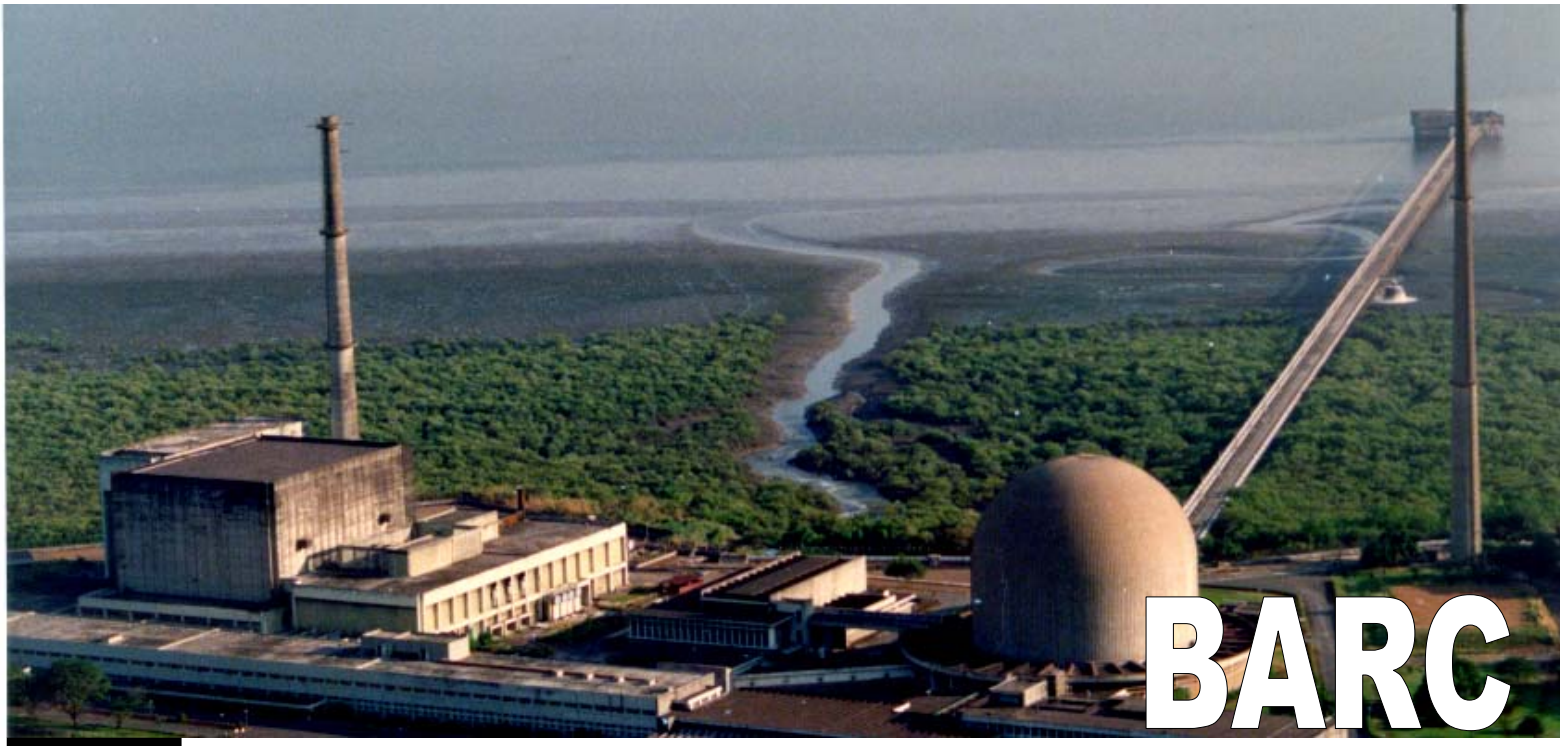

BARC
NEWSLETTER

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BARC OBSERVES FOUNDER'S DAY

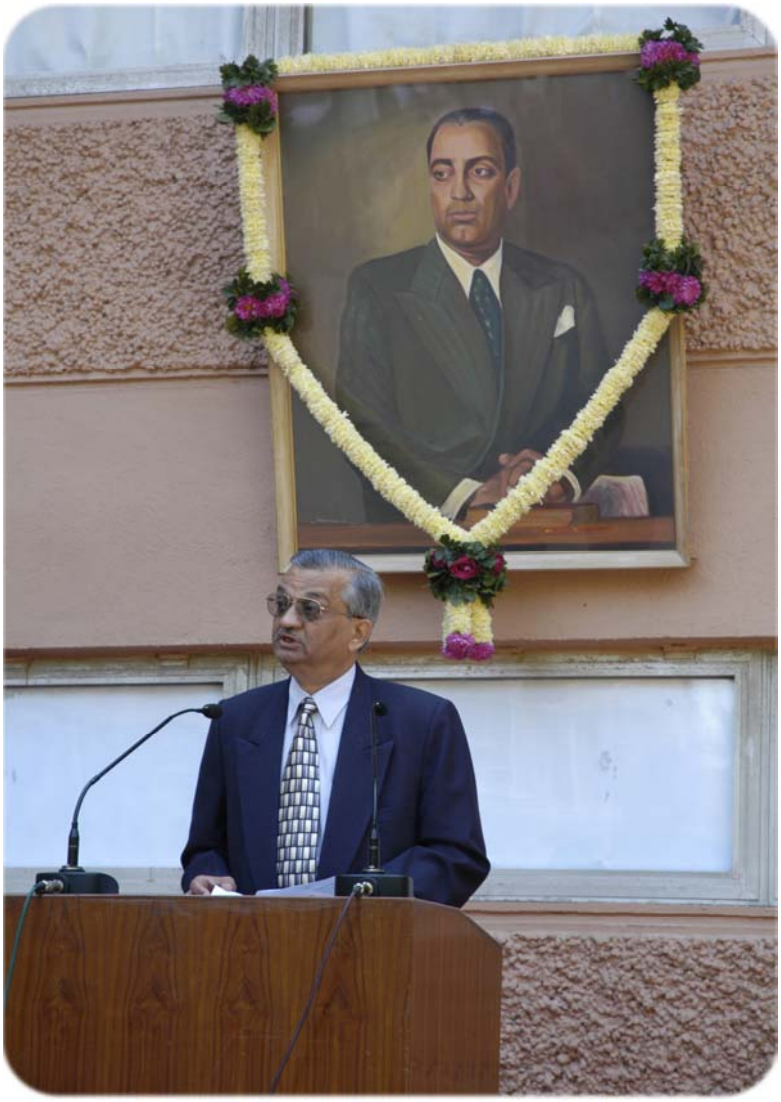
The staff of BARC celebrated the 96th birth anniversary of its illustrious Founder, late Dr Homi Jehangir Bhabha as Founder's Day with undiluted joy and fond remembrance on October 28, 2005. Dr Anil Kakodkar, Chairman, Atomic Energy Commission and Secretary to the Government of India and Dr S. Banerjee, Director, BARC addressed the staff members at BARC. A large number of serving and retired scientists, engineers and other staff members of BARC and other institutions of DAE were present on the occasion. 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 XVIIth All India Essay Contest in Nuclear Science and Technology. A Founder's Day special issue of *BARC Newsletter* containing award winning papers published during 2004 was also released on this occasion by Director, BARC.

BARC Founder's Day lecture was delivered by Mr. Placid Rodriguez, Raja Ramanna Fellow, IIT, Madras and former Director, IGCAR, Kalpakkam.

The full 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

Today we have assembled here to pay homage to our Founder Father, Dr Homi Jehangir Bhabha. Dr Bhabha gave us the vision to build the Atomic Energy Programme to contribute to national development. Dr Bhabha also created a blueprint for this programme and laid a solid foundation on which successive generations of members of DAE family have built and brought it to its present stage. This broad based scientific programme covering almost all science and engineering disciplines spans the entire Research, Development, Demonstration and Deployment chain. It is a matter of some satisfaction that the world today recognizes India as a country with advanced nuclear technology. Our programme is now well poised for a rapid growth both in terms of deployment of technologies that have been developed as well as in terms of development of new technologies.

The year that has gone by has seen a number of new achievements. Unit 4 of the Tarapur Atomic Power Station, the first 540 MWe PHWR designed and developed indigenously, has commenced commercial operation seven months ahead of schedule. Unit 1 of the Kakrapar Atomic Power Station operated continuously for more than a year setting a new benchmark for reactor operation in the country. The unique indigenously developed Plutonium-rich mixed carbide fuel used in Fast Breeder Test Reactor has performed extremely well upto a burn-up of around 150,000 MWd/t without a single fuel pin failure. Another important achievement during the year was the successful reprocessing of FBTR fuel that was discharged at a burn-up of 100,000 MWd/t. This is the first time that Plutonium carbide fuel has been reprocessed in the world. FBTR is now 20 year old and has proved to be an important test bed for development of technologies for fast breeder reactors. As a part of development of higher burn-up fuel for PHWRs, 25 MOX fuel bundles were successfully irradiated at a burn-up of about 11,000 MWd/t. This year we have introduced an additional 25 MOX fuel bundles in one of our PHWRs. The construction of five more PHWRs is progressing on schedule. These along with 2 x 1000 MWe advanced VVER reactors that are under construction at Kundankulam in collaboration with Russian Federation would

ontribute 3420 MWe additional capacity in about three years' time. This would take the total nuclear power generation capacity to about 6700 MWe.

The construction of 500 MWe Prototype Fast Breeder Reactor has picked up momentum, after a disruption that was caused as a result of the tsunami. The development of four sites for setting up of additional nuclear power units has been recently approved by the Government. We have also commenced work to identify additional sites for further expansion of the nuclear power programme.

A section of the gathering of the staff at Trombay on the Founder's Day

With a view to augment the availability of natural uranium fuel for PHWRs, we are pursuing an aggressive mine construction programme. The Banduhurang mine and the Turamdih mill are fast nearing completion. Our scientists have been very successful in developing an innovative process for commercially viable leaching of uranium ore from Tummalapalle. Similarly, we have initiated projects for recovery of uranium from phosphoric acid in collaboration with our partners.

En-masse coolant channel replacement and other safety upgradation jobs in the Madras Atomic Power Station Unit-1 are nearing completion and the Unit is expected to be back in operation by the end of this year. We have taken up further refurbishing activities at Tarapur Atomic Power Station as well as at the Narora Atomic Power Station. It is a matter of considerable satisfaction and pride that the technologies for the coolant channel repair work have continuously improved and now we are ready to use a laser-based coolant channel cutting technology which has been recently developed by the Centre for Advanced Technology, Indore.

The 2.5 GeV Synchrotron Radiation Source INDUS-2 has been fully assembled and integrated at the Centre for Advanced Technology, Indore. All subsystems have been made operational and initial experiments to store electrons in the ring have commenced. The Steady State Superconducting Tokamak SST-1 at the Institute of Plasma Research is nearing completion. It is on the basis of the experience and the capability that has been built in the country as a result of the work on this project that we are now looking forward to joining the International Thermonuclear Experimental Reactor (ITER) project as a full partner. Our contribution to the CERN has kept pace with programmes of building Large Hadron Collider there along with its detectors CMS and ALICE.

