed hydrogel for use in burn and injury dressing. With the application of radiation technology, a single step process to produce poly vinyl alcohol (PVA) based hydrogel burn and injury dressings has been developed. This hydrogel is free from any synthetic additives that are typically added during the cross linking reaction. The extensive clinical trials of radiation processed hydrogels for use as burn dressings were carried out in collaboration with leading hospitals in Mumbai.

The trials have established that these hydrogels are very effective in treating burns and wounds as well as non-healing ulcers including leprosy ulcers.

Dr Lalit Varshney has studied the use of radiation-processed hydrogel / water system to achieve monsooned characteristics in coffee beans and has optimised conditions under which the monsooning could be achieved under laboratory conditions. The processed beans have been analysed by professional tasters confirming the monsooning process. Dr Lalit Varshney has been studying the radiation effects on anticancer drugs.

Meritorious Service Award

This award is conferred on a maximum of six employees with a minimum continuous service of 20 years or more, who have exhibited consistent improvement in skill, technology ability, including outstanding performance in the maintenance of equipment and facilities, resulting in reduction in idle time and increase in the effective utilisation. Emphasis is also on consistently high performance and achieving perfection in work.

The award consists of a citation, a medal and a sum of Rs. 10,000/-

The awards for the year 2004 went to:

1. Mr Sunil Damodar Mhatre, Personnel Division, BARC;
2. Mr Govinda Swamy Ramdass, Research Reactor Maintenance Division, BARC;
3. Mr Sorab Kaikhusroo Kumana, Advanced Fuel Fabrication Facility, BARC; and
4. Mr Dharma Maruti Kale, Nuclear Agriculture & Bio Technology Division, BARC.

Mr Sunil Damodar Mhatre was conferred this Award for the year 2004 for his highly commendable contributions to the effective and efficient handling of ministerial work in the administration.

By working in a systematic manner and showing a rare initiative and commitment, Mr Mhatre has

Mr Sunil Damodar Mhatre receiving the Meritorious Service Award 2004 from Dr Anil Kakodkar, Chairman, Atomic Energy Commission

brought exceptional professionalism to his job. In particular, he has been instrumental in significantly improving the employees' satisfaction in the sphere of speedy processing of advances like House Building Advance and Motor Conveyance. His contributions have been extremely useful in other spheres of administrative activity like Estate Management for BARC properties such as acquisition of premises/land assessment and payment of taxes and maintaining extremely useful liaison with municipal offices like MCGB, NMMC, CIDCO, MSEB and Collector's Office.

Worthy contribution from Mr Mhatre has been settlement of arrears of service charges in respect of BARC flats in Vashi with CIDCO. In the process, he displayed a systematic and analytical approach to problem solving. It is to his credit that BARC has been able to save significant amount of money on this account. Another commendable work to which Mr Mhatre has contributed significantly is setting up of Day Care Centre, KILBIL (a modern scientific creche facility) at Anushaktinagar. Mr Mhatre has thus registered a worthy service record which has indeed been very rewarding and satisfying. He has been very successful in setting high standard of work leading to significant improvement of productivity in the administration.

Mr Govinda Swamy Ramdass was conferred this Award for the year 2004 for his outstanding

contribution in the specific areas of mechanical maintenance specially in high radiation zone of research reactors CIRUS and DHRUVA.

Mr Govinda Swamy Ramdass receiving the Meritorious Service Award 2004 from Dr Anil Kakodkar, Chairman, Atomic Energy Commission

During the last 25 years, Mr Ramdass has been a very committed worker and carried out assignments with full dedication and devotion. He has immensely contributed during construction of DHRUVA and for maintenance and refurbishment of CIRUS. The refurbishment of CIRUS was a challenge due to a host of reasons such as non-accessibility of incore components, non-availability of many replacement components, etc. Innovative efforts were required at working level to foster the ideas of gadget making and site execution. Mr Ramdass's contribution in the replacement of vibration isolators of the concrete floating foundation slabs of primary coolant pumps and repair of primary coolant heat exchangers are unique examples of a large quantity output of work with a fine quality.

The jobs like replacement of radiation shielding windows by new assembly and replacement of moderator flange joint gasket in the intricate location in CIRUS have been carried out for the first time. These jobs require extreme care and meticulous site supervision. On successful completion of above jobs, Mr Ramdass has demonstrated a high order of technical and supervisory qualities.

Mr Sorab Kaikhusroo Kumana was conferred this Award for the year 2004 for his outstanding contribution in the specific areas of installation of Plutonium handling glove boxes and in-situ maintenance of Plutonium active equipment.

Mr Sorab Kaikhusroo Kumana receiving the Meritorious Service Award 2004 from Dr Anil Kakodkar, Chairman, Atomic Energy Commission

Mr Kumana has been involved in installation and commissioning of glove boxes for Mixed Oxide (MOX) fuel fabrication plant, which is a very highly specialised job. The maintenance of machinery and equipment inside the glove boxes required meticulous planning and technical skills to meet safety and performance requirement. Mr Kumana has been involved with these systems and contributed significantly for installation, commissioning and maintenance of special machines inside the glove boxes for MOX fuel fabrication. Mr Kumana started his career as a Casual Labourer and has now risen to the position of Foreman 'A' due to his hard work, dedication towards the job, co-operation among the team members and leadership quality.

