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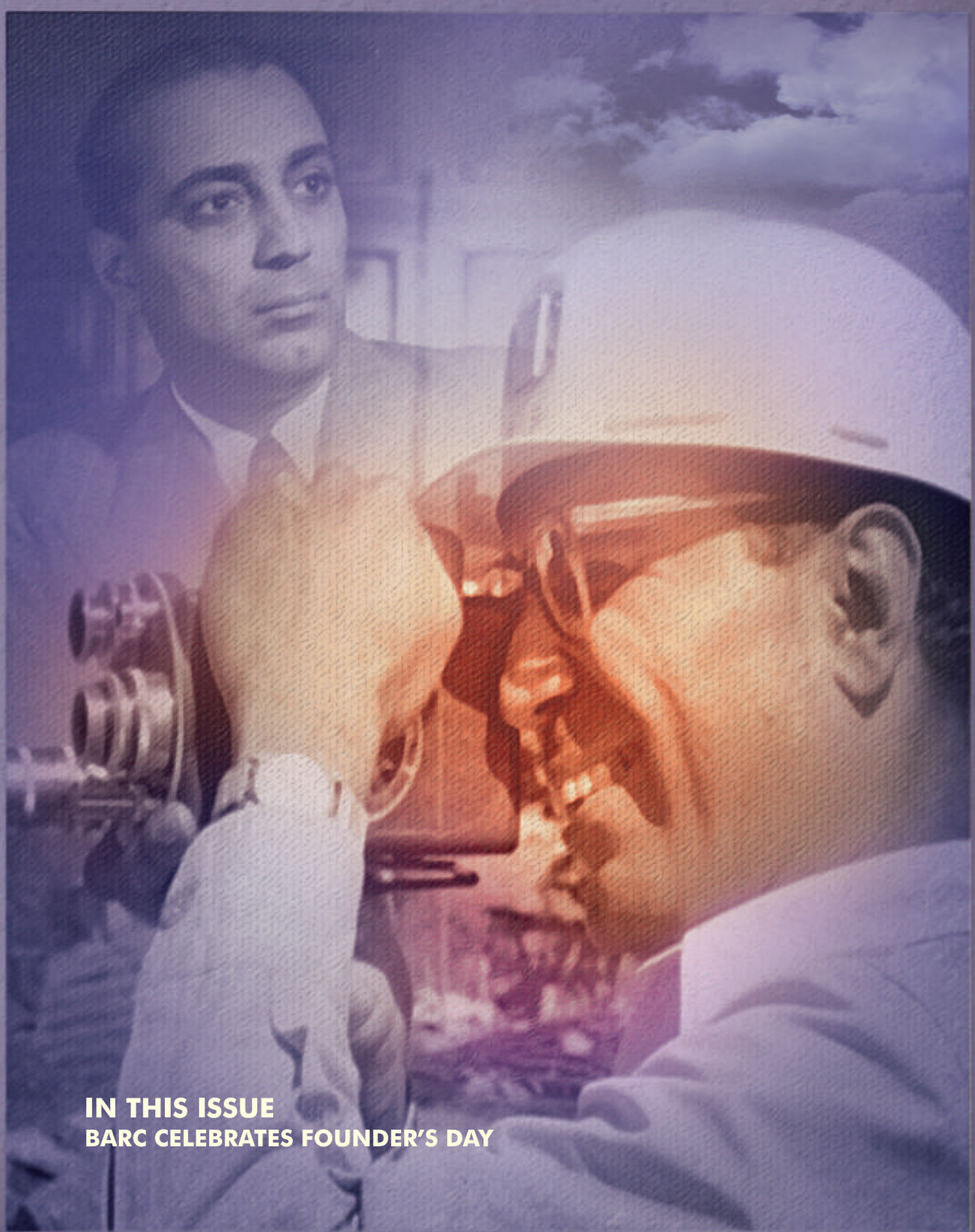
बी एआरसी न्यूज़लैटर
BARC NEWSLETTER



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BARC CELEBRATES FOUNDER'S DAY

In the forthcoming issue

Development of IR-based carbon analyzer for Uranium Metal

Uranium metal samples are received from other Divisions of BARC, for analysis of carbon content. For this purpose, a carbon analyzer is used. Earlier analyzers were based on low pressure method, which was very tedious. Therefore, the Analytical Chemistry Division has designed and fabricated a new type of carbon analyzer, which is based on IR detection system and which considerably decreases the analysis time. The instrumentation, the electronic hardware & software associated with the system, the standardization of the system and sample analysis have been detailed in the present article.

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BARC CELEBRATES FOUNDER'S DAY

On the 30th of October 2009, the Bhabha Atomic Research Centre, celebrated the 100th birth anniversary of it's Founder, Dr. Homi Jehangir Bhabha. The morning session of the day began with the address of Dr. Srikumar Banerjee, Director, BARC. Dr. Anil Kakodkar, Chairman AEC and Secretary, DAE also addressed the gathering of BARC Scientists and Engineers, outside the Central Complex auditorium. Later, inside the auditorium, the Chairman gave away the prizes to the winners of the 21st DAE All India Essay Writing Contest. Dr. Anil Kakodkar also released the Founder's Day Special Issue of the BARC Newsletter and also a Booklet on Scientometric Portrait of Dr. Bhabha. This was followed by the presentation of the Industrial Safety Shield & Award by Director, BARC. Mr. U.K. Chatterjee , Former Head , L&PTD, BARC delivered the Founder's Day Special Lecture. In the afternoon session, Chief Guest Prof. S.P. Sukhatme, Former Chairman AERB, distributed the DAE Awards for Excellence in Science & Technology for the year 2008. The programme concluded with a vote of thanks by Dr. S. Banerjee, Director BARC.

संस्थापक दिवस 2009
डॉ. अनिल काकोडकर
अध्यक्ष, परमाणु ऊर्जा आयोग द्वारा संबोधन

डॉ.अनिल काकोडकर, अध्यक्ष, परमाणु ऊर्जा आयोग द्वारा संबोधन

" प्रिय साथियों,

यह संस्थापक दिवस एक विशेष अवसर है, क्योंकि यह हमारे संस्थापक डॉ. होमी जहांगीर भाभा के जन्म की 100वीं वर्षगांठ पर आया है। बीता साल इस जन्म शताब्दी वर्ष को मनाते हुए बहुत से उल्लेखनीय कार्यक्रमों से भरा रहा। बहुत से कार्यक्रमों के अलावा पिछले वर्ष आज के दिन हमारे प्रधानमंत्री, डॉ. मनमोहन सिंह द्वारा शताब्दी वर्ष का उद्घाटन, "परमाणु ऊर्जा के शांतिपूर्ण उपयोग" विषय, जिस पर डॉ. भाभा ने स्वयं 1955 में प्रथम जेनेवा सम्मेलन की अध्यक्षता की थी, पर एक माह पूर्व दिल्ली में आयोजित महत्वपूर्ण अंतर्राष्ट्रीय सम्मेलन से न केवल हमें डॉ. भाभा की दूरदृष्टि एवं उनकी याद के प्रति अपना सम्मान प्रकट करने और अपने परमाणु ऊर्जा कार्यक्रम के विभिन्न पहलुओं पर विचार-विमर्श करने का मौका मिला बल्कि कई प्रकार से इसमें हम सभी को इस लायक बनाया कि इस कार्यक्रम को तेजी से क्रियान्वित करने के लिए हम अपने आपको तैयार कर सकें तथा यथासंभव कम से कम समय में डॉ. भाभा के सपनों को पूरा कर सकें।

मैं आप सभी के सामने अपने घरेलू त्रिचारणीय कार्यक्रम और अंतर्राष्ट्रीय असैन्य नाभिकीय सहयोग के बीच समन्वय द्वारा नये अवसर रखता रहा हूँ। एक व्यापक आधार वाला समूह हमारे नाभिकीय विद्युत कार्यक्रम के लिए कुशलता से आगे का मार्ग प्रशस्त कर रहा है। इस समूह की एक महत्वपूर्ण विशेषता यह है कि इसमें लगभग सभी क्षेत्रों के कई विशेषज्ञ शामिल हैं जो देखेंगे कि क्रियान्वयन के कार्य पूरे हो जाएं। ऐसा प्रतीत होता है कि जो प्रौद्योगिकियां उपलब्ध हैं उनके आधार पर 2032 तक दाबित भारी पानी रिएक्टरों, साधारण जल वाले रिएक्टरों, द्रुत अभिजनक रिएक्टर एवं प्रगत भारी पानी रिएक्टरों के माध्यम से और लगभग 59,000 मेगावाट बिजली के उत्पादन की क्षमता जोड़ी जा सकती है। इस समूह ने अनेक ऐसे कदम परिभाषित किये हैं जिसे हमें परमाणु ऊर्जा विभाग में अपनाने की जरूरत है और अब यह उन संबंधित कार्रवाइयों पर कार्य कर रहा है जो परमाणु ऊर्जा विभाग से बाहर औद्योगिक क्षेत्र के लिए आवश्यक हैं। मध्यावधि में इस समूह ने धात्विक ईंधन पर आधारित द्रुत अभिजनक रिएक्टरों एवं उसके ईंधन चक्र से संबंधित प्रौद्योगिकियों के विकास पर जोर दिया हैं।

और उन सभी अनुसंधान एवं विकास कार्यों की स्पष्ट रूप से पहचाान कर ली है जिन्हें एक निर्धारित समय- सीमा में पूरा किया जाना है। दिल्ली सम्मेलन का उद्घाटन करते समय हमारे प्रधानमंत्री ने वर्ष 2050 तक 470,000 मेगावाट बिजली का लक्ष्य निर्धारित किया है। यह लक्ष्य हमारी उन संभावित परिदृश्यों की सीमा के भीतर है जिसका इस समूह ने मूल्यांकन किया है। इस समूह ने ऐसी प्रौद्योगिकियों की भी जानकारी दी है जिन्हें दीर्घकालिक रूप से हमारे विशाल थोरियम के भंडारों एवं संलयन ऊर्जा का पूर्ण रूप से उपयोग करने के लिए विकसित करना जरूरी है।

हाल ही में हुई प्रगति का जिक्र करते हुए यह उल्लेखनीय है कि हमें काकरापार एवं रावतभाटा में दाबित भारी पानी रिएक्टरों की 700 मेगावाट विद्युत क्षमता की एक-एक इकाई स्थापित करने का अनुमोदन प्राप्त है। सरकार ने 700 मेगावाट विद्युत क्षमता वाले कुल च्ह दाबित भारी पानी रिएक्टरों की स्थापना के लिए दो नये स्थलों और पहले अनुमोदित कुडनकुलम एवं जैतापुर स्थलों के अतिरिक्त नये स्थलों के लिए भी साधारण जल रिएक्टरों के पार्कों की स्थापना हेतु अनुमोदन दे दिया है। जादुगुड़ा में यूरेनियम मिल के विस्तार का काम पूरा किया जा चुका है। जबकि तुरमडीह मिल के विस्तार, मोहुलडीह में खान तथा तुम्मलापल्ली में खान और मिल के निर्माण का कार्य चल रहा है। हम आशा करते हैं कि कर्नाटक, मेघालय एवं आंघप्रदेश में शीघ्र ही यूरेनियम की और भी परियोजनाएं शुरू हो जाएंगी। यूरेनियम की उपलब्धता में उत्तरोत्तर सुधार के साथ हम अब यह देख रहे हैं कि हमारे रिएक्टरों के क्षमता गुणक में बढ़ोत्तरी हो रही है तथा अगले कुछ महीनों में आरएपीपी-5 एवं 6 तथा कैगा-4 में नयी इकाइयों को शुरू करना संभव होना चाहिए। कुडनकुलम इकाई-1 एवं 2 तथा प्रोटोटाइप फास्टब्रीडर रिएक्टर के निर्माण का कार्य लगातार प्रगति पर है।

इंदिरा गांधी परमाणु अनुसंधान केन्द्र एवं भाभा परमाणु अनुसंधान केन्द्र द्वारा विकसित की जा रही एअर बोर्न टाइम डोमेन इलेक्ट्रो-मैग्नेटिक (टीडीईएम) प्रणाली आशा के अनुरूप परिणाम दिखा रही है और शीघ्र ही क्षेत्र में तैनाती के लिए उसके उपलब्ध होने की आशा है। टीडीईएम जमीन में गहराई पर स्थित ऐसे निक्षेपों का पता लगाने का एक महत्वपूर्ण औजार है जिनका कोई लक्षण सतह पर नहीं दिखता और इसने एएमडी के यूरेनियम अन्वेषण के प्रयासों में एक नया आयाम जोड़ा है।