In the area of applications of radiation and isotope technology, it is a matter of considerable satisfaction to see that several radiation processing plants are under construction in the private and cooperative sectors. Radiation processing using electron beams is another area where we are now on the threshold of significant scale deployment of this technology in the country. The Advanced Centre for Treatment, Research and Education in Cancer (ACTREC) is now functional. We have high expectations out of advanced research activities in this institution. A state-of-the-art Cobalt Teletherapy Machine

`Bhabhatron', developed through coordinated efforts of BARC and TMC and the industrial partner, is another example of robust high-technology development that can be realized by diverse teams working together.

Dear colleagues, having recalled with pride some of the important developments that have taken place last year, I now wish to turn to some of the challenges ahead. We, of course, have challenges related to our vision of quickly developing a commercially robust Fast Breeder Reactor Technology to be followed by utilization of Thorium for energy production on a large scale. While we do so, we have to quickly build technologies which enable short doubling time and capability for growth even with Thorium systems. Clearly we will need to pursue a path quite different from the rest of the world. This choice of a different path is necessitated by our unique situation of having to depend on thorium for our energy production in the long run. Development of a basket of technologies to be deployed in a chosen sequence is thus inevitable for us to minimize heavy dependence on imported nuclear fuel in the long run. With the comprehensive capability across the entire research, development, demonstration and deployment chain that we possess in our Department, I feel very confident that we will be successful in meeting this challenge. We must remain on this path despite the possible additionalities that might come in through opening up of civilian nuclear cooperation with other countries. Our objective is to maximize the contribution of nuclear power both in the short run as well as in the long run.

There are a number of additional technologies that we must continue to work on. These include advanced accelerator and laser technologies and their applications and also further advances in the back-end of the fuel cycle technologies to make them commercially more robust and viable. There is also the necessity to develop High Temperature Nuclear Reactor Technology for production of Hydrogen which would soon emerge as another carrier of energy in addition to electricity.

We have made good progress on the applications of radiation and isotope technologies. Considering our large population needing developmental inputs, the potential for turn over in radiation and isotope technology applications is perhaps comparable or larger than nuclear power. In this context we need to quickly develop high specific activity cesium radiation sources based on selective extraction of the isotope from spent fuel. This will not only make radiation processing more competitive but also result in economy in waste management through significant reduction in heat generation in waste products.

Our laboratories engaged in basic research have earned a place for themselves. We have taken some new initiatives to bridge the basic research - Technology domains as well as to create special opportunities for promising young researchers. These initiatives are important to enhance our success rate in new innovative approaches that we would need to adopt for our unique programme.

Human resource has been our strength. In the years to come we will have to lay special emphasise on further building up of our human resource capabilities and empowerment. The Homi Bhabha National Institute (HBNI) is an initiative in this direction. HBNI along with our broad-based research collaboration with Universities and Research laboratories in India and abroad should enable us to realize the twin objectives of rapid rate of progress of our R&D capabilities as well as attracting additional young researchers.

Dear colleagues, the journey of self-reliance, walking on a path different from that taken by others and remaining detached from attractions of greener pastures have been some of the important values we have cherished in the DAE family. I am aware of the psychological tension this creates when comparisons are made with

our counterparts outside. However, our successes in the nation building are our best rewards. Our efforts are largely group efforts and in this effort, we derive support and strength from the working of our colleagues at all levels. That we are able to work together and meet any challenge that comes in our way is our special strength and on the basis of this strength, I have no doubt that we will continuously enhance our contributions towards betterment of the quality of life of our fellow citizens. I wish all of you success in this endeavour.

Thank you

डॉ. अनिल काकोडकर
अध्यक्ष, परमाणु ऊर्जा आयोग एवं
सचिव, परमाणु ऊर्जा विभाग
का संबोधन

प्रिय साथियों,

आज हम अपने संस्थापक - जनक, डॉ. होमी जहांगीर भाभा को अपनी श्रद्धांजलि देने के लिए एकत्रित हुए हैं ।

डॉ. भाभा ने राष्ट्र के विकास में योगदान के लिए परमाणु ऊर्जा कार्यक्रम के निर्माण हेतु हमें एक दृष्टि दी । डॉ. भाभा ने इस कार्यक्रम का एक खाका भी निर्मित किया और एक मजबूत बुनियाद डाली जिसके ऊपर परमाणु ऊर्जा विभाग परिवार की उत्तरोत्तर पीढ़ियों के सदस्यों ने एक मजबूत ढांचा तैयार किया तथा कार्यक्रम को वर्तमान स्थिति में पहुँचाया । विज्ञान और इंजीनियरी के क्षेत्रों में एक व्यापक वैज्ञानिक कार्यक्रम तैयार किया गया जिसके अंतर्गत अनुसंधान, विकास, निदर्शन तथा नियोजन श्रृंखला के संपूर्ण विषयों का समावेश था । यह संतोष का विषय है कि आज विश्व, भारत को एक प्रगत नाभिकीय प्रौद्योगिकी वाले देश के रूप में मान्यता देता है । हमारा कार्यक्रम विकसित की गई प्रौद्योगिकियों के उपयोग तथा नई प्रौद्योगिकियों के विकास, दोनों ही क्षेत्रों में तेजी से आगे बढ़ रहा है ।

बीते वर्ष में हमने अनेक नई उपलब्धियाँ अर्जित की हैं । तारापुर परमाणु बिजलीघर की युनिट-4 में स्वदेश में अभिकल्पित एवं विकसित 540 मेगावाट के दाबित भारी पानी रिएक्टर का वाणिज्यिक प्रचालन का कार्य निर्धारित समय से सात महीने पहले शुरू हो गया । ककरापार परमाणु बिजलीघर की युनिट-1 ने लगातार एक वर्ष से अधिक अवधि तक प्रचालन करके देश में रिएक्टर प्रचालन के क्षेत्र में एक नया कीर्तिमान बनाया है। फास्ट ब्रीडर टेस्ट रिएक्टर में उपयोग किया जानेवाला पूरी तरह से स्वदेश में विकसित अपनी तरह के एक अलग प्लुटोनियम समृद्ध मिश्रित कार्बाइड ईंधन ने बहुत अच्छी तरह से कार्य किया है तथा बिना किसी एक भी ईंधन पिन के खराब हुए 150,000 MWd/t का बर्नअप स्तर प्राप्त किया है । इस वर्ष के दौरान दूसरी महत्वपूर्ण उपलब्धि रही है FBTR ईंधन का सफलतापूर्वक पुनर्संसाधन, जिसे 100,000 MWd/t पर डिस्चार्ज किया गया है । विश्व में यह पहली बार है कि प्लुटोनियम कार्बाइड ईंधन का पुनर्संसाधन किया गया । FBTR अब बीस वर्ष पुराना हो गया है तथा फास्ट ब्रीडर रिएक्टरों के लिए प्रौद्योगिकियों के विकास हेतु एक महत्वपूर्ण परीक्षण प्रविधि सिद्ध हुआ है । दाबित भारी पानी रिएक्टरों के लिए उच्चतर बर्नअप ईंधन के विकास के एक भाग के रूप में, 25 MOX ईंधन बंडलों को लगभग 11,000 MWd/t के बर्न अप स्तर तक सफलतापूर्वक किरणित किया गया । इस वर्ष हमने अपने एक दाबित भारी पानी रिएक्टर में एक अतिरिक्त 25 MOX ईंधन बंडल का समावेशन किया है । पाँच और दाबित भारी रिएक्टरों का निर्माण कार्य निर्धारित कार्यक्रमानुसार चल रहा है । ये तथा कुडनकुलम में रूसी परिसंघ के सहयोग से निर्माणाधीन 1,000 मेगावाट के दो प्रगत VVER रिएक्टरों के निर्माण से आगामी लगभग 3 वर्षों के अंदर हमारे विद्युत उत्पादन क्षमता में 3420 मेगावाट का अतिरिक्त इज़ाफा होगा । इसके साथ ही कुल परमाणु विद्युत उत्पादन क्षमता लगभग 6700 मेगावाट हो जाएगी ।

500 मेगावाट क्षमता वाले प्रोटोटाइप फास्ट ब्रीडर रिएक्टर के निर्माण कार्य में सुनामी के कारण आये व्यवधान के बाद तेजी आयी है । सरकार द्वारा अभी हाल ही में अतिरिक्त नाभिकीय विद्युत युनिटों की स्थापना के लिए चार स्थलों के विकास का कार्य अनुमोदित किया गया है । नाभिकीय विद्युत कार्यक्रम के और विस्तार के लिए हमने अतिरिक्त स्थलों की पहचान का काम भी शुरु कर दिया है ।

दाबित भारी पानी रिएक्टरों के लिए प्राकृतिक यूरेनियम ईंधन की उपलब्धता बढ़ाने की दृष्टि से हम एक उत्साही खान निर्माण कार्यक्रम चला रहे है । बांदुहुराँग खान और तुरमडीह मिल का कार्य तेजी से पूरा होने को है । हमारे वैज्ञानिकों ने तुम्मालापल्ली से वाणिज्यिक रूप से व्यवहार्य युरेनियम अयस्क के निक्षालन की एक नवीनतम प्रक्रिया के विकास का कार्य सफलतापूर्वक किया है । इसी प्रकार हमने अपने साझीदारों के सहयोग से फॉस्फोरिक एसिड से युरेनियम की प्राप्ति के लिए परियोजनाएँ शुरू की हैं ।

मद्रास परमाणु बिजलीघर की युनिट-1 में शीतलक चैनलों की सामुहिक बदली और अन्य संरक्षा संबंधी उन्नयन कार्य पूरा होने

को हैं तथा वर्ष के अंत तक इस युनिट में प्रचालन पुन: शुरु हो जाने की आशा है । हम तारापुर परमाणु बिजलीघर और नरोरा परमाणु बिजलीघर को और पुनर्सज्जित करने का कार्य शुरू कर रहे हैं । यह हमारे लिए अत्यंत संतोष एवं गर्व की बात है कि शीतलक चैनलों की मरम्मत हेतु उपयोग में लायी जाने वाली प्रौद्योगिकी में निरंतर सुधार हुआ है तथा अब हम कूलेन्ट चैनलों के लिए अभी हाल ही में प्रगत प्रौद्योगिकी केन्द्र, इंदौर द्वारा विकसित लेसर आधारित शीतलक चैनल टेक्नोलॉजी के प्रयोग के लिए तैयार हैं।