Mr Dharma Maruti Kale was conferred this Award for the year 2004 for his outstanding contribution in development and deployment of Trombay groundnut varieties through radiation induced mutagenesis and recombination breeding.

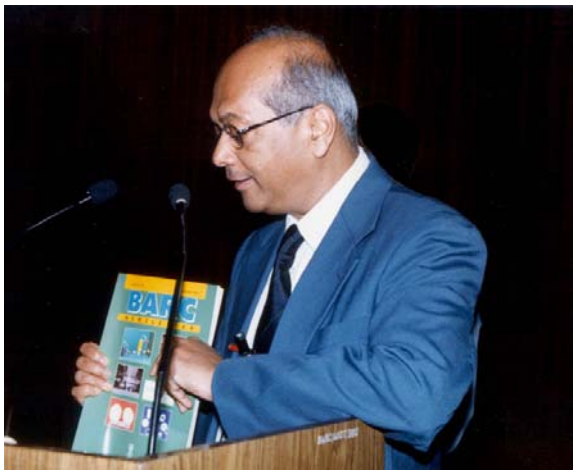
Groundnut improvement programme gathered momentum because of Mr Kale's continuous

and persistent efforts. Success of groundnut programme is spectacular.

Mr Dharma Maruti Kale receiving the Meritorious Service Award 2004 from Dr Anil Kakodkar, Chairman, Atomic Energy Commission

Mr Kale has made excellent contributions by the way of developing 12 groundnut varieties. They are not only high yielding but some of them possessed tolerance to diseases, fresh seed dormancy, high oil content, early maturity, high harvest index, high partitioning efficiency, large seed size and wider adaptability. Varieties like TAG 24 and TG 26 are popular among the farming community across the country. Mr Kale has developed many genetic stocks, which can be used by the groundnut breeders for improving the different yield related traits. He is considered as an expert practical researcher in selection of suitable groundnut genotype for desired traits. Right from the beginning of his career in BARC, Mr Kale is involved in the radiation–induced mutagenesis and recombination breeding. He developed a simple hybridization technique in groundnut, which has increased success rate and breeding efficiency considerably. Mr Kale has greatly contributed towards isolation, maintenance and inheritance of several induced mutants.

After presenting the DAE awards, Dr Srikumar Banerjee Director, BARC released the special issue of *BARC Newsletter* which was brought out as a homage to Dr Homi Bhabha and which contains research papers that won various awards in the year 2003.



Dr Srikumar Banerjee Director, BARC, releasing the special issue of BARC Newsletter *on the occasion of Founder's Day*

XVIth ALL INDIA ESSAY CONTEST IN NUCLEAR SCIENCE & TECHNOLOGY

The All India Essay Contest in Nuclear Science & Technology for students studying for graduation in any discipline was started by the Department of Atomic Energy in 1989 and has since been an annual feature. This year's contest is the 16th in the series.

The two topics for this year's essays were:

(A) Long term energy security and sustainable development in India: Role of nuclear power

(B) Emerging areas of application of radio isotopes and radiation technology: Current trends in the Indian context

The written essays were evaluated by 8 to 9 groups of evaluators from BARC, NPCIL & BRIT. After evaluation in groups, short-list of top essays were drawn up. The short-listed essays from all the groups were then subjected to further assessment through inter-group evaluation and normalisation process. A merit list of contestants was then prepared for inviting authors of better essays to BARC for giving oral presentation on their essays.

In oral presentation, a panel of judges evaluated the performance of individual authors based on the presentation and the question-answer session that followed. Prize-winners were decided on the basis of total marks obtained in the written version and in the oral presentation together.

Dr Anil Kakodkar, Chairman, AEC; and Dr Srikumar Banerjee, Diector, BARC; with winners of the XVIth All India Essay Contest in Nuclear Science & Technology

610 essays were received this year; while 353 essays were on the first topic, 257 were on the second topic. About half of the participants were girls. Out of the total, 105 essays were written in languages other than English (Hindi 71, Gujarathi 13, Marathi 12, Tamil 3, Kannada 2, one each in Oriya, Telugu, Malayalam and Urdu.)

The essays were evaluated by 60 evaluators in nine groups. The group leaders were: Mr R. Mago, General Manager, CC & PA, NPCIL, Mr B.B. Narang, Associate Director (CPS & PES), NPCIL, Mr A.C. Tikku, Head, Research Reactor Services Division, BARC, Mr Gurusharan Singh, Head, Isotope Applications Division, BARC, Mr S.K. Agarwal, Head, Reactor Operations Division, BARC, Mr K. Anantharaman, Reactor Engineering Division, BARC, Dr Sunil Sabharwal, Head, Radiation Technology Development Section, Isotope Group, BARC, Dr V. Meera, Head, Radiopharmaceuticals Division, BARC, and Mr U. L. Sharma, Head, Quality Assurance Section, Research Reactor Services Division, BARC.