वीईसीसी स्थित अतिचाालक साइक्लोट्रोन ने बीम को आंतरिक रूप से उसकी पूर्ण क्षमता में त्वरित कर दिया है तथा यह सुविधा बीम के एक बार बाहर निकाल लिए जाने के बाद प्रयोगों के लिए उपलब्ध हो जाएगी।

एक महत्वपूर्ण उपलब्धि हमने तब प्राप्त की जब आईएनएस अरिहंत का प्रक्षेपण किया गया। हमारे लिए यह एक गौरव का क्षण था जिसमें एक सुसंहत नाभिकीय विद्युत संयंत्र के निर्माण में, जिसके लिए संबंधित विनिर्देशों को सटीक रूप से क्रियान्वित करना अत्यंत कठिन होता है, स्वदेशी क्षमता को साबित किया जा सका। कल्पाक्कम स्थित भूमि आधारित रूप जो पहले प्रचाालनरत था अचछी तरह से कार्य कर रहा है। यह भी विद्युत उत्पादन के लिए स्वदेशी रूप से पीडब्ल्यूआर प्रणालियों के निर्माण में हमारी घरेलू क्षमता को प्रदर्शित करता है।

विद्युत के अलावा हमारे कार्यक्रम की दिशा खाद्य एवं कृषि, मानव एवं पशु स्वास्थ्य, शहरी एवं ग्रामीण अपशिष्ट प्रबंधन, स्वच्छ पेयजल एवं अनेक औद्योगिक अनुप्रयोगों के क्षेत्र में सामाजिक लाभ पहुंचाने की भी रही है। वास्तव में इसके परिणाम स्वरूप हम अपने कार्यक्रम को एक मानवीय स्वरूप भी प्रदान कर पाये हैं। इसके लिए प्रयोगशालाओं में कार्य करने के अलावा समाज के विभिन्न वर्गों तथा प्रयोगशाला में किये गये विकास कार्यों को समाज तक ले जाने के लिए अन्य जोखिम उठाने वाले लोगों (स्टेक होल्डरों) को शामिल करने की जरूरत होती है। मुझे इस बात की खुशी है कि विकसित भाभाट्रोन सुदूर चिकित्सा प्रणाली, निसर्ग ऋण अपशिष्ट बायोडाईजेस्टर एवं आकृति फ्रेम वर्क कार्य तेजी से बढ़ रहा है और इनका समाज पर विशेष प्रभाव पड़ रहा है।

अब यह अधिक स्पष्ट होता जा रहा है कि हम अनेक ऐसी गतिविधियों पर कार्य कर रहे हैं जो या तो समकालीन हैं या वास्तव में कुछ मामलों में हम बाकी दुनिया से आगे हैं। इसके लिए हमारा प्रेरक बल हमारे कार्यक्रम संबंधी आदेशों में निहित है। इस बात के होते हुए भी कि कहीं और समान विकास हो या न हो, हमारे लिए चूंकि यह आवश्यक है कि हम अपने मार्ग पर आगे बढ़ते रहें, हमारे संस्थानों की अनुसंधान गतिविधियों तथा हमारे कार्यक्रम में उपयोग के लिए अनुप्रयोगों के विकास के बीच मजबूत संपर्क का अत्यंत महत्व है। इसीलिए हम होमी भाभा राष्ट्रीय संस्थान (एचाबीएनआई)

के अंतर्गत मूलभूत अनुसंधान और संबंधित प्रौद्योगिकी के इंटरफेस पर पीएचडी स्तर के अनुसंधान पर जोर देते रहे हैं। शीघ्र ही हमारे, विशेषकर हमारी समझदारी या हमारी क्षमता के बीचा के अंतरालों में जुड़े क्षेत्र के अनुसंधान के विविध विषयों का एक ऐसा भंडार मिलने की आशा है जिसमें से विद्वतजन इस कार्यक्रम के महत्वपूर्ण क्षेत्रों में अपने अनुसंधान के विषयों का चयन कर सकेंगे।

भविष्य को देखते हुए हम अपनी अनुसंधान संबंधी अवसंरचाना का विस्तार कर रहे हैं। इसके कुछ प्रमुख उदाहरण हैं, विशाखापत्तनम के पास ट्रांबे परिसर से भी काफी बड़े क्षेत्र में बीएआरसी के एक नये परिसर; हैदराबाद में टीआईएफआर का एक नया परिसर; कोलकाता में वीईसीसी एवं एसआईएनपी के लिए एक नया परिसर आदि। एक दूसरा क्षेत्र है मानव संसाधन का विस्तार जिसने हमारा ध्यान अपनी ओर खींचा है। अब हम डीएई-एमयू-सीबीएस तथा नाइसर, के माध्यम से 10+2 स्तर से शुरू कर, एनआईयूएस के माध्यम से बीएससी स्तर, बीएआरसी प्रशिक्षण विद्यालय के माध्यम से बीई/बी.टेक, एमएससी/एम.टेक स्तर तथा एचबीएनआई के माध्यम से पीएचडी कार्यक्रम तथा केएसकेआरए योजना के माध्यम से पीएचडी के बाद के स्तर के विभिन्न स्तरों पर सर्वोत्तम प्रतिभा को प्राप्त कर सकेंगे, ऐसी संभावना है। हमारी यह जिम्मेदारी होनी चाहिए कि हम इन युवा लोगों को परामर्श दें तथा उनके आस-पास अच्छा परिवेश बनाये जो उनकी सृजनशीलता को बढ़ाने और नये उभरते क्षेत्रों में और उत्कृष्ट कार्य करने में अपनी मानसिक क्षमता का उपयोग करने में सहायक हो। इसके लिए हम अपने कार्यक्रम के प्रति उत्तरदायी हैं और इस प्रकार अपने राष्ट्र के प्रति भी जवाबदेह हैं।

साथियों आज इस पोडियम से मैं आपको अन्तिम बार संबोधित कर रहा हूँ। आपने कार्यक्रम के प्रति अपनी जो सशक्त प्रतिबद्धता दिखायी है और ईंधन आपूर्ति के संकट से निकलने में हमारे प्रयासों को जिस तरह से अपना समर्थन दिया है उससे हमारा कार्यक्रम तेजी से आगे बढ़ सका और राष्ट्रीय जरूरतें तथा लोगों की आशाएं पूरी हो सकीं उसके लिए मैं आप सभी को धन्यवाद देता हूँ। वास्तव में डॉ. भाभा ने हमारे लिए यही कार्य निर्धारित किया था। आइए हम यह सुनिश्चित करें कि इस समूह द्वारा भविष्य के लिए जो मार्ग निरूपित किये गये हैं उसे पूरे समर्पण के साथ और निर्धारित समय-सीमा में पूरा किया जाएगा। इससे पहले कि काफी देरी हो जाय आइए हम इसे शीघ्र पूरा करने का संकल्प लें और भाभा के सपनों को साकार करें। डॉ. होमी भाभा के जन्म दिन की 100वीं वर्षगांठ पर उनके प्रति हमारी यह सच्ची श्रद्धांजलि होगी।

धन्यवाद।"

ADDRESS BY DR. ANIL KAKODKAR CHAIRMAN, ATOMIC ENERGY COMMISSION

"Dear Colleagues,

This Founder's Day is a special occasion, as it marks the 100th birth anniversary of our founder Dr. Homi Jehangir Bhabha. The year that has gone by was full of several events to commemorate the birth centenary year. Inauguration of the Centenary Year by our Prime Minister, Dr. Manmohan Singh on this day last year, the major international conference held in Delhi a month ago on 'Peaceful Uses of Atomic Energy', a theme on which Dr. Bhabha himself had chaired the First Geneva Conference in 1955, apart from many other events have not only allowed us to pay our respect to the vision and memory of Dr. Bhabha and to deliberate on different aspects of our atomic energy programme, but also in many ways have enabled all of us to get ready for an accelerated implementation of the programme and fulfill Dr. Bhabha's vision in the shortest possible time.

I have been placing before all of you new opportunities through synergy between our domestic three stage programme and international civil nuclear cooperation. A broad based group is refining the way forward for our nuclear power programme. An important feature of the group is involvement of a significant number of experts in almost all related fields who would be around to see the implementation through. It seems that based on technologies that are available, it is possible to add a capacity of around 59,000 MW of electricity generation through PHWRs, LWRs, FBRs and AHWR by the year 2032. The group has defined various steps that we need to take in DAE and is now working out the related actions that are necessary in the industrial domain outside DAE. In the medium term, the group has emphasized on development of technologies related to metallic fuel based FBRs and their fuel cycle with clear identification of R&D tasks that need to be completed along with their respective time frames. While inaugurating the Delhi Conference, our Prime Minister has set up a goal of 470,000 MWe by the year 2050. This goal is well within the range of possible scenarios that have been evaluated by the group. The group has also brought out the technologies that need to be developed to fully exploit our vast thorium resources and fusion energy in the long term.

Coming to some of the recent developments, we now have the approval for two 700 MWe units of PHWRs each to be set up at Kakrapar and Rawatbhata. Government has also given approval for two new sites for setting up a total of six 700 MWe PHWRs and three new sites for setting up parks of Light Water Reactors in addition to sites at Kudankulam and Jaitapur that were approved earlier. Work on expansion of uranium mill at Jaduguda has been completed. While expansion of the mill at Turamdih, construction of mine at Mohuldih and mine and mill at Tummalapalli is progressing, we expect soon to start additional uranium projects in Karnataka, Meghalaya and Andhra Pradesh. With progressive improvement in availability of uranium, we have already started seeing increase in the capacity factor of our reactors and it should be possible to start new units at RAPP-5 & 6 and Kaiga-4 in the next few months. Construction of Kudankulam units 1 & 2 and PFBR continues to make progress.

Development of air borne Time Domain Electro-Magnetic (TDEM) system by IGCAR and BARC is showing promising results and is expected to be available for field deployment soon. TDEM is an important tool to detect deep seated deposits that do not have any surface manifestations and has added a

new dimension to AMD's uranium exploration efforts. Superconducting Cyclotron at VECC has accelerated the beam internally to the full potential and the facility would become available for experiments once the beam has been extracted out.

An important milestone was crossed when INS Arihant was launched. This was a proud moment demonstrating indigenous capability in building compact nuclear power plant meeting exacting and difficult to realise specifications. The land based version at Kalpakkam that was operational earlier continues to perform well. This is also a demonstration of our domestic capability in building indigenous PWR systems for electricity production.

Apart from electricity, our progammes have led to several societal benefits in the area of food and agriculture, human and animal health, urban and rural waste management, safe drinking water and several industrial applications. This indeed enables us to carry our programme forward with a human face. This, apart from work in the laboratories, requires engaging various segments of society and other stake holders to facilitate translation of laboratory development to the society. I am glad that deployment of developments like Bhabhatron Tele-therapy system, Nisargaruna Waste bio-digester and Akruti frame work is growing fast and making their own distinctive impact on the society.

It is becoming increasingly clear that we are pursuing several activities that are either contemporary or in fact ahead of rest of the world in some cases. The driving force for this lies in the imperatives of our programme. Since it is necessary for us to move forward on our path, notwithstanding the existence or otherwise of similar developments elsewhere, strong linkage between research activities in our institutions and development of applications for use in our programme is of crucial importance. We have therefore been emphasising Ph.D level research on the interface of basic research and related technology under HBNI. Soon we expect a basket of research topics, particularly in areas of gaps in our understanding or our capability to be available to scholars to enable them to choose their research topics in areas of importance to the programme.

With an eye on the future, we are expanding our research infrastructure. New campus of BARC, with an area much larger than Trombay campus, near Vishakhapatnam; TIFR's new campus at Hyderabad, a new campus for VECC and SINP in Kolkata are some major examples. Expansion of human resource is another area that has engaged our attention. We now have the possibility to tap the best talents at different levels beginning with 10+2 level through DAE-MU-CBS and NISER, B.Sc level through NIUS, BE/B.Tech, M.Sc/M.Tech level through BARC Training School and through HBNI Ph.D programme and post Ph.D level through KSKRA scheme. Mentoring these young people and sustaining an ambience around them that enhances their creativity and application of mind to excel in new emerging areas should be our responsibility. We owe this to our programme and hence to our nation.

Friends, this is the last time I am addressing you from this podium. I wish to thank all of you for your strong commitment to the programme and your support to the efforts to sail through the fuel supply crisis in a manner that allowed the programme to move fast forward and meet the national needs and expectations of our people. That indeed has been the task set up for us by Dr. Bhabha. Let us ensure that the way forward defined by the group is followed through with dedication and respect for time lines. Let us resolve to do so and realise the Bhabha dream before it is too late. That will be a fitting homage to the memory of Dr. Homi Bhabha on his 100th birthday.

Thank you."