2.5 GeV सिंक्रोट्रॉन रेडिएशन सोर्स इन्डस-2 का पूर्णतय: समुच्चयन एवं समाकलन प्रगत प्रौद्योगिकी केन्द्र, इन्दौर में कर लिया गया है । सभी उप प्रणालियों को प्रचालनरत कर दिया गया है और इलेक्ट्रॉन्स के भण्डारण हेतु रिंग में आरंभिक प्रयोग होने लगे हैं । प्लाज्मा अनुसंधान संस्थान में स्टडी स्टेट सुपरकंडक्टिंग टोकामाक SST-1 पूर्ण होने वाला है । यह इस परियोजना पर कार्य के फलस्वरूप देश में ही प्राप्त अनुभव और क्षमता पर आधारित है और अब हम अन्तरराष्ट्रीय ताप नाभिकीय प्रयोगात्मक रिएक्टर (ITER) परियोजना में पूर्ण भागीदारी करने वाले हैं । CERN हेतु हमारा सहयोग इस प्रकार है कि वृहत्त हाइड्रॉन कॉलाइडर, इसके CMS एवं ALICE सहित बनाने के कार्यक्रम में हमने कदम रखा है ।

विकिरण एवं आईसोटोप प्रौद्योगिकी के क्षेत्र में यह बात बहुत संतोषजनक है कि निजी एवं कोऑपरेटिव सेक्टरों में विभिन्न विकिरण संसाधन संयंत्रों का निर्माण जारी है । इलेक्ट्रॉन किरणपुंज प्रयोग करने वाले विकिरण संसाधन एक और वह क्षेत्र है जहाँ देश में इस प्रौद्योगिकी के अन्तर्गत उल्लेखनीय विकास हुआ है । कैंसर में उपचार, अनुसंधान शिक्षा हेतु एक प्रगत केन्द्र (ACTREC) अब कार्यरत है । हमें इस संस्थान से अनुसंधान के क्षेत्र में बहुत उम्मीदें हैं । भाभाट्रॉन नामक अद्यतन कोबाल्ट टेलीथैरेपी मशीन भा.प.अ. केन्द्र, टी.एम.सी और अन्य औद्योगिक भागीदारों के सहयोग से विकसित की गई । यह संतुलित उच्च प्रौद्योगिकी के विकास का एक अन्य उदाहरण है जिसे साथ में कार्य करते समय विभिन्न टीमों द्वारा महसूस किया गया ।

प्रिय साथियों, पिछले वर्ष हुए महत्वपूर्ण विकासों को गर्व के साथ याद करते हुए, मैं आगे उपस्थित कुछ चुनौतियों को देखना चाहूँगा । बेशक, हमारे सामने फास्ट ब्रीडर टैक्नोलॉजी के शीघ्र व्यावसायिक विकास के सपने से संबंधित चुनौतियाँ हैं जो वृहत्त स्तर पर ऊर्जा उत्पादन हेतु थोरियम के उपयोग द्वारा पूरी होंगी । ऐसा करने के लिए हमें शीघ्र ही कुछ ऐसी प्रौद्योगिकियाँ निर्माण करनी होंगी जो थोरियम परियोजनाओं के साथ कम समय में सक्षम विकास कर सकें । वस्तुत: हमें विश्व से अन्य बिलकुल और अलग अपना रास्ता बनाने की आवश्यकता है । इस अलग रास्ते का चुनाव हमारी विशेष परिस्थितियों के कारण आवश्यक है क्योंकि दीर्घ अवधि में ऊर्जा उत्पादन के लिए हमें थोरियम पर निर्भर होना पड़ेगा । चुनी गई श्रंखला में ढ़ेर सारी प्रौद्योगिकियों का विकास है इस लिए दीर्घ काल में नाभिकीय ईंधन के आयात को कम करना अवश्यंभावी है । हमारे विभाग में होने वाले सम्पूर्ण अनुसंधान, विकास, निरुपण एवं विस्तृत श्रंखला की व्यापक क्षमता को देखते हुए मुझे पूर्ण विश्वास है कि हम सफलतापूर्वक इन चुनौतियों का सामना कर सकते हैं । अन्य देशों के साथ असैनिक नाभिकीय सहयोग की शुरुआत के दौरान संभावित अतिरिक्त कार्य आ सकते हैं फिर भी हमें अपने पथ पर अडिग रहना है । हमारा उद्देश्य निकट और दीर्घ भविष्य में नाभिकीय योगदान के सहयोग को बढ़ाना है ।

और भी अन्य अनेक प्रौद्योगिकियाँ हैं, जिन्हें हमें जारी रखना है । इनमें प्रगत त्वरक एवं लेसर प्रौद्योगिकियाँ और उनके अनुप्रयोग भी शामिल हैं तथा ईंधन चक्र प्रौद्योगिकियों के पश्च भाग को व्यावसायिक रूप से अधिक संतुलित तथा समर्थ बनाने हेतु अन्य प्रगतियाँ करनी हैं । हाइड्रॉन के उत्पादन हेतु उच्च तापमान नाभिकीय रिएक्टर प्रौद्योगिकी का विकास करना भी अत्यन्त आवश्यक है ताकि विद्युत हेतु अतिरिक्त ऊर्जा प्राप्त हो सके ।

हमने विकिरण एवं आईसोटोप प्रौद्योगिकियों में अच्छी प्रगति की है । हमारी विशाल जनसंख्या को देखते हुए विकिरण एवं आईसोटोप प्रौद्योगिकियों के अनुप्रयोगों में हेर-फेर हेतु विकासात्मक निवेश व क्षमता शायद नाभिकीय विद्युत के बराबर या अधिक है । इस संदर्भ में हमें भुक्तशेष ईंधन से आईसोटोप के चुने हुए निष्कर्षण पर आधारित उच्च विशिष्ट सक्रियता सीज़ियम विकिरण स्त्रोतों को शीघ्र विकसित करने की आवश्यकता है । इससे न केवल विकिरण संसाधन अधिक प्रतिस्पर्धी बनेगा बल्कि इसके परिणामस्वरूप अपशिष्ट उत्पादों में ताप उत्पादन में उल्लेखनीय गिरावट द्वारा अपशिष्ट प्रबंधन की अधिक किफायती बना देंगे ।

हमारी प्रयोगशालाओं ने मूलभूत अुनसंधान में प्रवेश करके अपने लिए स्थान बना लिया है । हमने मूलभूत अनुसंधान तथा प्रौद्योगिकी क्षेत्रों के मध्य सम्पर्क स्थापित करने के लिए कुछ नई शुरुआतें की हैं इससे प्रतिभाशाली युवा अनुसंधानकर्ताओं को विशिष्ट अवसर प्राप्त होंगे । यह नवीन शुरुआतें अभिनव प्रस्तावों में हमारी सफलता की दर को बढ़ाने में महत्वपूर्ण हैं । हमारे विलक्षण कार्यक्रम हेतु इन्हें अपनाने की आवश्यकता है ।

मानव संसाधन हमारा सामर्थ्य है । आने वाले वर्षों में हमें हमारी मानव संसाधन योग्यताओं तथा शक्तियों को बनाए रख-ने के लिए विशेष बल देना होगा । इस दिशा में होभी भाभा राष्ट्रीय संस्थान (एचबीएनआई) एक शुरुवात है । एचबीए-नआई सहित भारत एवं विदेश में विश्वविद्यालयों और

अनुसंधान प्रयोगशालाओं के साथ विस्तृत रूप से हमारे अनुसंधान सहयोग दो उद्देश्यों को महसूस कराता है कि हमारी अनुंसधान एवं विकास क्षमताओं के साथ-साथ अतिरिक्त युवा अनुसंधानकर्ताओं को आकर्षित करना ।

प्रिय साथियों, आत्मनिर्भरता, अन्यों से हटकर एक अलग रास्ता बनाना आदि ऐसे कुछ महत्वपूर्ण मूल्य है जिहें हमारे परमाणु ऊर्जा विभाग परिवार की यात्रा में सम्मिलित किया है । बाहरवाले हमारे प्रतिस्थानियों के साथ जब हमारी तुलना की जाती है, तब किस प्रकार का मानसिक तनाव पैदा होता है, इससे मैं अवगत हूँ । फिर भी, राष्ट्र निर्माण में हमारी उपलब्धियाँ ही हमारे सर्वोत्तम पुरस्कार हैं । हमारे प्रयास बड़े समूह के प्रयास होते हैं और इनमें सभी स्तरों पर कार्य में हमारे साथियों की ताकत का हमें बल मिलता है । यह कि हम मिलकर कार्य कर सकते हैं और हमारे मार्ग में आनेवाले चुनौतियों का सामना कर सकते हैं जो कि हमारी एक विशेष ताकत है तथा हम हमारे साथी नागरिकों के जीवनस्तर में सुधार हेतु योगदान में बढ़ोत्तरी करते रहेंगे । इस प्रयास में मैं आपकी सफलता की कामना करता हूँ ।

धन्यवाद ।

Address by
Dr Srikumar Banerjee
Director, BARC

Dr Kakodkar, Chairman, Atomic Energy Commission, Senior Members of the 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 you all to celebrate the 96th birth anniversary of Dr Homi J. Bhabha - the 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 30th October morning to celebrate his birthday by taking stock of our achievements during the previous year and rededicating ourselves towards achieving our cherished goal of improving the quality of life of our people through the development of nuclear science and technology. We are also committed to pursue R&D activities to remain at the forefront of nuclear science and technology and to contribute towards the national security.

I am extremely happy to announce that last year has been yet another successful year in our developmental efforts. The list of 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 taken from areas such as reactor technology, fuel cycle

technology, basic research and developments in health care, food preservation and agriculture.

BARC has provided strong R&D support to NPCIL in design, development, safety assessment, safety review and successful commissioning of TAPS-4, the 540 MWe PHWR which has been connected to the grid on 4th June, 2005.

Flux Mapping System comprising a number of self powered neutron detectors developed at BARC was used for generating neutron flux profiles required for zonal power control in the 540 MWe large reactor core.

Some of the other developments at BARC for this reactor at Tarapur were; Reactor Regulating System, fully computerized Reactor Protection System, channel temperature monitoring system, dual processor hot standby process control system for PHT and steam generator and programmable digital control system. Acceptance testing of the first fuelling machine of this reactor was carried out in our Fuelling Machine Test Facility to qualify it for reactor worthiness. An in-house code Dyna540 was used in designing the steam side pressure program. A scheme for selective removal of gadolinium nitrate in presence of boron from moderator system was successfully deployed during its first approach to criticality.

R&D support BARC is providing to the ongoing PHWR program has helped NPCIL in implementing the following :

Indigenously developed Sludge Lancing Equipment (SLE) for sludge lancing of tube sheet of PHWR steam generators was formally handed over to NPCIL and was shipped later to Kakrapar.

Analytical and technical support for the life extension of coolant channels of Narora - Unit 1 was provided to obtain regulatory clearance for further operation. Wet scraping tools were successfully used in coolant channels of KAPS-1 & 2 and NAPS-2 to obtain samples from pressure tubes to estimate hydrogen pick up.

Gamma ray spectrometric method was successfully performed on PHT and Moderator piping in the purification building in NAPS-2 for identifying the radionuclides causing high dose.