After evaluation, 15 contestants which included 6 girls from topic (A), and 15 contestants from topic (B) which included 10 girls were invited to make oral presentation on their essays.

On October 29, 2004, Dr Anil Kakodkar, Chairman, AEC, distributed the prizes to the following winners of the essay contest.

Topic (A): "Long term energy security and sustainable development in India: Role of nuclear power". The presentations covered demand of electricity in India, various energy options and inevitability of nuclear power based on fuel resource position, environmental issues, cost comparisons, etc. India's 3-stage nuclear power programme, heavy water production and waste management were also covered.

Topic (B): "Emerging areas of application of radio-isotopes and radiation technology: Current trends in the Indian context". The presentations covered radiation sources - radioisotopes, electron beams and lasers. Emerging trends in research and application in the areas of healthcare, food and agriculture, industry, environment, water resource management and basic sciences were also covered.

Prize Winners: Topic (A)

First Prize: (Rs. 7,500/-)

Mr Anand Vijay Rao, B.A. III, Hamirpur, *Hindi*

Second Prize (Rs. 5,000/-)

Ms Kelkar Harsha Narsinha, B.Sc. II, Ratnagiri, *English*
Third Prize (Rs. 3,000/-)
Mr Sarag Jyoti Saikia, B.E. IV, Nagpur, *English*

Prize Winners: Topic (B)

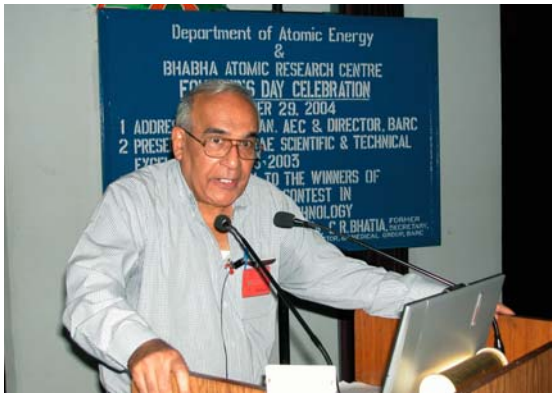
First Prize (Rs. 7,500/-)
Ms Harsha R. Dhore, B.Sc. II, Dhamangaon, *English*
Second Prize (Rs. 5,000/-)
Ms Sirpotdar Poonam Shashishekar, B.Sc. III, Ratnagiri, *English*
Third Prize (Rs. 3,000/-)
Ms Arti J.G. Taori, B.Sc. III, Dhamangaon, *English*

In addition to the above prize-winners, there were 24 consolation prize winners of Rs. 1500/- each (twelve in each topic).

FOUNDER'S DAY LECTURE

This year the Founder's Day lecture was delivered by Dr C.R. Bhatia, Former Secretary, Dept. of Biotechnology, Govt. of India & Ex-Director, Bio-Medical Group, BARC, on the topic "Is the society prepared for new biological knowledge and its applications?"

Dr Homi Bhabha recognised the importance of biology in the Atomic Energy Programme and appointed late Dr A.R. Gopal Ayengar to lay the foundations of Biomedical research in DAE. Besides studying the effects of radiation on various living systems, the applications of radiation in agriculture, food processing and medicine were identified as thrust areas. DAE's achievements in these areas have made a very significant impact on the quality of human life in the country. The initiation of molecular biology



Dr C.R. Bhatia, Former Secretary, Dept. of Biotechnology, Govt. of India & Ex-Director, Bio-Medical Group, BARC, delivering the Founder's Day lecture at Central Complex auditorium, BARC

research opened the doors for new biology. Since the mid-seventies, rapid progress in genetic engineering techniques has led to the development of genetically improved microbes, plants and animals (GMOs) and their commercial use. Now, we have the "omic" biology dealing with genomics, proteomics, transcriptomics, metabolomics, etc., and bio-informatics dominating the scene in addition to newer reproductive technologies, stem cell research, DNA tests, etc. Keeping pace with these developments from the beginning, the first genetically engineered plant in the country and cloning of Bt gene were achieved in BARC. The genetically engineered crops, though accepted in many countries, also evoke a strong opposition from environmentally conscious groups as being unnatural. Since more and more applications of genetic tools will be influencing life in the future, the question is: "Is our society prepared for this knowledge and its applications or would it prohibit their use?" Considering the immense proven and potential benefits of new biological knowledge and biotechnology, let us hope that collective wisdom, balancing the risks and benefits, would prevail and permit the continuous development of newer applications.

Edited and published by Dr Vijai Kumar, Head, Scientific Information Resource Division, Bhabha Atomic Research Centre, Trombay, Mumbai 400 085.
Editorial Management : T.C. Balan, Computer graphics & layout : N. Kanagaraj, SIRD, BARC
BARC Newsletter is also available at URL:http://www.barc.ernet.in (for private circulation only)