डॉ. श्रीकुमार बॅनर्जी, निदेशक, भाभा परमाणु अनुसंधान केंद्र द्वारा संस्थापक दिवस संबोधन

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"डॉ. काकोडकर, अध्यक्ष, परमाणु ऊर्जा आयोग, यहां उपस्थित परमाणु ऊर्जा विभाग परिवार के वरिष्ठ सदस्यगण एवं प्रिय साथियों, यह मेरे लिए अत्यंत प्रसन्नता एवं गर्व का विषय है कि मैं इस महान संस्था, भाभा परमाणु अनुसंधान केंद्र के संस्थापक डॉ. होमी जहांगीर भाभा के जन्म की सौंवीं वर्षगांठ के समारोह में आप सबका गर्मजोशी से स्वागत कर रहा हूँ ।

"हम प्रतिवर्ष 30 अक्तूबर को होमी भाभा जन्म दिवस समारोह मनाते हैं तथा इस दिन पिछले वर्ष के दौरान प्राप्त उपलब्धियों का लेखा-जोखा लेते हैं और नाभिकीय विज्ञान एवं प्रौद्योगिकी के विकास से संबंधित मिशनोन्मुखी कार्यों के प्रति अपने आप को पुन:समर्पित करते हैं ।

चूंकि इस वर्ष हम डॉ. भाभा का जन्म शताब्दी समारोह मना रहे हैं, अत: इस अवसर पर हम अपनी सामान्य प्रस्तुति से थोड़ा हटते हुए उन महत्वपूर्ण उपलब्धियों की चर्चा करेंगे जो 1966 में डॉ. भाभा के निधन के पश्चात प्राप्त की गई हैं ।

मैं अपने अंग्रेजी संबोधन में पिछले एक वर्ष के दौरान प्राप्त कुछ महत्वपूर्ण उपलब्धियों का संक्षेप में विवरण दूंगा तथा इसे मैं यहां नहीं दोहराऊंगा ।

होमी भाभा का स्वप्न था, अपने देश को नाभिकीय विज्ञान एवं प्रौद्योगिकी के क्षेत्र में एक उन्नत राष्ट्र बनाना । उन्होंने अपनी जनता के जीवनस्तर को बेहतर बनाने के लिए नाभिकीय विज्ञान एवं प्रौद्योगिकी की विभिन्न शाखाओं में व्यापक विकास कार्य के लिए एक योजना की रूपरेखा बनाई । भाभा जन्म-शताब्दी के अवसर पर आइए हम इस बात को देखें कि हम भाभा के स्वप्नों को साकार करने में कहां तक सफल हुए हैं । उनकी योजना का पहला उद्देश्य था, रिएक्टर प्रणाली से संबंधित पूर्ण प्रौद्योगिकी के विकास में दक्षता प्राप्त करना । इसमें कोई संदेह नहीं कि इसे प्राप्त कर लिया गया है। इसका सबसे अच्छा प्रमाण है 220 मेगावाट और 540 मेगावाट क्षमता वाले भारतीय दाबित भारी पानी रिएक्टर प्रणाली का विकास जिसका अभिकल्पन और निर्माण कार्य स्वदेशी स्तर पर किया गया तथा जिसका प्रचालन, रिकार्ड कैपेसिटी यूटिलाइजेशन फैक्टर के साथ किया गया । भाभा परमाणु अनुसंधान केंद्र और एनपीसीआईएल के वैज्ञानिकों और इंजीनियरों की दो पीढ़ियों ने पीएचडब्ल्यूआर प्रौद्योगिकी में विशेषज्ञता प्राप्त करने के लिए अथक कार्य किया, जिसकी सारे विश्व से मान्यता प्राप्त हुई । भाभा की शानदार योजना के अंतर्गत उनकी इच्छा थी कि हमारा

देश संपूर्ण ईंधन चक्र प्रौद्योगिकी के मामले में आत्मनिर्भर बने। इस तथ्य के बावजूद कि सिंहभूम जिले में प्राप्त यूरेनियम बहुत अच्छे स्तर का नहीं है, डॉ. भाभा ने जादुगुड़ा माइन्स और यूरेनियम मिल को खोलने के बारे में साहसिक निर्णय लिया । आज संपूर्ण ईंधन चक्र जिसमें यूरेनियम अयस्क की माइनिंग, नाभिकीय ईंधन के संसाधन, रिएक्टरों में ईंधन का उपयोग, प्लूटोनियम के निष्कर्षण के लिए भुक्त ईंधन के पुनर्संसाधन, द्रुत रिएक्टरों में प्लूटोनियम का उपयोग एवं उच्छा स्तरीय रेडियोएक्टिव अपशिष्ट का कांचीकरण शामिल है, के क्षेत्र में हमने विशेषज्ञता प्राप्त कर ली है । हम विश्व के उन कुच देशों में हैं जो बंद ईंधन चक्र का प्रचालन कर रहे हैं, जो एक ऐसी संकल्पना है जिसे आगामी शताब्दियों तक ऊर्जा की सतत आपूर्ति के लिए पूरे विश्व में धीरे-धीरे अपनाया जा रहा है । पीएचडब्ल्यूआर प्रणाली के सफल प्रचालन के लिए उच्च गुणवत्ता वाले भारी पानी की पर्याप्त मात्रा में उपलब्धता आवश्यक होती है । भारत में न केवल भारी पानी के उत्पादन की प्रौद्योगिकी के क्षेत्र में विशेषज्ञता प्राप्त की गई है बल्कि भारी पानी बोर्ड में हमारे साथियों ने ऊर्जा दक्षता में स्थिर बेहतरी प्राप्त की है जिसके परिणामस्वरूप आज हम स्पर्धात्मक दरों पर यहां तक कि निर्यात के लिए भी भारी पानी का उत्पादन करने में समर्थ हुए हैं ।

फास्ट रिएक्टर तथा सामरिक कार्यक्रमों दोनों में ही प्लूटोनियम के निष्कर्षण के लिए भुक्त ईंधन का पुनर्संसाधन एक प्रमुख तत्व है । ट्रांबे में प्लूटोनियम संयंत्र की स्थापना के साथ शुरू हुआ पुनर्संसाधन का कार्य अब कई गुना बढ़ चुका है तथा वर्ष 1985 से संचालित फास्ट ब्रीडर टेस्ट रिएक्टर को ईंधन की आपूर्ति के उद्देश्य को प्राप्त किया जा चुका है । विश्व में पहली बार एफबीटीआर के लिए मिश्रित कार्बाइड ईंधन के उपयोग को शुरू करने में बीएआरसी के वैज्ञानिकों और इंजीनियरों द्वारा दिखाया गया साहस वास्तव में अनुकरणीय रहा है । ईंधन का कार्य निष्पादन समय की कसौटी पर खरा उतरा है और इसमें लगभग 165,000 MWd/T बर्नअप प्राप्त किया गया है । आज हमारे सामने प्रोटोटाइप फास्ट ब्रीडर रिएक्टर के लिए मिश्रित ऑक्साइड ईंधन की आवश्यकता पूरी करने की एक बड़ी चुनौती है ।

भाभा ने देश में उपलब्ध यूरेनियम के अत्यंत कम स्रोतों और थोरियम के बड़े भंडारों को ध्यान में रखते हुए एक तीन चरण वाले परमाणु विद्युत कार्यक्रम की परिकल्पना की । हम इस निर्धारित पथ पर आगे बढ़ रहे हैं और परमाणु विद्युत उत्पादन के दूसरे चरण की दहलीज पर हैं । प्रगत भारी पानी रिएक्टर प्रौद्योगिकी के विकास के द्वारा हम थोरियम के बड़े स्तर पर उपयोग के लिए अनेक सार्थक प्रौद्योगिकियों को उपयोग में ला रहे हैं ।

भाभा ने खाद्यान्न तथा स्वास्थ्य देखभाल के क्षेत्र में भी नाभिकीय विकिरण के महत्व को पहचाना । नाभिकीय कृषि के क्षेत्र में 37 विभिन्न प्रकार के विकिरण उत्परिवर्ती बीजों के विकास के द्वारा हमने महत्वपूर्ण सफलता प्राप्त की है । भारतीय किसानों को विकिरण उत्परिवर्ती बीजों के प्रयोग द्वारा बहुत लाभ हुआ है । इन बीजों का विकास नाभिकीय कृषि के क्षेत्र में काम करने वाले वैज्ञानिकों द्वारा किया गया है । पिछले कुच वर्षों के दौरान खाद्य संरक्षण के कार्य एवं विकिरण संसाधन संयंत्रों में स्थिर बढ़ोतरी हुई है ।

हमारे अनुसंधान रिएक्टर, स्वास्थ्य संरक्षण से संबंधित विभिन्न अनुप्रयोगों के लिए लगातार रेडियो आइसोटोपों की आपूर्ति कर रहे हैं । हमारी प्रौद्योगिकियां, नई स्वास्थ्य संरक्षण सुविधाओं जैसे भाभाट्रॉन, प्लेथिसोमोग्राफी, टेली ईसीजी इक्विपमेंट का विकास कर रही हैं जिनके द्वारा जनता के एक बड़े भाग को लाभ पहुंचा रहा है ।

भाभा की यह भी इच्छा थी कि यह सभी विकास कार्य मूलभूत विज्ञान के मजबूत आधार के साथ हो । हमारे द्वारा प्रगत भौतिकी, रासायनिकी, जीव विज्ञान, इंजीनियरी विज्ञान और पदार्थ विज्ञान से संबंधित संचालित विभिन्न कार्यक्रमों को पूरे विश्व में मान्यता मिल रही है ।

मानव संसाधन विकास के क्षेत्र में, 1944 में भाभा ने एक भविष्य सूचाक प्रेक्षण किया कि अब से करीब दो दशकों में जब विद्युत उत्पादन के लिए नाभिकीय ऊर्जा का सफलतापूर्वक प्रयोग किया जाएगा तो भारत को इस क्षेत्र में विशेषज्ञता के लिए कहीं बाहर नहीं देखना पड़ेगा बल्कि यह हमें स्वदेश में ही उपलब्ध रहेगी । 1957 से, जब बीएआरसी ट्रेनिंग स्कूल के पहले बैच की शुरुआत हुई हम नाभिकीय विज्ञान एवं इंजीनियरी के क्षेत्र में अपने वैज्ञानिकों और इंजीनियरों के लिए इस शिक्षण कार्यक्रम को संचालित कर

रहे हैं । आज एचाबीएनआई स्नातक प्रशिक्षणार्थियों को न केवल डिग्रियां दे रहा है बल्कि परमाणु ऊर्जा विभाग के कर्मचाारियों की बड़ी संख्या को सतत रूप से शिक्षण सुविधा उपलब्ध कराने में सहयोग कर रहा है ।

हमारे लिए अब नए सपने देखने का समय आ गया है। मुझे विश्वास है कि हमारे बहुत से युवक साथियों के अपने सपने होंगे । वैज्ञानिक, नाभिकीय ऊर्जा के दोहन के नए तरीकों, ऊर्जा संरक्षण एवं भंडारण के नए उपायों, खाद्य, स्वास्थ और पर्यावरणीय नियंत्रण के क्षेत्र में विकिरण के प्रयोग की नई संभावनाओं की खोज कर सकते हैं, जबकि इंजीनियर इन विचाारों को मजबूत प्रौद्योगिकियों के रूप में मूर्तरूप दे सकते हैं जिसका प्रसार सारे संसार में हो सकता है । आज भारत का कई क्षेत्रों में अग्रणी स्थान है जैसे कि सूचाना प्रौद्योगिकी, आयरन एवं स्टील, फार्मास्यूटिकल्स एवं सर्विस सेक्टर्स । मुझे कोई कारण नहीं दिखाई पड़ता कि हम ऊर्जा क्षेत्र और कई अन्य उच्च तकनीकी क्षेत्रों में शीर्ष स्थान क्यों नहीं प्राप्त कर सकते । हमने भारी पानी रिएक्टर प्रौद्योगिकी में निपुणता प्राप्त की है । कल हो सकता है कि हमें अपने डिजाइन किए हुए लाइट वॉटर रिएक्टरों के साथ विश्व में स्पर्धा करनी पड़े । हमें फास्ट रिएक्टर प्रौद्योगिकी के क्षेत्र में पहले ही प्रतिष्ठित स्थान प्राप्त है तथा हमें विश्व को यह दिखाना है कि फास्ट रिएक्टरों से सुरक्षित रूप से स्पर्धात्मक दरों पर केवल ऊर्जा ही नहीं प्राप्त होती बल्कि इससे उर्वरक पदार्थों को विखण्ड्य पदार्थों में परिवर्तित करके भविष्य के लिए ईंधन का भंडार भी उपलब्ध कराया जा सकता है। वर्तमान में शार्ट डबलिंग टाइम वाले फास्ट रिएक्टर ईंधन के विकास पर बीएआरसी और आईजीसीएआर दोनों में ही किया जा रहा कार्य बहुत महत्वपूर्ण है। नाभिकीय विद्युत की उच्च क्षमता की स्थापना के बाद अपने विस्तृत थोरियम भंडारों के उपयोग के द्वारा देश को लंबी अवधि तक ऊर्जा सुरक्षा प्रदान करने का हमारा स्वप्न अवश्य पूरा होगा।

अपने संबोधन के निष्कर्ष रूप में मैं इस बात पर जोर देना चाहूंगा कि हमारे सामने भविष्य में अनेक चुनौतियां हैं । बीएआरसी में वैज्ञानिकों, इंजीनियरों और प्रशासकों सभी के सहयोगी प्रयास से मुझे विश्वास है कि बीएआरसी की परंपरा के अनुरूप हम भविष्य की चुनौतियों का डटकर सामना करने में सफल होंगे ।

मित्रों, अंत में आज इस विशेष दिन पर आइए, हम सब दृढ़ निश्चय करें कि हम अपनी जनता की भलाई के लिए नाभिकीय विज्ञान एवं प्रौद्योगिकी के अग्रणी क्षेत्रों में अपनी उत्कृष्टता को बनाए रखते हुए अपने आप को इस कार्य में पुनःसमर्पित करेंगे ।

धन्यवाद। ”

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 you all to celebrate the 100th birth anniversary of Dr.Homi J. Bhabha – the founder of this great institution, Bhabha Atomic Research Centre.