Sparger channels designed and developed at BARC have recently been installed in MAPS-1 for facilitating moderator entry into the calandria for full power operation.

The on-line diagnostic system for detecting blade vibrations in steam turbines has been incorporated at various nuclear and thermal power stations including TAPS-3.

A Real time Online Decision Support System "IRODOS", has been developed for analysing and decision making during any off-site nuclear emergency at Nuclear Power Plants. Its operating domain is 150 km x 150 km around a Nuclear Power Plant site. In an unlikely event of an emergency, this system will carry out real-time as well as predictive calculations of weather and dispersion of radioactive releases for the determination of the radiological dose and implementation of emergency counter-measures. First prototype system developed is programmed for Narora Atomic Power Station, and is currently in operation at Emergency Response Centre of BARC. It is proposed to set up 17 Emergency Response Centres across the country to respond to nuclear and radiological emergencies.

Our research reactors CIRUS, APSARA and DHRUVA have been operational with high availability factors.

After complete refurbishment, the full power operation of CIRUS at 40 MWt was achieved in November 2004 with an average availability factor of about 70%. In December 2004, highest ever availability factor of 94.78 % & capacity factor of 90.82 % for a month were achieved since its commissioning in 1960.

A 30T/day desalination unit based on Low Temperature Vacuum Evaporation Process has been integrated with CIRUS for waste heat utilization. Product water from desalination unit is being utilized for meeting the make up

requirement of demineralized water for primary coolant system.

The reactor was also utilized for thorium irradiation in Graphite reflector region, production of radioisotopes and neutron activation analysis of samples in pneumatic carrier facility.

Apsara was well utilized for various R&D activities including Fast Reactor Shielding Experiments, Neutron Activation Analysis, Radiation damage studies, Forensic research and Neutron radiography.

DHRUVA reactor continued to be the major facility for radioisotope production and for providing neutron beams for the national facility for neutron beam research with a high availability factor of 75%. Two more batches of ~10mg quantities of Pa-231 have been irradiated at DHRUVA to produce U-232 required for experimental work.

Production of gaseous radionuclides Argon-41 and Krypton-79 has been achieved for the first time. The availability of these gas tracers, used to follow the gas phase, will be an invaluable tool for the refinery industries.

Significant progress has been made in the program on design of new reactor systems.

The 300 MWe Advanced Heavy Water Reactor designed in BARC is currently undergoing pre-licensing safety appraisal by AERB. A very substantial improvement in the physics design by reducing the lattice pitch in the core from 245 mm to 225 mm has been implemented on the basis of our continuing R&D. This has helped in increasing the average discharge burn-up of the AHWR fuel from 24000 MWD/T to 38000 MWD/T, and has also improved its safety characteristics further.

An Integral Test Loop, a facility for simulating main Heat Transport system and Safety Systems of AHWR has been commissioned. The 40 meter tall experimental facility extends over nine floors of a building. Large scale engineering experiments in the Integrated Test Loop are being performed to study the natural circulation of coolant in the main heat transport loop, stability of flow, validation of the start up method and the performance of emergency core cooling system under accidental conditions.

BARC is also working out the detailed design of the proposed 600 MWth Compact High Temperature Reactor which will operate at 900^{o}C and will serve as a technology demonstration facility. It is envisaged that this reactor will use pebble bed kind of core configuration with molten lead as its coolant. Studies were conducted to increase the core life of the reactor from 5 full power years to 15 full power years. On the basis of detailed studies, the basic guidelines for the design of a High Temperature Reactor for producing hydrogen have been developed. Developments of refractory metal alloys, aluminide and silicide coatings on them, carbon based materials and compact beryllia shapes have progressed well for applications in the high temperature reactor.

BARC designed Inclined Fuel Transfer Machine for the Fast Breeder Reactor has been taken up for manufacturing by BHAVINI. Design of hoisting system has been evaluated by establishing double chain hoisting test facility at Hall - 7.

Let me now tell you about some important achievements in the fuel cycle development program.

Significant uranium deposits in Tummallapalle region of Cuddapah basin had earlier been established by AMD. This deposit is hosted in alkaline rocks, therefore, conventional acid leaching is not suitable. BARC in collaboration with AMD and UCIL has setup a pilot plant at Jaduguda to treat 300 kg. of ore per batch to test the applicability of alkaline leaching process for Tummallapallle ore deposit. The pilot plant based on pressure leaching under oxygen pressure has shown very promising results and a process yield of 81% has been achieved. The development of pressure alkali leaching will open up the

possibility of processing of other uranium ores which are not amenable to acid leaching.

The unique high Pu mixed carbide fuel for FBTR has now reached a burn-up exceeding 145 GWd/T. FBTR is now being used as a test bed for studying behaviour of our future fast reactor core structurals and fuel materials. An experimental fuel subassembly of PFBR fuel design is under irradiation - which has reached a burn-up 52GWd/T which is 50% of peak target burn-up.

As a part of our development of high burn up fuel for PHWRs, 50 MOX fuel bundles were introduced in a PHWR at Kakrapar. 25 MOX bundles have already achieved the target burn-up of about 11 GWd/T which is nearly double the average burn up of standard Natural Uranium fuel.

BARC has delivered 200 pins of MOX fuel (U-44% Pu) to IGCAR which is expected to be loaded into FBTR core during the next reloading campaign.

Keeping in view the needs of development of nuclear fuels and materials for new generation of reactors, a state of the art Metallurgical hot Cells Facility has been designed and constructed at BARC and will be shortly commissioned. The 106 Curie capacity hot cells are provided with 1.5 meter thick high density hematite concrete shielding capable of handling high burnup thorium fuel.

Coating technology has been successfully applied for developing neutron sensors for AHWR and P4 facilities, for the coating of uranium components for Bhabhatron and alumina coating on graphite moulds for reducing the contamination of carbon in uranium ingots.
A 50 ton multiaxial component integrity testing machine has been commissioned. It is now possible to evaluate mechanical properties of materials at various length scales starting from the atomic scale to nanometer - micrometer - millimeter and finally to the component level. The technology for fabrication of shape memory alloy components for applications in the Light Combat Aircraft is being transferred to Aeronautical Development Authority for their large scale production.

The process instrumentation system of Plutonium Plant, Trombay has been augmented for enhancing operational convenience and plant safety. Reprocessing of spent fuel from research reactors has been resumed in the plant. Some of the problems encountered in the operation of PREFRE, Tarapur were successfully solved and plant continues to operate satisfactorily.

Waste Immobilization Plant, Trombay is operational for vitrification of high level radioactive waste and the plant has successfully produced 100 canisters of vitrified product. A campaign for tank remediation by ion-exchange (TRIX- II) for treatment of intermediate level liquid waste at Trombay using indigenously developed ion exchange resin has helped in a substantial reduction of the liquid level in waste tanks.

Let me give you a brief account of the important achievements in basic research in Physics, chemistry and biological sciences:

A high resolution ultraviolet beam line for Indus-1 consisting of optical focusing system and a spectrometer incorporating a grating of 4800 lines/mm was commissioned with lower wavelength cut-off at 1100 Å. The spectral resolution 0.03A has been achieved.

In the programme of Indus-2 beam line development, substantial progress is made in the fabrication of three beam lines for extended x-ray absorption fine structure studies, for Photoelectron spectroscopy and for Energy dispersive x-ray diffraction.

Small angle neutron scattering was used to understand the hydration process and time evolution of pore structure in cements. Very different results were obtained for hydration with light water and heavy water that need to be understood in terms of dynamical scaling theories.

High resolution structures of two important proteins, namely Gelonin and Saporin, have been determined.

A variety of high performance optical devices such as polarised beam combiners, narrow band pass filters, high reflecting mirrors based on multilayer coatings for 1.315 μm laser resonator were developed for certain critical applications.

The studies on auto-ionization Rydberg series of europium atom have established a total of 225 auto-ionization levels. Such spectroscopic investigations have their importance in laser isotope separation.

In continuation of our studies on biomolecules using indigenously built MALDI-Time of Flight Mass Spectroscopy, the mass spectra of trypsin digested lysozyme and cytochrome proteins at different concentration levels were recorded. All the expected fragment peptides were detected and resolved and their molecular mass determined with high precision.

Indigenously built Triple Collector Mass Spectrometer has been delivered to RMP, Mysore. The instrument is currently being used for measuring the isotopic ratios in UF6 process gas.

The ENSTAR, Scintillator detector array built in BARC has been made operational at COSY, Jülich and the first experiment using this array has been completed.

Physics design simulation studies for the Low Energy Heavy Ion Particle Accelerator (LEHIPA) have been completed.

As a part of our research activities in Chemistry, catalyst loaded ion exchange resin (CLIX) was evaluated for its suitability to remove dissolved oxygen in the coolant systems of PHWRs. Experiments carried out in a simulation system indicated that dissolved oxygen can be reduced from a concentration of 7 ppm to less than 10 ppb using this resin and hydrogen.

Nanoferrites containing cobalt and nickel and in the size range 2 - 50 nm were prepared using micro emulsion method and polymer combustion route. Analysis of the ferrites by Mossbauer technique indicated that ferrites having particle size of 2-10 nm exhibit super paramagnetic relaxation.

In the programme on biodegradation/ bioremediation of organic and inorganic wastes aerobic microbial granules were successfully cultivated in laboratory scalesequencing batch reactor. The developed granules were successfully used for biodegradation of organic compounds using laboratory scale column reactors.

High purity Pyrromethene 567 laser dye has been synthesized and characterized for the first time in India. Laser characterization of the indigenously synthesized dye showed good lasing efficiencies and proper tuning range.

BARC has a very strong base in safety studies and in engineering research in the context of nuclear power plants

Detailed prelicensing calculations, comprising of a large number of safety analyses in different categories, were made for Advanced Heavy Water Reactor. These involve design calculations for evaluation of performance of components like valves, controllers, isolation condensers, etc.

In the area of material modelling, an in-house code has been developed based on the discrete-dislocation plasticity. The code is used to generate stress-strain data of common materials.

A 16" pipe with part-through-flaw has been tested under the combined loads of internal pressure and bending moment to demonstrate the leak-before-break phenomenon.

Structural analysis was performed and required modifications were suggested for a 32 meter diameter dish antenna to be used by ISTRAC for CHANDRAYANN-1 mission.

On-line 3-D creep-fatigue monitoring system has been developed which is working satisfactorily at NTPC Dadri. Similar systems at HWP Tuticorin and Kota are being upgraded.

For the first time, measurement of catalyst mixing characteristics in Fluidized Catalytic Cracking Unit (FCCU) was carried out using La-140 radiotracer for Guwahati Refinery of Indian Oil Corporation Limited.

Isotope Hydrological Investigations were carried out at the request of Himalayan Environmental Studies and Conservation Organization (HESCO), Dehradun to identify the recharge zones of the drying springs in the Mountainous Himalayan Region and Uttaranchal, which will benefit the population in the region.