We celebrate Homi Bhabha's birthday every year on 30th October by taking stock of our achievements during the previous year and rededicating ourselves towards our mission oriented tasks related to the development of nuclear science and technology.

As this year, we are celebrating the birth centenary of Dr. Bhabha, I shall slightly deviate from our usual presentation by including some major achievements that has been made since Bhabha's demise in 1966.

Launching of Arihant

As you all know, the nuclear submarine Arihant has been launched by India in August this year. BARC had a significant role in this major project. The steam generating plant of this submarine was designed, developed and built by BARC. The compact Pressurised Water Reactor was designed for this purpose with several special features ; such as, very quick response for power ramping, extremely stable under ship motions and resistance against exposure to very high acceleration, resulting from eventual depth charges. Since the nuclear reactor is fuelled with high fissile containing fuel, it can supply energy in the submerged condition for an extended period without refueling. Many systems and equipment designed and built were first of its kind in the country. The entire steam generating plant has been designed to give highly reliable offshore operation in a completely isolated environment. Control and instrumentation design is fault tolerant and requires minimum operator interventions. An elaborate diagnostic system enables a very high availability factor. Many new materials and technologies have been developed and new infrastructure has been created for this project. The development of the steam generating plant of Arihant was preceded by setting up of the land based prototype system at Kalpakkam known as PRP. The reactor in PRP has been working since last three years and has served as a technology demonstrator for the compact pressurized water reactor with a load following capability. This has proved several design features including fuel performance and established the reliability of various systems and equipment. The entire propulsion plant with primary, secondary, electrical and propulsion system along with its integrated control was packed in the aft end of a land based submarine hull designed and built specifically for this purpose. This prototype is serving as a training centre for the crew for the nuclear submarine. The crew training is further enforced with the help of an indigenously designed and built full scope simulator.

With the successful development of compact pressurized water reactor, BARC has ushered in the field of PWR technology in the country. In future, the experience gained in this project will go a long way in the indigenous development of an Indian Pressurised Water Reactor system for large scale electricity generation. This landmark achievement has been possible due to a sustained team work by a group of dedicated engineers and scientists in our centre.

In the uranium enrichment programme, we have succeeded in improving the separating work unit of gas centrifuges manifold. The production capacity has also been substantially enhanced to fulfill the requirement.

About 1.1 MT of low enriched uranium has been processed by liquid-liquid blending. The material is converted into nuclear fuel bundles for irradiation testing in PHWRs.

Reprocessing Programme & KARP recommissioning

The second major achievement during this year has been bringing back the reprocessing plant KARP into operation at Kalpakkam. We took up the arduous task of renovation and upgradation of this Reprocessing Plant and after nearly five years of hard work, we have succeeded in our task. The plant is now performing extremely well since March, 2009, when the spent fuel chopping was resumed. The entire off-grade uranium stored in waste tank farm has already been processed. The commissioning of automatic charging facility has helped in enhancing the throughput and lower the radiation exposure to the operating personnel in the plant. With the commencement of reprocessing at KARP and continued operation of reprocessing plants at Tarapur and Trombay, our rate of production of fuel material for fast reactor is substantially enhanced.

Some of the other important achievements in the back-end of the fuel cycle during the year are : i) encapsulation and transportation of eleven alpha contaminated glove boxes from Radiological Laboratories to our Interim Storage Facility in Trombay, (ii) processing of 200 m^3 of intermediate level waste using ion exchange based mobile module (TRIX), (iii) safe transportation of vitrified waste products and interim storage of overpacks in Solid Storage Surveillance Facility (S3F), Tarapur, (iv) augmentation of Ammonium Di-uranate (ADU) facility by installation of new furnaces and continued supply of Depleted Uranium (DU) & Deep Depleted Uranium (DDU) to NFC, Hyderabad, (v) successful commissioning of the state-of-the-art Spent Fuel Chopper for gang chopping of fuel bundles in the one stroke to enhance the production rate by four times, vi) successful testing of a nuclear biological and chemical (NBC) water purification system at ETP, Trombay under stipulated conditions for its effectiveness against specific radionuclides for the Defence Laboratory, Jodhpur.

The second phase of cold crucible induction melter (CCIM) technology to demonstrate liquid feeding for vitrification of HLW was successfully tried. Based on successful experience of Advanced Vitrification System (AVS-1),Tarapur for immobilization of HLW, work for establishing such facilities (AVS) is progressing welll at Tarapur (AVS-II), Kalpakkam and Trombay. At the project, WIP-3A at Kalpakkam for vitrification of HLW, green heating of the joule heated ceramic melter has been started and all the parameters are being monitored from the control room.

Significant progress was recorded in respect of collaborative programmes for the manufacture and supply of Three Piece Articulated Manipulators for remote operations. Based on successful development, full scale manufacture of Articulated Manipulators (30 pairs) was taken up and 10 pairs have been received for use in our laboratories. Also, 12 tonnes of high density radiation shielding glass blocks for radiation shielding windows have been received from Central Glass & Ceramics Research Institute (CGCRI), Kolkata under a collaborative programme.

Process for recovery of ^{106}Ru from secondary waste has been established on laboratory scale and two batches, 100 ml each of ^{106}Ru (specific activity 300 mCi/l) have been supplied to Radiopharmaceuticals Division (RPhD) for treatment of eye cancer. Pure isotope ^{90}Y present in radioactive waste is also recovered regularly.

In view of the expanding programme of reprocessing and waste management, the formation of Nuclear Recycle Board is approved. Under the aegis of this Board, several integrated reprocessing and waste management plants of large capacity will be set up to meet the growing demand of Pu fuel for the fast reactors.

Research Reactor operation and refurbishment of APSARA

APSARA, our first research reactor, commissioned in 1956 has served various users for more than five decades with an impressive availability factor exceeding 85%. In view of the ageing of the structures, systems and components, it has been decided to refurbish and upgrade the Apsara reactor. Various non-destructive testings carried out on several structures of Apsara indicated that the reactor pool structure is healthy and can be retained as such. However, the main reactor building structure does not fulfill the minimum requirement of the present day safety norms. After debating over various options, it has been decided to demolish the existing structure and construct a new reactor building while retaining the existing pool structure. The plan for upgradation also includes change over from the highly enriched uranium fuel core to a low enriched uranium fuel core in line with the global norms. The reactor power of Apsara will also be enhanced to 2 MW (th) and the maximum thermal neutron flux will increase to 6.5×10^{13}. The upgraded reactor will provide enhanced facility to carryout beam tube research, radioisotope production, calibration and testing of neutron detectors, material irradiation and bulk shielding experiments. All the process and nuclear control systems will be modernized.

Basic design of the new reactor core and various reactor systems for the refurbished Apsara has been completed. Apsara was shutdown in the first week of June, 2009 and the core has been defueled completely as a part of the decommissioning activities, prior to refurbishment. Reincarnated Apsara is expected to be available for the users by 2012.

Research reactors Cirus and Dhruva were was operated at availability factor of around 88%. More than 1000 isotope samples have been produced in these reactors during the year. A neutron radiography set up was commissioned satisfactorily for materials testing in one of the beam lines at Cirus.

A Boron-10 lined gamma compensated Ion chamber developed indigenously, has been installed in one of the beam tubes of Dhruva to facilitate accelerated life testing. A number of research scholars from various academic institutions in the country continued to utilize the reactor under the aegis of the UGC-DAE Consortium for Scientific Research.

The conceptual design of a high flux Multi Purpose Research Reactor (MPRR) has been completed. A feasibility study for incorporation of an external spallation neutron source in the MPRR core so as to operate the reactor as an accelerator driven sub-critical reactor system in future is in progress.

Critical Facility after attaining its first criticality in April 2008 is being operated regularly at the designed power of 100 watts to facilitate various physics experiments, including estimation of the worth of the shut-off rods and adjuster rods.

In P-4 Facility, re-criticality of burnable poison rod calibration facility was successfully achieved as a first step towards undertaking testing of BPRs and other components.

Fuel Fabrication for Fast Reactors

BARC has the responsibility for supplying nuclear fuels for the Fast Reactors FBTR and PFBR (under construction) at Kalpakkam. As part of the continued

production of Uranium Plutonium mixed carbide fuel for FBTR, fuel pins worth seven fuel sub-assemblies have been shipped to IGCAR during this year. This included one Fuel Sub-assembly pins made with reprocessed plutonium from FBTR fuel as part of the fuel cycle closure. The PFBR experimental MOX Fuel pins fabricated at AFFF, Tarapur loaded in the very centre of FBTR core has now reached a burn up exceeding 92,000 MWd/T.

The manufacture of MOX fuel pins for PFBR first core is continuing at our facility in Tarapur and has crossed the land mark of one thousand full length MOX fuel pins. Fabrication of Six million DD UO_2 pellets required for Axial breeder blanket of the first core of PFBR has also been completed. End plug welding of D-9 clad tubes using Nd – Yag laser has been qualified.

BARC is also involved in R&D on metallic fuel for the advanced fast breeder reactors with high breeding ratio. A new thermophysical property evaluation lab has been set up in BARC where evaluation of thermophysical and thermomechanical properties of several Uranium Plutonium alloys and fuel-clad chemical compatibility studies are in progress.

As part of the fuel irradiation programme, (ThO_2-1%PuO_2)MOX fuel pins have been fabricated to be loaded in one of the fuel position of DHRUVA Reactor. The fuel hardware and the pellet geometry will be similar to AHWR fuel.

Post Irradiation examination of (ThO_2-4%PuO_2) fuel pins irradiated upto 21,000 MWd/T burn-up in Ac-6 cluster in CIRUS has been taken up. The tests have confirmed the excellent behaviour of (Th-Pu) MOX fuel including much lower fission gas release compared to similar U based fuels.

The mechanical properties of zircaloy clad of PHWR fuel irradiated to burn-up of 15,000 MWd/T has been evaluated which showed about 30% loss of ductility compared to virgin material.

Design & Development of Innovative Reactors

Studies were performed for a variant of AHWR using Thorium / LEU based fuel. LEU (19.75%) can be used as a good external feed in thorium oxide fuel in AHWR making all reactivity coefficients including channel and moderator temperature coefficients negative. High burn-up of 64000 MWD/T can be achieved and natural uranium resource utilisation would be better than in PHWRs and LWRs. This reactor has an excellent export potential because of its proliferation resistant fuel.

The AHWR core design was re-optimised for achieving self sustenance in ^{233}U. The other developments under this programme were (i) Experimental simulation of postulated Loss Of Coolant Accident (LOCA) in AHWR in Integral Test Loop (ITL), (ii) design & development of the Accumulator Isolation Passive Valve (AIPV) and (ii) development of Water lubricated anti-friction bearings for fuel handling.

Demonstration Experiment for U-233 Clean-up

The design and fabrication method for electrode less discharge lamps (EDLs) operating with microgram quantities of natural uranium were optimized and the technique was suitably adapted in fume hood to prepare EDLs of ^{232}U and ^{233}U isotopes. With these indigenous EDLs, the emission spectra of the uranium isotopes were recorded with a Fourier Transform Spectrometer (FTS). The isotope shifts of the optical transitions of ^{232}U and ^{238}U were measured in the entire ultraviolet and visible region for the first time anywhere in the world. After recording the ^{233}U – ^{238}U isotope shifts possible first step transitions were identified for the thee step photo-ionization schemes were identified for U-233 clean up programme.

The Compact High Temperature Reactor (CHTR) is being built as a technology demonstrator for the comprehensive Indian high temperature reactor

program. A new feature of Burnup Compensation Rods (BCRs) is introduced in the CHTR core and detailed physics analysis is done. The use of BCRs will help in controlling the excess reactivity during the long reactor core life. This will in turn reduce the worth of each control rod during reactor operation.

Design of heat pipe manufacturing system has been completed and the components are under procurement. Analytical studies for shielding analysis and seismic behaviour of Compact High Temperature Reactor and the design of heat sink (based on passive cooling by air), were successfully carried out. A High Temperature Liquid Metal Loop using Lead Bismuth Eutectic (LBE) as the working fluid was commissioned and steady state and transient thermal hydraulic experiments have been carried out in the loop. A high temperature chemical vapour deposition process has been developed for TRISO coated fuel particles with uniformly thin coatings.

You all know that our department has taken up hydrogen energy programme. As a part of this, a catalyst has now been developed for HI decomposition for the production of hydrogen by thermo-chemical water splitting. It could reduce the HI decomposition temperature from 350^0C to 175^0C. Also a hydrogen skid mounted electrolyser (30 Nm^3/hr) has been designed and fabricated. This 25 cell module, weighing around 1 ton has successfully demonstrated its capability for Hydrogen generation. This is the biggest in-house H_2 generation plant by electrolysis process in the country.

As a part of our contributions to **ITER activities,** we are committed to Institute of Plasma Research to meet the urgent time bound requirement for Lithium compound of very high purity level for the TBM programme. Our Lithium metal plant continued to produce Lithium of desired purity level. To meet the additional demand, expansion of existing plant has been taken up in two phases on priority basis and the same has progressed as per schedule.

A process for preparation of lithium titanate pebbles (~ 2kg/ batch) has been successfully developed and is one of the material for the test blanket module programme. The process is based on the solid state reaction starting from lithium carbonate and titanium di-oxide. The product has been characterized and conforms to the specification.

BARC has successfully developed and fabricated Cable In Conduit Conductor (CICC) for various configurations for superconducting magnets required for fusion research work at IPR. The CICC consists of 0.80 mm dia Nb-Ti strand containing 492 filaments each of less than 25 micron size with Cu:SC ratio of 1.15:1 having twist pitch of 12.4 mm and 0.80 mm dia copper wire. 60 m long CICC containing 504 nos. of wire of above configuration has been successfully fabricated & supplied to IPR, Gandhinagar in the form of 2 m dia coil and initial results are encouraging.

R&D Support for PHWR, FBR and VVERs

A Sludge Lancing Equipment (SLE) designed and integrated by BARC and supplied to NPCIL was successfully operated for sludge removal from a steam generator of Kakrapar Atomic Power Station for the first time. Developed as an import substitute, this equipment uses high velocity water jets to remove sludge (corrosive deposits) from the secondary side of tube sheet of steam generators, thereby ensuring longer service life of steam generators.

Occasionally, need arises to repair the closure seal face of the end fittings of coolant channels of PHWRs. Conventionally, this work entails defuelling the channel, followed by draining and drying to carry out the lapping of the seal face. A channel isolation plug has been recently developed for the 540 MWe PHWR. The plug can be installed by the fuelling machine in the end fitting. Subsequently, closure seal face can be accessed for lapping operations. The use of this plug does not require the draining and drying of the coolant channel. A prototype of the plug has been satisfactorily tested.

In 37 rod cluster for 540/700 MWe PHWRs, the use of Thorium along with slightly enriched uranium in segregated rods was studied. In these studies, significant saving in natural uranium resource requirement was observed along with production of ^{233}U.

Two BARCIS systems for in-service inspection of coolant channels of RAPS and Kaiga have been supplied and commissioned at reactor sites. An MoU has been signed with NPCIL for development and supply of BARCIS for 540 MWe PHWRs.

Robotics and Manufacturing

Based on an MoU signed with NTPC, BARC has developed an **Automation System for Boiler Tube Inspection.** A Magnetic Crawler has been specially developed to carry the EMAT probe for automated inspection. The system has recently been field tested at NTPC's Dadri Plant.

A prototype Snake Arm Robot of one meter length and payload capacity of 10 kgs has been developed. The arm consists of four flexible and hollow segments, each segment has four joints each of which is independently controlled by a servo motor. The curvature and plane of curvature of each segment is controlled through guide wires by a drive unit at the base. The arm is suitable for inspection and manipulation in tight spaces.

BARC has developed a **Radiotherapy Simulator for diagnosis and localization of cancer.** The simulator is similar to our teletherapy machine Bhabhatron, but uses diagnostic X-rays as the source of radiation. This helps in choosing the radiation beam and aiming it to the target. The machine is installed at Indian Red Cross Society Hospital, Nellore and the commissioning is in advanced stage of completion.

First prototype assembly of Canned motor pump has been successfully manufactured and delivered. Manufacture of this Pump needed development of many manufacturing processes like Ceramic Metal (CM) Seals for Electrical feed throughs for stator of two speed motor, welding of Can to the inside diameter of the Stator body of the motor etc. A special rolling tool was designed and developed for expansion of the Can. An automatic pulsed TIG welding mechanism was also developed for welding the thin can. The Assembly was hydro-tested at 250 bar and Helium leak tested satisfactorily.

Dual Barker Coil System (BCS) has been developed for Indian Institute of Geomagnetism, New Panvel, Navi Mumbai. The system is completely made up of high purity copper, brass and aluminium, devoid of even the small traces of ferromagnetic elements. It is used to produce magnetic fields of very accurate fidelity over an extended region for measuring the earth's horizontal and vertical magnetic field vectors. By separately energizing the coils, it can be used to carry out geomagnetism studies in one setting only, by installing proton magnetometer sensor inside the coil system.

Vibration Monitoring System developed by BARC was successfully used for vibration monitoring of Gas Turbine in Auriaya power plant under an MoU with NTPC. All the objectives of MoU have been fully realised.

A 10 MeV Electron Accelerator set up in Kharghar, Navi Mumbai is now operational at a power level of 3.6 kW. The beam has been employed for process trials for cross linking of polythelene, diamond coloration, Teflon degradation and production of photo neutrons. With the demonstration of steady operation and the availability of material handling system, the electron beam accelerator facility is now ready for providing service to industries.

Electronics

As a focused approach towards the basis electronics,

a new Centre for Microelectronics (CMES) has been set up at Prabhadevi, Mumbai and is now fully operational. The centre has a class 10k clean room in which mixed signal IC tester, parametric device characterization set up, 1/f noise measurement system, die bonder and a semi automatic wire bonder have been installed. The centre has CAD tools for design and development of semiconductor devices, processes and integrated circuits. Several full custom CMOS ASICs have been developed and tested in the centre.

The technology of silicon PIN detectors developed by BARC is now well established at BEL foundry. The latest development is a quad 20mm x 20mm PIN detector which is ready to be commercially supplied to GANIL, France. This activity will get a further boost from development of the technology of high resistivity single crystal silicon by float zone process at BARC. Already, a large size 100 x 400 mm ingot has been pulled.

In the ANUPAM series of supercomputers, development of 35 Teraflops machine having about 4500 CPUs interconnected through a network of multi level infini-band switches with specialized heat removal systems, is completed. A new 4.5 teraflop computational system has also been set up at Facility for Electromagnetic systems (FEMS) Autonagar, Vizag for simulation of pulse power experiments.

10 MeV Electron Accelerators are also being developed as a source of energy pack for container scanner. In this programme, which is being pursued in collaboration with ECIL, a high power pulsed 9 MeV electron beam has already been obtained.

Materials Chemistry

Process development studies on laboratory and pilot plant scale have been nearly completed to evolve a technoeconomic flowhseet for the processing of uranium deposits from Gogi in Karnataka. Simultaneous pre project related data are being generated to set up a 500 T/day mill for production of uranium from this deposit.

Thorium-Uranium alloy has been produced by metallothermic reduction on laboratory scale.

Beryllium pilot plant at Vashi has been refurbished and most of the unit operations have been started on a campaign basis. A pilot plant for production of nuclear grade beryllia has been commissioned.Vacuum hot pressed beryllium sleeves and large number of beryllium pellets have been fabricated for departmental use. Rotating electrode process has been developed for fabricating beryllium pebbles.

Lithium titanate has been prepared by various synthesis techniques and ceramic pebbles of lithium titanate are being evaluated for meeting the specifications for test blanket module.

A process flowsheet has been developed on laboratory scale to fabricate heat-treatment Zr – 2.5 Nb alloy for AHWR pressure tubes. The material has been fully characterized and it matches the structure of the material currently being used in Russian and Japanese reactors.

Photocatalytic water splitting using solar energy has shown promising catalytic effects of doped titania and titanates in their nano states. Hydrogen yield out of water splitting has been as high as one standard litre per hour per square meter exposure to the solar light. A carbon analyser for the measurement of carbon in uranium metal at trace levels has been designed and fabricated. The set up is based on the measurement of carbon dioxide resulting due to combustion of sample in oxygen-rich atmosphere, using an IR detector. This system gave a measurement reproductibility of 2%. The system was standardized and validated and is being employed for routine analysis of samples.

DAE's Societal Initiatives

BARC Centre for Incubation of Technologies (BARCIT) is being set up in the Training School Complex, south site. The work on four technology incubation cells is initiated in the area of water, biotechnology, lab & medical equipment and E-beam applications. This will enable expeditious conversion of BARC R&D know-how to commercialization with industry (HR) manpower under the guidance of BARC innovators.

Ten **Advance Knowledge and Rural Technology Initiative (AKRUTI)** centres have been set up in Maharashtra (7), Andhra Pradesh (1), Karnataka (1) and Madhya Pradesh (1). Two more AKRUTI centres are being set up in Meghalaya North Eastern region and one at BARC, Vizag. AKRUTI Tech-Pack is now made available at concessional price to promote exclusive rural entrepreneurship with additional benefit of trial irradiation for agri produce for preservation for village entrepreneurs of AKRUTI Tech Pack.

In the field of **Nuclear Agriculture**, two new Trombay crop varieties were notified. TG-39, a confectionary grade groundnut variety was notified for cultivation in Rajasthan as TBG-39 (Trombay Bikaner Groundnut) and as TDG-39 (Trombay Dharwad Groundnut) for Karnataka. TG-51, an early maturing groundnut variety was notified for West Bengal, Orissa, Bihar and North Eastern States. With this, the total number of Trombay crop varieties released and notified by the Ministry of Agriculture, Government of India for commercial cultivation has reached 37.

The interest of entrepreneurs in using radiation technology for **Food Preservation** and allied products is increasing. For the past three years, radiation technology has been used for overcoming quarantine barriers for export of mango from India. During the last three years, 562 tons of mango were radiation processed (157 tons in 2007, 275 tons in 2008 and 130 tons in 2009) at Krushak, Lasalgaon. This year, using a combination of radiation and low temperature, it was possible to successfully transhipment 14.3 tons of mango to US by sea route. The trial was successful. This will make mango more cost competitive in the U.S. market.

Desalination technology development programme is progressing very well under BARC. The Multi Stage Flash unit of NDDP has produced high quality distilled water having 2 ppm TDS from seawater suitable for high end industrial use. Along with MSF plant, the Sea Water Reverse Osmosis (SWRO) plant continued its operation and now the RO plant has been put on round-the-clock basis through outsourcing. The RO plant is producing potable water of about 200-300 ppm TDS, at its rated capacity. The successful performance of the NDDP has confirmed the capabilities of BARC. Dr. Mohamed ElBaradei, Director General, International Atomic Energy Agency (IAEA) visited NDDP on 28th September, 2009. Also, under IAEA Technical Cooperation Programme, training in nuclear desalination was provided to the technocrats of Algeria.

The technology of **Back-washable UF Spiral Module** for water purification has been transferred to one more parties during the year. It removes bacteria and virus from raw water and provides safe drinking water.

Tera Becquerel amounts of **Radiochemicals** were produced and supplied to BRIT for further processing and supplying to the user institutions. Iodine-125 brachytherapy sources were continued to be produced and supplied to the 3 collaborating Eye care Hospitals for treatment of ocular cancers, benefiting nearly 15 patients in the past year.

P-32, a beta emitting nuclide was tested for **treatment of superficial cancers by mould brachytherapy** for the first time in the world. Based on the excellent results in small animals, limited clinical trials were conducted at AIIMS, at their behest. 7 patients with basal cell carcinoma lesions in the face, which were otherwise not treatable have been treated

with the P-32 brachytherapy moulds, prepared at the Radiopharmaceuticals Division, each one custom made to match the size, shape and the activity needed by the patient. One dog patient, with recurrent cancerous growth on its nose was also treated in a similar manner with a custom made P-32 patch at ACTREC.