A pulsed Nd:YAG laser has been used for surface etching of ThO2 pellets for metallographic evaluation. The principal advantage of the technique is that it generates far lesser volume of waste in comparison to conventional processes and therefore ideal for post irradiation examination of fuel.

A 4 MHz 40 kW, inductively coupled RF Plasma Reactor has been commissioned. The ICP torch has been operated up to 15 kW power level under varying pressure conditions from a few Torr to about 200 Torr.

The 40 kW atmospheric plasma spray system has been adapted for developing stabilized zirconia duplex coatings, which have potential applications in high temperature reactors due to their suitability in the environment of highly reactive molten metals.

A 24 kW Electron Beam Welding Gun, capable of producing a penetration of around 50 mm in stainless steel has been indigenously developed and commissioned and successfully operated at full power. The unit operates at 80 kV using a tantalum formed cathode and will be used mainly for welding thick sections of stainless steel, copper and their alloys.

A 180^0 deflection, 130mm-strip EB gun has been designed, developed and tested for its performance up to 80kW on copper target placed in a water-cooled copper crucible. This configuration of gun and crucible will yield a high evaporation rate from a smaller pool in laser isotope separation experiments

A helium gas based Cryogenic Refrigerator (1kW at 20K) for cryodistillation of hydrogen .is undergoing operational trials.

BARC has supplied three desalination units (5000 litres/day capacity each) in the Tsunami affected areas of Tamil Nadu for a wide range of feed water quality. Two desalination units were installed in Nagapattinam General Hospital and Chandrapadi village while the trailor mounted RO desalination unit has been put up at Sadras village for providing drinking water to the local community. Desalination and water purification technologies developed by BARC are used in different states of the country.

Our technology for online domestic water purifier based on ultrafiltration polysulfone membrane for producing bacteria free safe drinking water (@40 litres/day) has been transferred to 14 parties in the different parts of the country, out of which six parties have already launched their products in the market. It operates at tap pressure and removes turbidity and pathogens without use of any chemical and electricity.

An MoU was signed with National Institute of Ocean Technology (NIOT) for providing consultancy on design review of 1.0 lakh litres/day low temperature desalination plant using ocean thermal energy gradient for sea water desalination. The plant was recently installed and commissioned at Kavaratti (Lakshadweep) by NIOT.

The first indigenous teletherapy machine, name "BHABHATRON", has been developed and commissioned at ACTREC, Navi Mumbai. The technology for production of the machine is transferred to private industry.

A robotic system for deactivation of anti-tank mine fuses has been developed for Ordinance Factory, Khamaria, Jabalpur.

An automated gamma scanning system for inspection, trouble-shooting and process

optimization of industrial columns has been developed and field-tested at HWP, Manuguru.

The Fluoride Detection Kit for detection of fluoride in groundwater, has been adjudged as the best in a survey sponsored by UNICEF.

The technology for making banana juice and powder without adding any external enzymes was transferred to a party in Thailand. RF controller and support modules for super conducting LINAC supplied to Australian National University (ANU), Canberra, Australia has been successfully installed.

The advances in computers and computational technology developed in BARC was not only instrumental in providing the best computational platforms to scientists of BARC but also to many others in the country. BARC achieved yet another milestone by developing new version of ANUPAM parallel processing system attaining highest computing performance of 365 Gflops for High Performance Linpack (HPL) benchmark on 128 node (dual Pentium Xeon at 2.4 GHz) system.

Another successful development was that of high-resolution (5120x4096) wall-size tiled display system using commercially available multiple LCD's (4x4) interfaced with a parallel cluster for large volume data visualization purpose.

Grid middleware tools namely SHIVA & Grid-View developed as part of LCG DAE-CERN collaboration have been chosen by CERN for regular deployment on CERN grid.

Nearly 1000 vitrified Cesium-137 brachytherapy sources prepared at the Radiopharmaceuticals Division by an improved method, has enabled BRIT to supply them to the hospitals for therapy of cervical cancers. Preparation and supply of Iodine-125 brachytherapy sources was continued for treatment of patients with eye cancers.

A novel radiopharmaceutical employing Lutetium-177 has been developed for use as an agent for palliation of pain due to skeletal metastasis. Based on the excellent results from studies in animals, this molecule will soon be taken up for human clinical trials.

During this year one new soyabean variety Trombay-Amravati Soya-38 and one Mung variety Trombay Mung Bean-37 were released and notified by Ministry of Agriculture, Government of India for commercial cultivation in the Vidarbha region and in the North Eastern Plains Zone respectively. With this, the number of Trombay crop varieties released and notified so far has reached 26.

Five more new crop varieties (two in groundnut, and one each in soyabean, mustard and sunflower) were identified for commercial release by State Agriculture Universities/ICAR.

Four mutant types (two in groundnut, one each in sunflower and sesame) were registered by the National Bureau of Plant Genetic Resources, ICAR for their novel characteristics.

Dear Colleagues, I am sure you will all appreciate that the achievements we make in BARC are possible only because we all work here in harmony. It is sometimes not so easily visible how an individual's work gets integrated into the overall programme. It is, therefore, our duty to constantly highlight how constructive interference of the contributions of individuals finally lead to big happenings in our programme. Our strength lies in this synergy. In this context, I would like to mention that the contributions made by every segment of our scientific, administrative, support and security staff are equally important in maintaining the overall excellence.

You will recall how closely our colleagues cooperated in handling the difficult situation we faced during the recent flooding in Mumbai. I take this opportunity to express my deep sense of gratitude to all those who helped in averting the crisis during this flooding incident by their untiring work. The clearing up of the areas affected within the short time and recovering many of the damaged equipment have been possible due to the dedicated and coordinated effort of our colleagues.

Friends, you all will agree that we have many more challenges ahead of us particularly in the current era when the atomic energy program in the country is fast opening up. With the global changes we are witnessing in the area of nuclear collaboration, there is a strong possibility of inducting different nuclear reactor systems in our program. The country is also looking forward to rapid energy growth. We must be prepared to rise to the occasion to meet the challenges being posed to us to master the new technologies in the near future by expanding our research horizons wider and further.

Our own program on development of innovative reactor systems, accelerator driven subcritical system, the early thorium utilization has their own priorities and challenges ahead of us. We are also on the verge of defining our goals for the forthcoming XIth plan projects in line with these programs. As you know, we will be celebrating the golden jubilee year of BARC during 2006-07 and there can be no better time than this when we are required to poise for accepting major technological challenges. Developing our new campus at Vizag encompassing over 2000 hectares of land will undoubtedly be a great fillip to our expanding programme.

While we must work together for achieving the above well focused and time bound goals, we as a scientific community, need to strive harder to ensure providing an excellent academic environment in our organization. The newly established Homi Bhabha National Institute which will become functional soon is a step in this direction. The spirit of enquiry human creativity and urge to excel must be nurtured particularly amongst our younger colleagues, so that research leading to new discoveries and innovative ideas receives adequate support and the so called Blue Sky Research also remains within our purview.

Friends, on today's occasion of Founder's Day celebration, let us rededicate ourselves for sustaining our developmental efforts for taking this premier organization to newer heights and contribute to the national cause in a major way I think this pledge should be the best homage to our founder Dr. Homi J. Bhabha.

Jai Hind!

डॉ. श्रीकुमार बॅनर्जी
निदेशक, भाभा परमाणु अनुसंधान केंद्र का संबोधना

डॉ. काकोडकर, अध्यक्ष, परमाणु ऊर्जा आयोग,
यहाँ उपस्थित डीएई परिवार के वरिष्ठ सदस्यगण एवं प्रिय साथियों,

मेरे लिए यह वास्तव में बड़े हर्ष एवं गर्व की बात है कि मैं आज इस महान संस्थान भाभा परमाणु अनुसंधान केंद्र के संस्थापक डॉ. होमी जे. भाभा की 96वीं जयंती के अवसर पर आप सभी का हार्दिक स्वागत कर रहा हूँ । डॉ. भाभा के प्रति अपनी श्रद्धा और आदर के रूप में प्रति वर्ष 30 अक्तूबर को प्रात: एकत्रित होकर हम सब उनका जन्मदिन मनाते हैं । इस दिन हम बीते हुए वर्ष के दौरान प्राप्त उपलब्धियों का जायजा लेते हैं और नाभिकीय विज्ञान एवं प्रौद्योगिकी के विकास के माध्यम से अपनी जनता के जीवनस्तर को बढ़ाने से संबंधित अपने प्रिय लक्ष्य को प्राप्त करने के प्रति पुन:समर्पित होते हैं । हम नाभिकीय विज्ञान एवं प्रौद्योगिकी के क्षेत्र में अग्रणी बने रहने हेतु अपने अनुसंधान एवं विकास कार्यों को और आगे बढ़ाने तथा राष्ट्र की सुरक्षा में योगदान देने के लिए प्रतिबद्ध हैं ।

मुझे यह कहते हुए अत्यंत खुशी हो रही है कि हमारे विकास के प्रयासों में पिछला वर्ष एक और सफल वर्ष रहा है । हमारे केंद्र में पिछले वर्ष के दौरान किए गए कार्यों एवं प्राप्त उपलब्धियों की सूची काफी लंबी है । मैंने अपने अंग्रेजी वक्तव्य में उनके बारे में प्रकाश डाला है तथा उसे यहाँ फिर नहीं दोहराना चाहूँगा ।

प्रिय साथियों, मुझे यह विश्वास है कि आप इस बात की प्रशंसा करेंगे कि भापअ केंद्र में प्राप्त उपलब्धियां इसलिए संभव हुई हैं क्योंकि यहां हम सब एकदूसरे के प्रति सद्भावना से काम करते हैं । कभी कभी यह आसानी से पता नहीं चल पाता है कि कैसे किसी एक व्यक्ति द्वारा किया गया कार्य पूरे कार्यक्रम के साथ जुड़ जाता है । अत: यह हमारा कर्तव्य है कि हम हमेशा उन रचनात्मक प्रयासों को प्रकाश में लाते रहें जिनके कारण किसी अकेले व्यक्ति द्वारा दिया गया योगदान हमारे कार्यक्रम के अंतर्गत अंतत: बड़ी घटना में तब्दील हो जाता है । इस एकता में ही हमारी शक्ति है । इस संदर्भ में, मैं कहना चाहता हूँ

कि हमारे वैज्ञानिक, प्रशासनिक, सहायक एवं सुरक्षा कर्मचारियों के प्रत्येक वर्ग द्वारा दिया गया योगदान हमारी संपूर्ण उत्कृष्टता को बनाये रखने के लिए समान रूप से महत्वपूर्ण है ।

आप सभी को याद होगा कि हाल ही में मुंबई में बाढ़ की कठिन परिस्थिति के दौरान हमारे सहकर्मियों ने कैसा सहयोग दिया था । बाढ़ की कठिन परिस्थिति में बिना थके हमारी सहायता करने वाले उन सभी व्यक्तियों के प्रति मैं हार्दिक कृतज्ञता प्रकट करता हूँ । अत्यंत कम समय के अंदर प्रभावित क्षेत्रों को साफ करने एवं कई क्षतिग्रस्त उपस्करों को ढूंढ निकालने जैसे कार्य हमारे सहकर्मियों के समर्पित एवं सहयोगी प्रयासों के कारण ही संभव हुए ।