The indigenous production of ^{177}Lu in high specific activities and optimization of procedures to label molecules with ^{177}Lu, has resulted development of ^{177}Lu based **therapeutic radiopharmaceuticals** by BARC. ^{177}Lu-chloride is now ready for commercial deployment as a radiochemical through BRIT and two ^{177}Lu based radiopharmaceuticals, namely, Lu-DOTATATE and Lu-EDTMP are under preliminary clinical trials for treatment of cancer patients suffering from neuroendocrine tumours and skeletal metastases, being carried out at the Oncology Centres of three well established Hospitals in India.

At the request of NFC, Hyderabad, BARC undertook **development of ^{147}Pm sources,** to be used in an instrument for measurement of graphite coating thickness. The backscatter of beta particles from ^{147}Pm is used to gauge thickness of coatings. The ^{147}Pm sources prepared on Aluminium matrix by anodization-cum-adsorption method has been tested at NFC with satisfactory results.

A new technique in surgery, viz. Cochlea, which is done in selected hospitals in India was successfully performed in BARC Hospital by our ENT surgeons. A new instrument – Remote Control Digital Radiofluoro System Flexavision has been installed in the Radiology Unit of BARC Hospital.

Homi Bhabha had a dream of making our country advanced in the field of nuclear science and technology. He sketched a plan for a comprehensive growth in different aspects of nuclear science and technology for improving the quality of life of our people. On this occasion of Bhabha centenary, let us examine as to what extent we have been successful in realizing the dreams of Bhabha. The first objective of his plan was to achieve the competence in the total technology development of a reactor system. No doubt, this has been achieved. The best testimony is the development of Indian Pressurised Heavy Water Reactor system of 220 MWe and 540 MWe capacity which has been designed and constructed indigenously and operated with a record capacity utilization factor. Two generations of scientists and engineers of BARC and NPCIL have relentlessly worked for perfecting the PHWR technology which has received recognition all over the world. In Bhabha's grand scheme of things, he wished that the country should become self-sufficient in the entire fuel cycle technology. In spite of the fact that the uranium ore in Singhbhum District is not of very high grade, Dr.Bhabha took the bold decision in opening up the Jaduguda mines and the uranium mill. Today, the entire fuel cycle which include mining of uranium ore, the subsequent processing of nuclear fuel, utilization of the fuel in reactors, reprocessing of the spent fuel to extract plutonium, utilization of plutonium in fast reactors and vitrification of high level radioactive waste has been mastered by us. We are among a few countries in the world to operate the closed fuel cycle, a concept which is gradually being accepted world over for a sustained energy supply for centuries to come. Successful operation of PHWR system requires availability of high quality heavy water in adequate quantity. Not only the technology of heavy water production has been mastered in India, our colleagues in the Heavy Water Board have steadily improved the energy efficiency resulting in our being able to produce heavy water at a competitive rate even for export.

Spent fuel reprocessing for extracting plutonium is the key element both in the Fast Reactor and the strategic programmes. The reprocessing activity which started with the setting up of a Plutonium Plant in Trombay has now expanded manifold and we have accomplished the objective of supplying fuel to the Fast Breeder Test Reactor which has been running since 1985. In fact, the courage BARC scientists and

engineers have shown in introducing the mixed carbide fuel for the FBTR for the first time anywhere in the world is indeed exemplary. The fuel performance stood the test of time by achieving nearly 165,000 MWd/T of burn up. Today, a bigger challenge lies ahead of us to supply the mixed oxide fuel requirements for the Prototype Fast Breeder Reactor.

Bhabha outlined the three-stage nuclear power programme considering the modest uranium resource and the large thorium reserve in the country. We are moving ahead in this chartered path and are on the threshold of the second stage of nuclear power production. Through the development of Advanced Heavy Water Reactor technology, we will be proving several technologies meaningful for the large scale utilization of thorium.

Bhabha also visualized the importance of nuclear radiation in the food and health care. The contribution we have made in nuclear agriculture by developing 37 different types of radiation mutated seeds has made a very significant impact. The Indian farmers have reaped the benefits of radiation mutated seeds which have been developed by the scientists working in the area of nuclear agriculture. Food preservation and radiation processing plants have been steadily multiplying during the last few years.

Our research reactors have been continuously supplying radioisotopes for a variety of health care applications. Our technologies have been developing newer health care facilities such as Bhabhatron, Plethysomography, Tele ECG equipment which are benefiting a large section of our population.

Bhabha also desired that all these developments should come on a firm footing of basic sciences. The wide ranging programme on advanced physics, chemistry, biology, engineering science and material science which we are pursuing today are being globally acclaimed.

In the area of Human Resource development, in 1944, Bhabha had made the prophetic observation that "when nuclear energy has been successfully applied for power production, in say, a couple of decades from now, India will not have to look abroad for its expertise, but will find them ready at home". Since 1957, when the first batch of BARC Training School was inducted, we have been running this education programme for preparing our scientists and engineers to get oriented in the field of nuclear science and engineering. Today, HBNI is not only giving degrees to the gradating trainees, but also helping in providing continuing education to a large section of DAE employees.

Time has come for us to have fresh dreams. I am sure, many of our young colleagues have their own dreams. Scientists can explore new ways of harnessing nuclear energy, new means of energy conversion and storage, new methods of using radiation in food, health and environmental control, while engineers can give shape to these ideas into robust technologies which can spread all over the world. Today, India has a leading position in several areas such as information technology, iron and steel, pharmaceuticals and service sectors. I see no reason why we cannot occupy a pre-eminent position in the energy sector and in several other hi-tech areas. We have mastered the heavy water reactor technology today. Tomorrow, we may have to compete with the world with our own design of Light Water Reactors. We already have an eminent position in Fast Reactor technology and we may have to lead the path to show the world that Fast Reactors not only provide energy at a competitive cost in a safe manner but also provide fuel reserves for the future by converting fertile material to fissile. The current work being pursued both in BARC and IGCAR on developing Fast Reactor fuel with short doubling time is of great significance in this respect. We must fulfill our cherished dream of providing long term energy security to the country by utilizing our vast reserves of thorium after establishing a substantially higher capacity of nuclear power.

While concluding my address, I would like to emphasize that we have plenty of challenges ahead. With the synergetic effort of all of us in BARC, scientists, engineers 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.

Friends, finally on this very special day, let us firmly resolve and rededicate ourselves to continue our pursuit of excellence in the frontier areas of nuclear science and technology for the betterment of life of our people.

Thank you."

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

21ST DAE ALL INDIA ESSAY WRITING CONTEST

Dr. Anil Kakodkar, Chairman, AEC kindly gave away the prizes to the winners of the 21st DAE All India Essay Contest.

For this year's essay contest, the three topics were:

Topic 1: Expanding Indian Nuclear power programme
– Realizing Dr. Bhabha's Vision.

Topic 2: Reaping the benefits of Radiation Technologies
– Dr. Bhabha's Vision, Growth and Current Scenario in India.

Topic 3: Laser and its applications.

A total of 393 essays were received, out of which 363 were in English and the remaining 30 were in other Indian regional languages. As has been the practice in the past, the essays were evaluated by a team of evaluators forming 8 groups drawn from BARC and NPCIL. After preliminary evaluation, the essays were subjected to a normalization process within the groups. Depending on the ranking, some of the essays were short-listed and these essays were further evaluated through inter-group evaluation for final round of normalization.

The first 12 contestants in the merit list for Topic- 1, 9 contestants in the merit list for Topic-2 and 12 contestants in the merit list for Topic-3 were invited to Mumbai, to visit various facilities of the Department of Atomic Energy and make an oral presentation of their essays. 12 contestants from topic-1, 9 contestants from Topic-2 and 10 contestants from Topic-3 made their presentations on Thursday, 29th October, 2009. The panel of judges for Topic [1] were:

1. Mr. D.K. De, SO/H, NPCIL
2. Mr. K. Anantharaman, Head, FES, BARC
3. Mr. A.V. Kharpate, Head, RRMD, BARC
4. Mr. S. Duraisamy, Head ROD, BARC
5. Mr. R. C. Sharma, Head, RRSD, BARC.

The panel of judges for Topic [2] were:

1. Dr. Meera Venkatesh, Head, RPhD, BARC
2. Dr. Lalit Varshney, RTDD, BARC
3. Dr. A.K. Sharma, Head, FTD, BARC
4. Mr. K.V.S. Shastry, DGM, BRIT, BARC
5. Dr. Grace Samuel, SO/G, Radiopharmaceuticals Chemistry Section, RPhD, BARC.

The panel of judges for Topic [3] were:

1. Dr. A. K. Das, Head, L&PTD, BARC
2. Dr. Shailesh Kumar, SO/G, L&PTD, BARC
3. Dr. A.K. Pulhani, SO/F, L&PTD, BARC
4. Dr. Padma Nilya, SO/F, L&PTD, BARC
5. Mr. A.S. Rawat, SO/F, L&PTD, BARC
6. Mr. S. Sasikumar, SO/E, L&PTD, BARC
7. Mr. M. L. Shah, SO/E, L&PTD, BARC.

Based on the assessment of panel of judges and the evaluators, the list of the prize winners was finalized. In addition to the First, Second and Third prizes for each topic, consolation prizes were also awarded to the remaining contestants, who were invited to make oral presentations.

Topic 1: Expanding Indian nuclear power programme – Realizing Dr. Bhabha's vision

I	Prize winner Mr. Ajith Tom George B.Tech. I, Coimbatore	English
II	Prize winner Ms. Richa Kumari B.Sc. III, Bengaluru	English
III	Prize winner Ms. Swati Chaudhary B.Sc. III, Barmer	Hindi

1.	Mr. Anirban Das, B.Sc. I Kolkata	Bengali
2.	Mr. G. Sanmugraj, B.Sc.III Nammakal	English
3.	Mr. P. Nikilesh, B.Sc II Chennai	English
4.	Mr. J. Mariathangaraj, B.Sc. III, Kovilpatti	English
5.	Ms. Poornima R. Joli, B.E.II Dharwad	English
6.	Ms. Abinaya Natrajan, B.E.III, Kavalakkan	English
7.	Mr. S. Deepuk, 5 year Integrated MA, Chennai	English
8.	Ms. Paridhi P. Trivedi, B.Pharma IV, Gandhinagar	English
9.	Mr. A. Rajakumaran, B.Tech. IV, Karaikudi	English

Topic 2: Reaping the benefits of radiation technologies – Dr. Bhabha's vision, growth and current scenario in India

I	Prize winner Mr. Rejoice Thomas B.Tech. I, Coimbatore	English
II	Prize winner Mr. Jishnu Samanta B.Sc. II, Kolkata	English
III	Prize winner Ms. Sneha Anil Deshmukh B.Sc. II, Dhamangaon	English

1.	Mr. Bhavnesh Hanumant Dhuri B.A. II, Devgad	Marathi
2.	Mr. Vishwakarma Suraj Rishibhai B.C.A. III, Surat	Englisn
3.	Mr. Chaitanya Jayprakash Raorane B.Sc. III, Ratnagiri	English
4.	Ms. Mansi Rajan Khare B.Sc. I, Ratnagiri	English
5.	Ms. Divya Singh B.Sc. B.Ed., III semester, Mysore	English
6.	Ms. J. Rubavathi B.Sc. III, Kovilpatti	English

Topic 3: Laser and its applications

I	Prize winner Ms. I. Alavi Moideen Kolambil B.Sc. II, Malappuram	English
II	Prize winner Ms. Richa Bharatbhai Patel B.Sc. III, Vallabh Vidyanagar	English
III	Prize winner Ms. Bhanu Choudhary B.Sc. III, Barmer	Hindi

Consolation prizes

1.	Ms. Rasika Suhas Sahoni B.Sc. II, Ratnagiri	English
2.	Mr. Manish B.Sc. I, Kurukshetra	English
3.	Mr. Pratik Deepak Talgaonkar B.Sc. II, Ratnagiri	English
4.	Ms. Geetanjali Ganpat Sapale B.Sc. I, Ratnagiri	English
5.	Ms. Kiran B.Sc. III, Polwal	English
6.	Mr. Prateek Gupta B.Sc. II,Ambala	English
7.	Ms. Munj Namita Vijay B.Sc. IIRatnagiri	English

Forthcoming Conference

InDA - APDA Conference on Desalination and water Purification (InDACON-2010)

The Board of Research in Nuclear Sciences, in association with the Indian Desalination Association (InDA) and the Asia-Pacific Desalination Association (APDA) will be hosting the above conference, at Chennai from March 10-12, 2010. The objective of the conference is to review developments in desalination and water purification technologies and identify key elements, in formulating an integrated water management philosophy, to provide fresh water at affordable cost. The scientific programme of the conference includes Oral & Poster presentations as well as invited talks. The topics that would be covered include:

- Integrated water management schemes for supply of purified water.
- Developments in desalination & water recovery technologies.
- Hybrid desalination & water treatment systems.
- Nuclear desalination and cogeneration technologies.
- Membrane development.
- Membrane process for water purification & treatment.
- Nano-technology for water purification.
- Safe drinking water technologies & deployment methodologies.
- Use of non-conventional energy sources for desalination & water purification.
- Environmental issues in desalination & water purification.
- Financial aspects.
- Economies & affordability of desalination & water purification systems.
- Role of NGOs & private trusts in providing safe drinking water.