मित्रों, आप सभी इस बात से सहमत होंगे कि हमारे सामने आगे कई चुनौतियां हैं विशेषकर वर्तमान परिदृश्य में जब देश में परमाणु ऊर्जा कार्यक्रम में तेजी से खुलापन आ रहा है । विश्व में हो रहे परिवर्तनों के परिप्रेक्ष्य में नाभिकीय सहयोग के क्षेत्र में हमारे कार्यक्रम में विविध नाभिकीय रिएक्टर प्रणालियों को शामिल करने की बड़ी संभावना है । देश में ऊर्जा की तेजी से वृद्धि की आवश्यकता है । हमें अपने अनुसंधान के दायरे को और बढ़ाना तथा विकसित करना है एवं निकट भविष्य में नई प्रौद्योगिकियों में निष्णांतता हासिल करते हुए आगे आनेवाली चुनौतियों का सामना करने हेतु तैयार रहना होगा ।

नवीनतम रिएक्टर प्रणालियों, त्वरक चालित उपक्रांतिक प्रणाली के विकास से संबंधित हमारे कार्यक्रम में थोरियम के जल्दी उपयोग के बारे में अपनी प्राथमिकताएं एवं चुनौतियां हैं । इन कार्यक्रमों के साथ ही हम आगामी ग्यारहवीं योजना की प्लान परियोजनाओं के अंतर्गत अपने लक्ष्यों को परिभाषित कर अंतिम रूप देने में लगे हैं । जैसाकि आप जानते ही हैं कि हम वर्ष 2006-07 के दौरान बीएआरसी का स्वर्ण जंयती वर्ष मनाने जा रहे हैं और इससे अच्छा अवसर क्या हो सकता है कि जब हम अपने सम्मुख उपस्थित बड़ी प्रौद्योगिक चुनौतियों को स्वीकार करें । विभिन्न गतिविधियों को शुरु करने की योजना का निर्माण एवं वाईज़ाग में 2000 एकड़ से भी अधिक जमीन पर हमारे नए कैम्पस का विकास इस दिशा में एक बड़ा कदम है ।

जहाँ एक ओर हमें उपरोक्त सुकेंद्रित एवं समयबद्ध लक्ष्यों को प्राप्त करने हेतु दृढ़ता से आगे कदम बढ़ाना है वहीं दूसरी ओर एक वैज्ञानिक समुदाय के रूप में हमें अपने संगठन में उत्कृष्ट शैक्षणिक वातावरण सुनिश्चित करने हेतु मजबूत प्रयास करना होगा । नया स्थापित होमी भाभा राष्ट्रीय संस्थान जो शीघ्र ही कार्यरत होने वाला है, इस दिशा में एक महत्वपूर्ण कदम है । हम सभी को व्यक्ति की सृजन क्षमता को बढ़ावा देने तथा उत्कृष्टता के विकास हेतु पूरी सहायता देनी चाहिए, विशेषकर हमारे युवा सहकर्मियों में, ताकि नई खोजों एवं नई संकल्पनाओं के संबंध में किए जाने वाले अनुसंधान कार्यों में उन्हें प्रेरणा मिले एवं तथाकथित ब्लू स्काई रिसर्च हमारे कार्यक्षेत्र का अंग बनी रहे ।

मित्रों, आज संस्थापक दिवस समारोह के अवसर पर आइए, हम इस प्रतिष्ठित संस्थान को नई ऊंचाइयों तक ले जाने के लिए किए जा रहे विकास संबंधी प्रयासों में निरंतरता बनाए रखने के प्रति अपने आपको पुन: समर्पित करें ताकि राष्ट्रहित में हम अपना प्रमुख योगदान दे सकें । मैं समझता हूँ कि हमारी यह प्रतिज्ञा अपने संस्थापक डॉ होमी जे. भाभा के प्रति हमारी उत्तम श्रद्धांजलि होगी ।

जय हिन्द

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 and 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. The Homi Bhabha Science and Technology Award
2. The Technical Excellence Award
3. The Meritorious Service Award

These awards are given annually. The Homi Bhabha Science & Technology Award is the most prestigious amongst these. It consists of a citation, a medal, and an amount 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 award for the year 2005 went to :

1. Dr U. Kamachi Mudali
   Indira Gandhi Centre for Atomic Research, Kalpakkam; and
2. Dr G. Ravi Kumar
   Technical Physics and Prototype Engineering Division, BARC.

Dr U. Kamachi Mudali receiving the Homi Bhabha Science & Technology Award 2005 from Dr Anil Kakodkar, Chairman, Atomic Energy Commission

Dr U. Kamachi Mudali was conferred the Homi Bhabha Science and Technology Award for the year 2004 for his excellent contributions in corrosion science and technology. His prime areas of research and development include corrosion of austenitic stainless steels, advanced titanium based alloys and their welds, coatings and electrodes, and corrosion protection through surface modification. His research career is marked by creative abilities as evidenced by several original findings in the area of corrosion science and technology. He has provided excellent research & development support for the fast breeder reactor program, and associated nuclear fuel reprocessing plants at Indira Gandhi Centre for Atomic Research (IGCAR). Dr Mudali is a keen and active researcher who has put in remarkable efforts for implementing several research projects of immense value to the Department. The hallmark of his work is the high level of originality, focus and innovation.

Dr Mudali began his research career with studying the localised corrosion (pitting, crevice corrosion and intergranular corrosion) behaviour of nitrogen-bearing austenitic stainless steels and their weldments. The findings aided in confidently choosing these alloys as materials of construction for the Prototype Fast Breeder Reactor (PFBR) being built at Kalpakkam. He elucidated a mechanism by which nitrogen enhanced the corrosion resistance in stainless steels. He has established a time-temperature-sensitisation-pitting diagram which can delineate the regions undergoing localised corrosion during various thermal treatments of stainless steels of relevance to our program. He has played an active role as corrosion specialist and has helped in choosing corrosion resistant materials and procedures for corrosion control in a number of systems and components of PFBR. Besides the choice of materials, he has made remarkable contributions to surface treatment procedures and storage methodologies for various components.

Dr Mudali has played a key role in the development of titanium-stainless steel explosive joints to be used in reprocessing plants. He has developed various mixed oxide coated titanium anodes which have found applications in the electrochemical processes employed in fast reactor fuel reprocessing, for example, the electrolytic partitioning of Uranium and Plutonium. Dr Mudali and his colleagues have established a dynamic nitric acid loop with an inventory of 350 litres of 6N nitric acid for providing corrosion rate data for the life assessment of stainless steel components. He has filed a patent for a corrosion protection

method based on oxide coatings on titanium. His current research is aimed at establishing electrochemical noise analysis as an online corrosion monitoring method in reprocessing plants. Though his major efforts are in the development areas in nuclear reactors and nuclear fuel reprocessing plants, Dr Kamachi Mudali has laid emphasis in the basic understanding of the corrosion phenomena.

Dr Anil Kakodkar, Chairman, AEC, presenting the Homi Bhabha Science & Technology Award 2005 to Dr G. Ravi Kumar

Dr Gurazada Ravi Kumar was conferred the Homi Bhabha Science and Technology Award for the year 2004 for his significant contributions to the understanding of the irreversible magnetic behaviour and physics of the order-disorder transition of the vortex matter in weakly pinned superconductors. His work is not only of considerable academic importance but also has great practical relevance.

Dr Ravi Kumar has carried out extensive experimental studies to understand the physics of the order-disorder transition in weakly pinned superconductors. His ingenious development of a novel "half scan technique" to resolve extremely small magnetic hysteresis loops in the presence of inhomogeneous magnetic field in a SQUID magnetometer resulted in a flurry of interesting experimental results. He proposed the idea of metastable supercooled and superheated vortex states to describe the history dependence accompanying the transition. A theoretical model to describe the history dependence was also proposed. His model predicted that a unique equilibrium state could be reached from any metastable configuration by repeated field cycling, which was later substantiated by experiments. Analysis of the equilibrium state provided clear thermodynamic evidence that the order-disorder transition is first order in nature.

Dr Ravi Kumar designed superconducting magnets with high field homogeneity and was also instrumental in setting up facility for characterisation of superconducting cables with critical current upto 1500 amperes. He developed a technique to identify the intra-grain and inter-grain contributions to the magnetic response of granular superconductors. He has also made substantial contributions to the understanding of the thermo-magnetic history dependence of critical currents in high-temperature superconductors.

The second category of awards, that is the Technical Excellence 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 use 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

b) Handling of emergency or crisis situations exhibiting, rare alertness and skill hereby averting accident/serious plant situation; or
c) 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.

Dr A.H.M. Shaikh receiving the Technical Excellence Award 2005 from Dr Anil Kakodkar, Chairman, AEC

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

This year the award went to :

Dr Akhtar Hussain Mehboob Shaikh of Solid State Physics Division, BARC;

and

Joint Nomination of Mr Sankardas Pradhan and Mr Maguluri Srinivasa Rao of the Reactor Projects Division, BARC.

Dr Akhtar Hussain Mehboob Shaikh was conferred the Technical Excellence Award for the year 2004 for his highly commendable contributions to the design and development of neutron and x-ray detectors and radiography facilities at BARC.

The contributions of Dr Shaikh in the field of radiation detectors and radiography have been of crucial importance to the Indian nuclear programme. His group has provided hundreds of neutron detectors for various applications at BARC and other laboratories in India.His expertise in the production of high-quality neutron detectors, extensive development of linear and two-dimensional position-sensitive neutron detectors, development of a variety of x-ray detectors, etc. have all been very important to various R&D programmes of DAE. He has carried out collaborative research for the development of micro-strip detectors that has produced promising results. His work on neutron radiography has been very useful in looking at fuel assemblies, INSAT subsystems, etc. He has been an IAEA expert in detectors and radiography.

In the recent past, Dr Shaikh has exploited the Neutron Radiography technique to study laboratory generated hydride blisters in zircaloy and Zr-Nb2.5%Nb pressure tube materials. The neutron radiographs of coupons of irradiated zircaloy-2 pressure tubes from RAPS-2 were successfully recorded to have hydride formation at PT-CT contact.

Dr Shaikh was also responsible in successfully growing good quality single crystal of copper of large size (80 mm diameter and 50 mm length) which has been used suitably to build a curved monochromator for thermal neutrons.

Mr Sankardas Pradhan and Mr Maguluri Srinivasa Rao were conferred the Technical Excellence Award for the year 2004 for their

highly commendable contributions to the design and development of critical equipment of small reactor system.

Dr Anil Kakodkar, Chairman, AEC, presenting the Technical Excellence Award 2005 to Mr S. Pradhan

Dr Anil Kakodkar, Chairman, AEC, presenting the Technical Excellence Award 2005 to Mr M. Srinivasa Rao

Mr S. Pradhan and Mr M. Srinivasa Rao have done commendable work by way of design and development of equipment, such as support tank and associated systems, which were first of its kind designed and manufactured in the country. Support tank is highly complex equipment designed for critical functional and stringent manufacturing requirements. They have been associated with this Project since its conceptual design stage, development and detail engineering, and subsequently upto manufacturing and supply of these equipment.

Unique functional requirement and high degree of reliability necessitated special design considerations in terms of use of special materials, detailed stress analysis of complex structure and evolution of new manufacturing technologies and inspection methods to meet highly stringent quality control requirements. Extensive studies and experimentation was carried out using numerous mock-ups and trials to establish suitable manufacturing techniques. They have put-up a commendable effort and provided excellent engineering support to the manufacturer for successful completion of these equipment. A computer model was prepared which facilitated in a big way, visualisation of the product and evolution of proper sequencing of manufacturing activities. Mr Pradhan and Mr Srinivasa Rao have exhibited their competence in effectively organising challenging work of plant aggregation, which was extremely complex and entirely new work. Based on their clear understanding of the job and unquestionable devotion to work, they have made the project a success.

Mr Pradhan and Mr Srinivasa Rao have shown consistently excellent performance and have demonstrated their exceptional capability and ingenuity by producing quality work.

The third category of the award is the 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/-

Dr Anil Kakodkar, Chairman, AEC, presenting the Meritorious Service Award 2005 to Mr T.R. Koli

This year the awards go to :

1) Mr Tulshiram Raghunath Koli, Research Reactor Maintenance Division, BARC.
2) Mr C. Subramanian, Central Workshops, IGCAR, Kalpakkam.
3) Mr G.G. Rahate, Atomic Fuels Division, BARC.
4) Mr D.T. Dhanawade, Engineering Design & Development Section, NFG, BARC.
5) Ms Annie Sarah, DAE Hospital, Kalpakkam.
6) Mr D.H. Patwardhan, Molecular Biology Division, BARC.

Mr Tulshiram Raghunath Koli is conferred the Meritorious Service Award for the year 2004 for his dedication to work and his consistently commendable performance in the field of Mechanical Equipment (Piping) Maintenance for CIRUS Reactor.

Mr Tulshiram Raghunath Koli joined BARC in 1977. His intelligent and innovative approach and dedication to work led him to become an excellent pipe fitter. Mr Koli has demonstrated a high degree of professional approach in undertaking the challenging and complex piping jobs in the critical process systems of CIRUS Reactor. The unconventional technique of pipeline isolation by freezing for maintenance of equipment is a rare skill mastered by him. Remote plugging of leaky calandria tubes successfully and repairs on the core coolant outlet cross-header, both involving high degree of accuracy & intricacy are few examples of the outstanding jobs carried out by him. He has demonstrated innovative professional abilities while working in the constrained areas with due regard to radiological aspects.

Refurbishment of fuel channel isolating valves, rehabilitation of primary coolant water system header and repairs on spent fuel transfer buggy in the most expeditious manner with a high degree of precision speak volumes about his consistency in performance.

This citation would remain incomplete if a specific reference is not made to his significant contributions towards implementing the various piping modifications warranting radiographic quality welds in stainless steel piping which were performed with total sense of dedication that improved the plant performance considerably.

Mr C. Subramanian was conferred the Meritorious Service Award for the year 2004 for

his significant contributions to the specific areas of Manufacturing and Development Activities related to Pressure Vessels, Heat Exchangers, Piping for Fast Breeder Test Reactor (FBTR), Prototype Fast Breeder Reactor (PFBR) and other related facilities.

Dr Anil Kakodkar, Chairman, AEC, presenting the Meritorious Service Award 2005 to Mr C. Subramanian

Mr C. Subramanian has remained professionally focused on modification of 100 kW Plasma Transferred Arc Water Cooled Cutting Torch for Plasma Cutting Machine. He is also involved in repair and maintenance of used copper nozzles and tungsten electrode assembly for Plasma Cutting Torch, which basically constitute the lifeline of Plasma Torch. Mr C. Subramanian has acquired very creditably all the skills required in designing and fabrication of special fixtures to manufacture Sodium Storage Tank & Nickel Detector for Steam Generator Test Facility.

A worthy contribution from Mr Subramanian has been in fabrication of a Cooling Coil having multi directional bend including design & fabrication of special fixture for Secondary Sodium Circuit of FBTR and manufacturing of 35 thermo couple tube sheaths for Control Plug of PFBR, comprising of 35 subassemblies which is one sixth of the full scale model. Each sheath has multiple bend in a single plane, with bend radii ranging from 1.2 to 50 metres. The present citation would remain incomplete if reference is not made to the participation of Mr Subramanian in manufacturing of critical nuclear components like Cover Gas Hydrogen Sensor, Sodium Return & Sampling helical thin tubes for Failed Fuel identification Module, Safety Brake Set up for Transfer Arm, Stellited Rupture Disc assembly for FBTR & PFBR respectively including repairing of LP & HP Turbines shroud crack for MAPS.

Dr Anil Kakodkar, Chairman, AEC, presenting the Meritorious Service Award 2005 to Mr G.G. Rahate

Mr Gajanan Gopal Rahate was conferred the Meritorious Service Award for the year 2004 for his distinguished contribution to the specific program of Research & Development as well as

production of several types of nuclear core assemblies, specifically nuclear fuel and other critical components for power reactor programme.

Mr Gajanan G. Rahate has worked on welding of Zirconium alloy by 3 important techniques e.g. Resistance, Gas Tungsten Arc Welding (GTAW) and Electron Beam Welding. He has shown great proficiency and has novel approach to meet the specific requirements of intricate geometry of new products.

A significant contribution of Mr Rahate is in end closure welding of cylindrical reactor components having very small plenum space and developing idea to the stage of production. He also worked on joining of spacers on empty clad tubes for Pressurized Heavy Water Reactor (PHWR) fuel assemblies and welding technique for end closure joints of non-conventional type. He successfully modified existing resistance welding machine and adapted it to meet the quality requirement. This has been an important link in the production chain. He developed a dissimilar metal welding method, using resistance welding for fabrication of special structures in tantalum and molybdenum. He has made useful suggestions in modifying the existing EB Welding equipment for increasing productivity of equipment and quality of burnable poison rods. Description of his role in the programme cannot be concluded without mention of development of a process as well as a furnace for infiltration technique required for fuel fabrication for light water reactor.

Mr Rahate is a keen observer and an expert trouble shooter. He has kept himself professionally updated while working at the shop floor with his colleagues on experimentation, devising novel methods and tools for fabrication process.

Mr Dinkar Tukaram Dhanawade is conferred the Meritorious Service Award for the year 2004 for his outstanding contribution to the specific area of process equipment and tool development for plutonium based fuel fabrication inside glove box.

Dr Anil Kakodkar, Chairman, AEC, presenting the Meritorious Service Award 2005 to Mr D.T. Dhanawade

Mr Dhanawade has mastered the operation of glove box system & equipment / machinery required for fabrication of plutonium bearing fuels. He is a man of exceptional skill with a capability to come out with many original ideas for solving technical problems. He was deeply involved in all the major projects executed by Engineering Design & Development Section over the years.

He has demonstrated his caliber in machining intricate parts out of reactive and radiotoxic materials to a high degree of precision within the constrains of alpha-tight glove boxes. Mr Dhanawade has also made significant contributions to the development of turning fixtures for generating intricate profiles and modification of commercial lathe machines for operation inside glove boxes. He has evinced keen interest in housing the CNC lathe inside the

glove box and mastered its operation within a short span of time.

Mr Dhanawade has shown extraordinary ability in visualization and development of tooling, jigs and fixtures for compaction of reactive components to intricate shapes, manufacture of delicate hardware and jacketing the compacts into hermitically sealed fuel components.

Dr Anil Kakodkar, Chairman, AEC, presenting the Meritorious Service Award 2005 to Ms Annie Sarah

Ms R. Annie Sarah was conferred the Meritorious Service Award for the year 2004 for her significant contribution to the specific area of Nursing and hospital management activities.

Ms R. Annie Sarah had shown a genuine commitment to her chosen profession. Her empathy with patients and selfless service with sincerity had drawn admiration from all. In the wards, her constant attention and care of patients entrusted to her, had helped her to note critical symptoms in the patients and administer the first aid at the appropriate time which had helped to save precious lives.

She has been a role model for the junior staff. Her discipline in her day to day work is worthy of emulation. She has remained focused in her job and trains all new para-medical staff with dedication. As a nursing supervisor for 8 years, she has shown excellent leadership qualities and contributed to the improvement of hospital services.

She has carried out her work with a pride in her profession. Her contribution to the quality of nursing has helped in the smooth functioning of the DAE Hospital, Kalpakkam.

Mr Dattatraya Hari Patwardhan was conferred the Meritorious Service Award for the year 2004 for excellent technical assistance to research and applications in the area of stress biology and crop improvement programs of Bioscience Group.

Mr Dattatraya H. Patwardhan made significant contributions to the IAEA project on Neutron Irradiation of Seeds for improvement of rice and jute crops in the 1970s, and provided skillful technical assistance to the three-year long

Dr Anil Kakodkar, Chairman, AEC, presenting the Meritorious Service Award 2005 to Mr D.H. Patwardhan

field trials conducted for the evaluation of cyanobacterial and Azolla nitrogen biofertilisers in the 1980s.

Other noteworthy contributions of Mr Patwardhan include meticulous operation and maintenance of a 15-L fermentor for mass cultivation of cyanobacteria, and operation of a system for procurement of highly perishable biochemicals from Centre for Biochemical Technology, Delhi and their efficient distribution to various Divisions in the Bioscience Group, in the 1990s. This citation would be incomplete without mention of Mr Patwardhan's enthusiastic participation and dependable assistance to the stress biology research in the Molecular Biology Division in recent years.