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DAE (EXCELLENCE IN SCIENCE, ENGINEERING & TECHNOLOGY) AWARDS - 2008

The DAE (Excellence in Science, Engineering & Technology) Awards Scheme has been instituted, to recognize outstanding achievements of the members of the DAE community. These awards are given annually. Beginning from the year 2006, this Award Scheme has been expanded to include other categories. The DAE Awards are now given in the following eight categories:

1. Homi Bhabha Science & Technology Awards
2. Science & Technology Excellence Awards
3. Young Technologist Awards
4. Young Scientist Awards
5. Young Engineer Awards
6. Meritorious Service Awards
7. Group Achievement Awards
8. Special Contribution Awards.

The Homi Bhabha Science & Technology Award winners for the year 2008 were seven scientists from BARC and one each from IGCAR, VECC. Each award carries a medal and a citation and a cash award of Rs. 5 Lakhs. The BARC awardees were:

1. **Dr. Alok Chakrabarti**, RIB Group, VECC
2. **Dr. Haridas Pal**, Radiation & Photochemistry Divn, CG, BARC
3. **Mr. Kalmady Rajesh**, Computer Divn, E&IG, BARC
4. **Dr. Subhashish Mazumder**, Solid State Physics Divn, PG, BARC
5. **Dr. Pujari P.K.**, Radiochemistry Divn, RC&IG, BARC
6. **Mr. Rama Rao A.**, Reactor Engg. Divn, RD&DG, BARC
7. **Dr. Sinha, A.K.**, Centre for Des. & Manuf., BARC
8. **Mr. Sivaraman N.**, Chemistry Group, IGCAR
9. **Dr. Yusuf S.M.**, Solid State Physics Divn, PG, BARC.

Dr. Alok Chakrabarti, was awarded for his pioneering contributions in the field of Exotic Nuclei Physics and Radioactive Ion Beams.

Highlights of Contributions

Under his leadership, the Radioactive Ion Beam facility project has reached a number of important milestones

Dr. Alok Chakrabarti, receiving the Homi Bhabha award from Prof. S.P. Sukhatme, Former Chairman, AERB

and most notably, with the commissioning of the country's first heavy-ion RFQ Linac, India has joined the select club of developed countries who have built this state-of-the-art machine.

The ion-beam based material science programme initiated by him has produced highly credible scientific output under his able guidance.

He was also responsible for initiating and steering of several national and international collaborations; such as, RIKEN (Japan) for exotic nuclei physics and accelerator development, TRIUMF (Canada) for design and development of Electron Linac and SAMEER for RF transmitters. He has made a valuable contribution to the first exotic nuclei experiment conducted with the RIPS facility at RIKEN, Japan. His group discovered a novel method for decay spectroscopy of exotic nuclei at RIKEN.

Dr. Haridas Pal was awarded for his outstanding contributions in understanding of the photo-induced processes in condense phase and in supramolecular host-guest systems.

Highlights of Contributions

Contributed significantly in understanding of the mechanism and dynamics of Electron Transfer (ET) processes in microheterogeneous media. For the first time, he has shown Marcus inversion behaviour for bimolecular ET reactions in micellar media.

Dr. Haridas Pal, receiving the Homi Bhabha award from Prof. S.P. Sukhatme, Former Chairman, AERB

In the area of supramolecular chemistry, he has demonstrated how supramolecular interaction can be effectively utilized to develop a dye laser system with superior laser quality, using benign water as the solvent.

Mr. Kalmady Rajesh, was awarded for his outstanding contributions in the areas of high performance computing and grid computing, thereby enabling the BARC scientific community to solve highly complex problems in several fields of science and engineering.

Highlights of Contributions

He was responsible for the design and development of the ANUPAM series of parallel supercomputers namely ANUPAM-860, ANUPAM-Alpha, Anupam-Aruna, Anupam-Ameya and Anupam-Ajeya supercomputers.

He has successfully implemented and parallelized the Computational Fluid Dynamics application-VASBI, to simulate the flow of air through intake ducts of the LCA aircraft being designed by ADA.

In the new field of Grid Computing, he has played a major role in the development of the Gridview monitoring and visualization tool for the Worldwide LHC Computing Grid (WLCG).

Mr. RajeshKalmady, receiving the Homi Bhabha award from Prof. S.P. Sukhatme, Former Chairman, AERB

Dr. Subhashish Mazumder was awarded for his significant contributions towards instrumentation, experimental and theoretical aspects of both Small-Angle Neutron Scattering (SANS) and Small-Angle X-ray scattering (SAXS).

Dr. Subhashish Mazumder, receiving the Homi Bhabha award from Prof. S.P. Sukhatme, Former Chairman, AERB

Highlights of Contributions

He contributed significantly to the design and installation of country's first Small Angle Neutron Scattering (SANS) instrument at BARC.

In small-angle scattering, he has developed a formalism on multiple small-angle scattering accounting for polydisperse statistical nature of the medium and established size distribution of nano-sized w-precipitates in maraging steel using the aforementioned formalism.

He is currently building a SAXS facility in the upcoming synchrotron facility at INDUS-II.

Dr. P.K. Pujari, was awarded for his outstanding contributions to the programme of nuclear chemistry, particularly, in the areas of position annihilation studies for investigating various materials.

Highlights of Contributions

Contributed significantly to the understanding of the behaviour of positron/positronium(Ps) in molecular solids.

Generated significant new information on the microstructure of polymers and membranes in terms of free-volume.

Dr. P.K. Pujari, receiving the Homi Bhabha award from Prof. S.P. Sukhatme, Former Chairman, AERB

His work on high temperature superconductors (HTSC) has revealed electronic-structural changes at the onset of superconductivity.

His studies in Zr based alloys together with TEM and Orientation imaging microscopy (OIM) has given new insight into the positron dynamics especially with respect to defect recovery, grain growth and phase transformation.

Mr. A. Rama Rao, was awarded for his outstanding contributions in the area of vibration engineering and technology.

Highlights of Contributions

He has established a world-class vibration laboratory to take up the most challenging tasks. The facilities developed by him have been in constant demand from many units within the department and elsewhere.

Mr. A. Rama Rao, receiving the Homi Bhabha award from Prof. S.P. Sukhatme, Former Chairman, AERB

Dr. A.K. Sinha, receiving the Homi Bhabha award from Prof. S.P. Sukhatme, Former Chairman, AERB

He has developed a non-intrusive method of detecting turbine blade vibration based on analysis of turbine casing vibration. He has successfully installed an online blade health monitoring system in TAPS-3 in March 2007.

He was successful in evolving a new test procedure based on signal analysis in the acoustic range. The method has been successfully deployed for testing production components of the missile.

He has also devised an innovative method for seismic qualification of the reactor components of PRP project.

Dr. A.K. Sinha, was awarded for his significant and valuable contributions towards Design & Development of various types of high precision instruments/ equipment and special purpose machines for various applications.

Highlights of Contributions

He designed and developed "5-axes Dynamic Positioning Mechanism for 3.32 Metre diameter Sub Reflector of 32 Metre Deep Space Network (DSN) Antenna for Chandrayaan-I project.

He developed equipment namely Ultra High Precision Rotary Table, Radiometry Scanning Machine and High precision 19-axes experimental station.

He also contributed in the development of vacuum compatible Elliptical Crystal Bender for EXAFS Synchrotron Beam line installed at Indus-II, RRCAT.

He developed Double Wedge Tuner (DWT) for ILC under MOU with Fermi Lab,USA. under a MOU, for ILC.

Mr. Sivaraman N., was awarded for his outstanding contributions in the area of high performance separation methods for isolation of actinides and lanthanides, which have several applications in nuclear fuel cycle and chemical analysis.

Highlights of Contributions

He successfully developed the HPLC-based technique for the determination of burn-up of fast reactor fuels for the first time.

The ion-pair chromatographic technique for individual separation of lanthanides as well as actinides developed by him in connection with the burn-up measurements has led to separation of all 14 lanthanides in about 2.8 minutes, the fastest LC technique as of now in literature which significantly reduced analysis time, liquid waste generation as well as dose to operator during analysis of radioactive samples.

Mr. N. Sivaraman, receiving the Homi Bhabha award from Prof. S.P. Sukhatme, Former Chairman, AERB

He played a leading role in setting up a Super-critical Fluid Extraction (SFE) facility for the removal of actinides from various waste matrices.

Dr. S.M.Yusuf, was awarded for his outstanding contributions towards understanding the magnetic, electronic and structural behaviour of many technologically important magnetic materials of current interest.

Highlights of Contributions

He successfully established a microscopic understanding of the novel phenomenon of magnetic pole reversal which can be utilized to design device applications in volatile magnetic memories, and thermo-magnetic switches.

Dr. S.M. Yusuf, receiving the Homi Bhabha award from Prof. S.P. Sukhatme, Former Chairman, AERB

He was responsible for discovering the phenomenon of switching of exchange bias in nanoparticles of chromates, offering new possibilities to fabricate magneto-electronic nano-devices.

He achieved a fundamental understanding of magnetic properties for CMR manganites as well as dimensionality crossover of magnetic ordering in low dimensional systems.

He was instrumental in establishing the neutron depolarization technique in India.

The Science & Technology Excellence Awards were given to 21 scientists from BARC, 6 from IGCAR, 1 from NCCCM and 4 from VECC. Each award carries a medal, a citation and a cash prize Rs. 1 Lakh. The BARC awardees were:

1. Dr. Aswal, V. K., SSPD, BARC
2. Dr. Adhikari, S., RPCD, BARC
3. Dr. (Ms) Alamelu, D., FCD, BARC
4. Dr. Arya A.K., MSD, BARC
5. Dr. Bhowmick Ashok, TPPED, BARC
6. Mr. Behere, P.G., NFG/AFFFT, BARC
7. Mr. Banerjee, D., BETTD & Mr. Dani, U., WMD, BARC
8. Mr. Dulera Indravadan, RED, BARC
9. Dr. Ghanty, T. K., TCS/CG, BARC
10. Mr. Gupta Anjan Dutta, VECC
11. Mr. Kulkarni, M.S., RSSD, BARC
12. Dr. Kapoor, R., MMS/MG, BARC
13. Dr. Kumar Sanjeev, NCCCM
14. Mr. Mukhopadhyay Deb, RSD, BARC
15. Dr. Mittal Ranjan, SSPD, BARC

16. Mr. Mohan Joe, LWRD, BARC
17. Dr. Murugan, S., IGCAR
18. Dr. (Ms.) Jaya Mukherjee, L&PTD, BARC
19. Mr. Nimje, V.T., APPD, BARC
20. Mr. Nanekar Paritosh, QAD, BARC
21. Mr. Nashine, B.K., IGCAR
22. Dr. Ponraju, D., IGCAR
23. Mr. Puthiyavinayagam P., IGCAR
24. Mr. Ray, D.D., DRHR, BARC
25. Mr. Roy Amitava, VECC
26. Mr. Roychowdhury P., APPD, BARC
27. Mr. Satish, K., RPD, BARC
28. Dr. (Ms.) Saibaba Saroja, IGCAR
29. Dr. (Ms.) Sandhya R., IGCAR
30. Mr. Som Sumit, VECC
31. Mr. Sarkar Biswajit, VECC.

The Young Scientist Awards for the year 2008 were given to seven scientists; six from BARC and one from VECC. Each award carries a medal and a cash prize of Rs. 1,00,000/-.

The BARC awardees were:

1. Dr. (Ms.) Choudhury Rajul Ranjan, SSPD, BARC
2. Dr. Das Tapas, RPhD, BARC
3. Dr. Ghosh Tilak Kumar, VECC
4. Mr. Kumbhakar Manoj, RPCD, BARC
5. Dr. Singh Surendra, SSPD, BARC
6. Dr. Satpati Ashish Kumar, ACD, BARC
7. Dr. (Ms.) Pandey Usha, RPhD, BARC.

The Young Applied Scientist & Technologist Awards for the year given to 9 scientists; seven from BARC and one each from NFC & IGCAR. Each award carries a medal and a cash prize of Rs. 1,00,000/-.