BARC ANNOUNCES INDUSTRIAL SAFETY AWARD SCHEME

As a part of safety promotional activities in BARC, an Industrial Safety Award scheme, in the form of Director's Safety Shield on rotation, has been introduced by Industrial Hygiene and Safety Section of Radiation Safety Systems Division (RSSD) since the year 2004. Trombay Council, after approving the proposal, constituted the Industrial Safety Award Scheme Committee under the Chairmanship of Mr P.B. Kulkarni, Chairman, Conventional and Fire Safety Review Committee (SFSRC) and Director, Engineering Services Group for finalisation of the methodology for categorisation of work activities, assessment procedure etc. Accordingly, Director's Safety Shield has been instituted for three different categories, viz. :

Category A : Operating Plants,
Category B : Research & Development Laboratories amd Industrial Units
Category C : Engineering, Projects and Support Services

For the year 2004, in response to the circular from Head, Radiation Safety Systems Division, BARC, various Divisions/Units of BARC submitted entries under the respective categories. Industrial Safety Award Scheme Committee scrutinised the entries and short-listed a few of them for final assessment through plant visits and document verifications. Based on the assessment report submitted by an Inspection Team, the Committee concluded to declare PREFRE, Tarapur, as the winner of the Safety Shield under the Category A: Operating Plants. However, the Committee did not find any

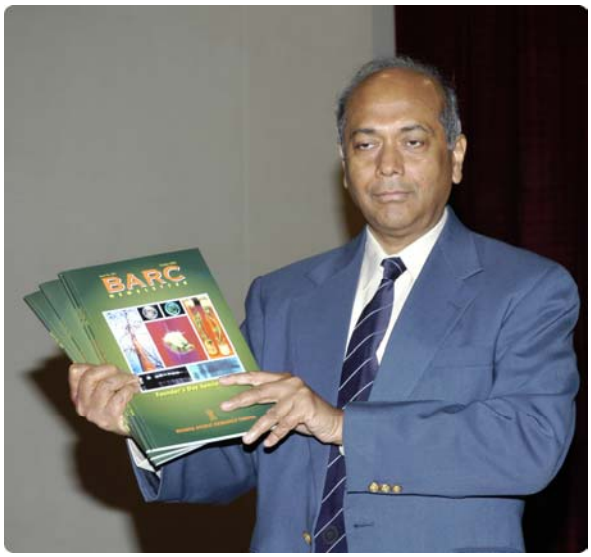
Dr S. Banerjee, Director, BARC, awarding the Safety Shield for the year 2004 to PREFRE authorities, Tarapur

of the entries for consideration of the award in Categories B and C.

The Safety Award was given away by Director, BARC, to the winner during the Founder's Day function held on October 28, 2005 at the Central Complex Auditorium, BARC. On behalf of PREFRE Plant, Mr P. Janardan, Plant Superintendent, Mr R.D. Changarani, Chief Superintendent, NRG Facilities, Tarapur, and Mr P.K.Dey, Head, Fuel Reprocessing Division, BARC, received the safety shield. Initially, on behalf of Industrial Safety Award Committee, Member Secretary Dr D.K. Ghosh, then Head, Industrial Hygiene and Safety Section, RSSD, briefed about the award scheme to the audience and later declared the winner.

Special Issue of BARC Newsletter

After presenting the Industrial Safety Shield, 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 in various awards in the year 2004.



Dr Srikumar Banjeree, Director, BARC, releasing the special issue of BARC Newsletter ***on the occasion of Founder's Day 2005***

XVIITH ALL INDIA ESSAY CONTEST IN NUCLEAR SCIENCE & TECHNOLOGY

DAE All India Essay Contest in Nuclear Science and Technology for students was started by the Department in the year 1989. The essay contest has been instrumental in spreading awareness amongst students about the programme of the Department and importance of the nuclear programme for sustainable energy production as well as for peaceful applications for societal benefits. It also provides an opportunity for the selected students to interact with the experts in the field and to visit some of the Departmental facilities which help in broadening their perspective of the Department's activities. The essay contest has been very popular among the student community and it can be gauged from the fact that since its inception more than 14,500 students at graduate level have taken part till date. This year's contest is the 17th in the series.

The two topics for this year's essay were :

(A) Nuclear power : A Viable Alternative in the context of India's Future Energy Needs and Environmental Safety

(B) Radioisotopes and Radiation Technology : Unique Applications for Societal Benefit

The written essays were evaluated by a team of 67 evaluators forming 9 groups drawn from BARC, NPCIL and BRIT. After preliminary evaluation, the essays were subjected to a normalisation process within the group. The short listed essays from each group were assessed further through inter group evaluation and final round of normalisation. First 15 contestants in the merit list for each topic were invited to make an oral presentation of their essays, which was conducted on October 27, 2005.

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

Winners of the XVIIth All India Essay Contest in Nuclear Science & Technology

basis of total marks obtained in the written version and in the oral presentation together.

In response, a total of 489 essays were received out of which 306 were on the first topic and 183 on the second topic (415 in English and 74 in other India Regional languages).

The essays evaluated by 67 evaluators were in nine groups. The group leaders for Topic (A) were : Mr R. Mago, General Manager, CC & PA, NPCIL, Mr B.B. Narang, Associate Director, (CPS & RES), NPCIL, Mr S.K. Agarwal, Head, Reactor Operations Division, BARC, Mr S.K. Marik, Head, Research Reactor Services Division, BARC, Mr A.V. Kharpate Head, Research Reactor Maintenance Division, BARC, and Mr K. Anantharaman, Reactor Engineering Division, BARC. The group leaders for Topic (B) were : Dr V. Meera, Head, Radiopharmaceutical Division, BARC, Dr Sunil Sabharwal, Head, Radiation Technology Development Section, BARC, and Mr Gurusharan Singh, Head, Isotope Application Division, BARC.

After evaluation, 15 contestants which included 3 girls from Topic (A) and 15 contestants from Topic (B) which included 7 girls were invited to make oral presentation on their essays.

On October 28, 2005, Dr Anil Kakodkar, Chairman, AEC, distributed the prizes to the following winners of the essay contest.

Topic (A) : "Nuclear power : A Viable Alternative in the context of India's Future Energy Needs and Environmental Safety". The important subjects which the essay covered were: demand of electricity in India, various energy options and inevitability of nuclear power based on fuel resource position, contribution of research reactors for technology development, environmental issues, cost comparisons, etc. India's 3-stage nuclear power programme, DAE's capability in the nuclear fuel cycle, heavy water production and waste management were also covered.

Topic (B) : "Radioisotopes and Radiation Technology : Unique Applications for Societal Benefit". The important subjects which essay covered were: Radiation sources - Radioisotopes, Electron Beams and Lasers. Contribution of research reactors and accelerators in production of radioisotopes,

application in healthcare, food and agriculture, industry, environment, water resource management and basic sciences were also covered.

Prize Winners : Topic (A)

First prize: Rs. 7500/-
Ms K. Rajasulochana, B.Sc. III, Kovilpatti, *Tamil*

Second prize: Rs. 5000/-
Mr T. Thangadurai, B.Sc. II, Perumalpuram, *English*

Third prize: Rs. 3000/-
Mr Sanjiv Kumar S. Siddul, B.Sc.III, Solapur, *English*

Prize Winners : Topic (B)

First prize: Rs. 7500/-
Ms Shweta Nalawade, B.Sc. III, Ratnagiri, *English*

Second prize: Rs. 5000/-
Mr Ashwini Kumar Gupta, B.Tech. IV, Tirupati, *English*

Third prize: Rs. 3000/-
Ms Neeta Anil Salgaonkar, B.Sc. II, Ratnagiri, *English*

In addition to the above prize-winners, there were 12 consolation prize winners for Topic (A) and 11 for Topic (B).

FOUNDER'S DAY LECTURE

This year the Founder's Day lecture was delivered by Dr Placid Rodriguez, Raja Ramanna Fellow, Indian Institute of Technology, Madras and former Director, IGCAR, Kalpakkam, on the topic, "From three decades of nuclear isolation to global leadership in nuclear technology in three decades".

The author who had a career-long, four decades of association with the Department of Atomic Energy started the lecture by recalling the heady

Dr Placid Rodriguez, Raja Ramanna Fellow, Indian Institute of Technology, Madras and former Director, IGCAR, Kalpakkam delivering the Founder's Day lecture at Central Complex auditorium, BARC

exciting days of the early years. The growth of the Indian nuclear programme from the early Nehru-Bhabha days to the present has been truly spectacular. Indian Pressurised Heavy Water Reactor Technology can be said to have reached "technical maturity" in recent years. After some early hiccups, not unusual for a new technology, the Fast Breeder Reactor (FBR) programme seems to have taken firm roots. We are now a "de facto nuclear weapon state". This has contributed immensely to boost the national pride, morale, prestige and national security.

Whatever may be the open reactions and criticisms from the nations around the globe, the respect and admiration (often not expressed openly) for India have only grown. The recent positive engagement between India and the US and the responses from the members of the Nuclear Supplier Group is a manifestation of this appreciation of India's nuclear capabilities and its role in the imminent renaissance in nuclear power technology in the whole world.

"The return of the nuclear power" globally can see India in a leadership position by 2050, and possibly earlier by 2030. Our potential for leadership in PHWR FBR and Thorium Utilization Technologies is highlighted. It is emphasized that the potential is independent of any import of LWRs by the country. The potential includes India's roleas a supplier of Technology as well as Human Resources to the rest of the world. The lecture recommended the paradigm shifts essential to realize the potential.

DAE-BRNS NATIONAL SYMPOSIUM ON "COMPACT NUCLEAR INSTRUMENTS AND RADIATION DETECTORS-2005" (CNIRD-2005)

A DAE-BRNS National Symposium on "Compact Nuclear Instruments and Detectors" organised jointly by BARC, Mumbai, and Defence Laboratory, Jodhpur, was held in the premises of The Institution of Engineers (India) at Jodhpur during March 2-4, 2005. The symposium was inaugurated by Dr Deepankar Banerjee, Distinguished Scientist, Chief Controller R&D (AMS) of DRDO. Mr G. Govindarajan, Director, A&M and E&I Groups, BARC, delivered the Presidential address and inaugurated the Technical Product Exhibition. Mr R.K. Syal, Director, DL Jodhpur, delivered the welcome address.

Over 180 participants attended the symposium from different labs of DAE, DRDO, ISRO, CSIR (CEERI), CDAC, etc including active participation by the public sectors and industries in this field. There were 26 technical invited talks and 97 technical posters related to innovations in gas filled detector, plastic / NaI(Tl)/CsI/CZT detectors, semiconductor detectors, self powered detectors for ionizing radiations along with FPGA/ASIC/ Hybrid microcircuits, compact nuclear instrumentation and embedded systems as supporting electronics. The deliberations were made by the experts from these fields. All technical papers were displayed in three poster sessions. Each of the session had three to four expert reviewers. There was a process to select the best paper award. A committee constituted to evaluate all the contributory papers based on the reviews made by the poster session experts. Following two technical papers are selected for the best paper awards:

1. 'Compact 8K Multichannel Analyzer with USB Interface and Multi-mode Operation' by C.P. Kulkarni, M. Vinod, M. Poulson, P.P. Vaidya, M.D. Ghodgaonkar and S.K. Kataria, Electronics Division, BARC; and 'An Advanced Personal Dosimeter Reader System for Nuclear Radiations' by A.S. Rathore, A.K. Yadav, D.K. Gupta, P.K. Bhatnagar, H.C. Samaria, R.L. Chouhan and Mukesh Gautam, Defence Labs, Jodhpur.

Nuclear Instrument manufacturing vendors like PLA, Nucleonix, Electronics Enterprises, BEL, Intel Design System Pvt. Ltd., Keithley International Environment Consultancy made the industrial representations in the form of exhibits. State-of-art compact nuclear instruments developed at BARC including USB MCA and low power portable spectroscopy system were also exhibited.

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