1. Mr. Arun Kumar, BARC
2. Mr. Arun Kumar Singh, BARC
3. Mr. Hemanath, M.G., IGCAR
4. Mr. Khupekar Abhijeet, BARC
5. Mr. Kumar Vaibhav, NFC
6. Mr. Mohanty , S.K., BARC
7. Mr. Ravi Kumar G., BARC
8. Mr. Sridhar, G., BARC
9. Mr. Tikaria Amit, BARC.

The Young Engineer Awards were given to twenty three engineers; sixteen were from BARC, two each from IGCAR, VECC and NFC, one from RMP. Each award carries a medal, a citation and a cash prize of Rs. 1,00,000/-.

1. Mr. Bapat Harsh M., BARC
2. Ms. Baveja Neetu, BARC
3. Ms. Choudhuri Gargi, BARC
4. Mr. Chinmay Nandi, IGCAR
5. Mr. Deepthi Kumar, RMP
6. Mr. Dey, S.P., BARC
7. Mr. Gokulakrishnan, T., IGCAR
8. Mr. Khan Imran Ali, BARC
9. Mr. Jain Vikas, BARC
10. Mr. Kannao, V. M., NFC
11. Mr. K.K. Singh, BARC
12. Mr. Majumdar, P., BARC
13. Mr. Manole, A.A., BARC
14. Mr. Maji Bikas Chandra, BARC
15. Mr. Manir Ahammed, VECC
16. Mr. Murthy RamaTammana Sree, BARC
17. Mr. Neogy Suman, BARC
18. Mr. Prashant Kumar, BARC
19. Mr. Ravi Shankar, A., IGCAR
20. Mr. Singh, J.P., BARC

21. Mr. Sabhapathi N., NFC
22. Mr. Sujoy Kumar Sarkar, BARC
23. Mr. Shah, M. S., BARC

The Meritorious Service Awards were given to 25 employees from DAE. 17 employees from BARC, 7 from IGCAR and one from VECC. Each award carries a medal, a citation and cash award of Rs. 20,000/-. The list of awardes is as follows:

1. Ms. Agashe, P., MSD, BARC
2. Mr. Bajpai, U.K., RMD, BARC
3. Mr. Bavkar, J.B., PD, BARC
4. Mr. Chandran, S., CED, IGCAR
5. Mr. Dasan Pengat, AFD, BARC
6. Mr. Durai A., ACVSD, IGCAR
7. Mr. Devan R., ESD, IGCAR
8. Mr. Ganapathy M., CFD, IGCAR
9. Ms. Jayaraman. M., PD, BARC
10. Mr. Koli, A.D., RRMD, BARC
11. Mr. Loganathan. A.T ., C&ISD, IGCAR
12. Mr. Mungekar, R.H., RED, BARC
13. Mr. Nair, P. M., RED, BARC
14. Mr. Natarajan, K.M., CWD, IGCAR
15. Mr. Prajapati, H.J., QAD, BARC
16. Mr. Ramachandran, P.K., FRD, BARC
17. Mr. Rajan. A., SFD, IGCAR
18. Mr. Rahurkar, A. G., Comp. Dn., BARC
19. Mr. Rohra, B. P., PD, BARC
20. Mr. Rai, S., PD, BARC
21. Mr. Shembe, P.S., MMS, BARC
22. Mr. Thomas, C.J., RMD, BARC
23. Ms.Thomas Laly, AD, BARC
24. Mr. Verma T. S., L&CMS, BARC.
25. Mr. Vishwanathan T., VECC

The Special Contribution Awards were given to 87 scientists and engineers from DAE Out of these eighty six were from BARC, one from AMDER; Hyderabad, Each award carries a medal, a citation and cash award of Rs. 50,000/-.

1. Mr. Agarwal, G.K., SO/G, PRP, BARC
2. Mr. Anand N.S., SO(SB), RC&IG, BARC
3. Mr. Bhandut Prashant, SO/C, NRG, BARC
4. Mr. Babu, C.G., F/B, NFG, BARC
5. Mr. Bhojane, S. M., SO(SB), RC&IG, BARC
6. Dr. (Ms.) Bhanu, A.U., SO/F, RC&IG, BARC
7. Mr. Chaughule, N.V., SA/D, HS&EG, BARC
8. Mr. Chinna Babu, K.L.N., SA/C, NFG, BARC
9. Mr. Dhondkar, J.K., SO(D), LWRD, BARC
10. Mr. Dogra Santosh, SA/D, HS&EG, BARC
11. Mr. Das Tanmoy, SO/B, HS&EG, BARC
12. Mr. Dhiwar, V.I., SO/E, RC&IG, BARC
13. Mr. Dangore, A.Y., NDDP & AUGF, BARC
14. Mr. Gathibandhe, M.V., SO(F), RPD, BARC
15. Mr. Gaware Jitendra, SA/D, EAD, BARC
16. Mr. Gandhi, K.G., SO/H, NRG BARC
17. Mr. Hasilkar, S.P., SO/F, RC&IG, BARC
18. Mr. Joshi, V.M., SA/D, HS&EG, BARC
19. Mr. Jeevanram, S.S., SO/H, NFG, BARC
20. Mr. Joseph, J., SO/G, NFG, BARC
21. Mr. Jha Kaushal, O/E, NFG, BARC
22. Mr. Johny, P.V., Tech. G, NFG, BARC
23. Mr. Kothari, P.K., SO(G), RTD, BARC
24. Mr. Kumar, S., SO/F, PRP, BARC
25. Mr. Kachare, S.V., SA/D, HS&EG, BARC
26. Mr. Kulkarni Devendra B., SO/C, HS&EG, BARC
27. Mr. Kulkarni V.N., SO/D, HS&EG, BARC

28. Ms. Kurup Priya, SO/F, CnID, BARC
29. Mr. Kishan Ram, SO/H, TSD, BARC
30. Mr. Khan Haroon, T/G, RED, BARC
31. Mr. Kumar Arun, SO/H, NFG, BARC
32. Mr. Kumar Surendra, SO/SB, NFG, BARC
33. Mr. Kushwaha, O.P., SA/C, NFG, BARC
34. Mr. Kadam, S.R., Tech/F1, NFG, BARC
35. Mr. Majumdar Amit, SO(G), AMD, BARC
36. Mr. Murali, E.K., Tech.J, ChEG, BARC
37. Mr. Mishra, R.K., SO/E, NRG, BARC
38. Mr. Mathew, P., SO/C, HS&EG,BARC
39. Mr. Mhatre, R.N., T/H, RED, AMD
40. Mr. Mittal, R.K., SO/E, NFG, BARC
41. Mr. Malagi, R.M., SO/D, NFG, BARC
42. Mr. Mahadeshwar, K.G., Tech/D, NFG, BARC
43. Mr. Mahato, P. K, SO/E, RPG, BARC
44. Mr. Nair, N.B., SO/E, NRG, BARC
45. Mr. Nawge, M.S., F/B, NFG, BARC
46. Mr. Narasimhan, S., SO/F, MG, BARC
47. Mr. Nair, P.R., SO/F, RC&IG, BARC
48. Mr. Patil, S.S., SA/D, HS&EG, BARC
49. Mr. Pujari, R.N., SA/E, HS&EG, BARC
50. Mr. Patil, M.B., T/F, CDM, BARC
51. Mr. Panse, H.B., SO/G, CDM, BARC
52. Mr. Pol, S.N., T/D, RED, BARC
53. Mr. Pappachan, A.L., SO/G, MG, BARC
54. Dr. Panakkal, J.P., OS, NFG, BARC
55. Mr. Prasad, R.S., SO/F, NFG, BARC
56. Mr. Patil, A.B., SO/D, NFG, BARC
57. Mr. Pilankar, D.G., Sr.Tech/H, NFG, BARC
58. Mr. Pathak, S.S., SO (SB), RC&IG, BARC
59. Mr. Parulkar, S.K., SO/H, E&IG, BARC
60. Mr. Raut, S.D., SO/C, NFG, BARC
61. Mr. Rao, Y.C., SO/F, NRG, BARC
62. Dr. Rao, S.C.A.V.S.S., SO/G, NRG, BARC
63. Dr. Srivastava, S.K., SO(F), AMD, BARC
64. Mr. Shivade, R.K., SO/D, HS&EG, BARC
65. Mr. Sathe, J.D., SA/E, NFG, BARC
66. Mr. Salvi, P.B., SA/D, NFG, BARC
67. Mr. Sahu, L.D., SA/D, HS&EG, BARC
68. Mr. Sankhla Rajesh, SO/E, HS&EG, BARC
69. Mr. Singh Sanjay, SO/B, HS&EG, BARC
70. Mr. Saroj, S.K., SA/D, HS&EG, BARC
71. Mr. Shinde, A.M., SO/C, HS&EG, BARC
72. Mr. Singh, A.K., SA/D, HS&EG, BARC
73. Mr. Srinivasan, P., SO/D, HS&EG, BARC
74. Mr. Singh Amar, T/F, RED, BARC
75. Dr. Sengupta, A.K., SO/H, NFG, BARC
76. Mr. Singh, V.K., SA/C, NFG, BARC
77. Mr. Sadanandan, M., Tech.G, NFG, BARC
78. Mr. Shirgaonkar, D.G., Tech/D, NFG, BARC
79. Mr. Srinivas, K., SO/F, MG, BARC
80. Mr. Sharma, V.K., SO/G, RC&IG, BARC
81. Ms. S. Parasakthi, Stenographer, PD, BARC
82. Mr. Varkhedkar, V., SO/C, HS&EG, BARC
83. Mr. Vengurlekar, V.B., T/D, RED, BARC
84. Mr. Venkatesan, V., SA/D, NFG, BARC
85. Mr. Verma, V.K., SA/C, NFG, BARC
86. Mr. Venkiteswaran, S., SO/G, RC&IG, BARC
87. Mr. Verma O.P., SO/SB, NFG, BARC.

Group Achievement Awards: The Group Achievement Awards were given to 36 groups out of which 23 groups were from BARC; five from IGCAR; 3 from RRCAT; 2 from NFC and one each from BRIT, HWB and VECC.

No.	Group Leader	Unit	Group members	Prize amount
1.	Mr. V.K. Mehra, Director, RPG,	BARC	142	Rs. 10 Lakh
2.	Mr. P.K. Dey, OS, Head, FRD,	BARC	484	Rs. 10 Lakh
3.	Dr. V.C. Sahni, Former Director, RRCAT & Director Physics Group,	RRCAT	235	Rs. 10 Lakh
4.	Mr. V.K.Raina, Director, Reactor Group,	BARC	76	Rs. 4 Lakh
5.	Mr. R.L.Suthar, Head, CDM,	BARC	60	Rs. 4 Lakh
6.	Dr. A.K. Suri, Director, Materials Group,	BARC	34	Rs. 3 Lakh
7.	Dr. P. Chellapandi, Director (safety), Assoc. Director, NEG & Head, REG/NEG,	IGCAR	26	Rs. 2.5 Lakh
8.	Dr. T.K. Mitra, SO/H, Associate Director,	IGCAR	27	Rs. 2.5 Lakh
9.	Dr. V.C. Sahni, DS Director,	RRCAT	48	Rs. 2 Lakh
10.	Mr. R.K. Gupta, Head,HCD&ES, NRG,	BARC	19	Rs. 2 Lakh
11.	Mr. A.K. Singhal, Head, CTD,	BARC	18	Rs. 2 Lakh
12.	Dr. G.J. Nair, Head, Seismology Division,	BARC	23	Rs. 2 Lakh
13.	Mr. M.S.N. Sastry, Director (E&P),	HWB	17	Rs. 2 Lakh
14.	Mr. T. K. Haldar, Director (R&D), HWB, Mr. S.K. Ghosh, Director, Chem.Engg.Group,	HWB Talcher & BARC	20	Rs. 2 Lakh
15.	Mr. V.K. Mehra, Director, RPG and ESG, & Mr. N.S. Gabhane, (Former Head, TSD, BARC) Director,	BARC	15	Rs. 1.5 Lakh
16.	Mr. C.K.G. Nair, Head, ESNS, EAD, HS&EG,	BARC	14	Rs. 1.5 Lakh
17.	Dr. Pitambar Singh, SO/H, NPD,	BARC	13	Rs. 1.5 lakh
18.	Mr. R. P. Singh, Associate Director, NFG & Head, AFD & Mr. M. M. Hussain, SO/G, AFD,	BARC	25	Rs. 1.5 Lakh
19.	Mr. T.K. Bera, Project Director, RMP, Mysore	BARC	16	Rs. 1.5 Lakh
20.	Mr. Arun Kumar Bhaduri, Head, Materials Technology Division	IGCAR	19	Rs.1.5 Lakh
21.	Mr. C.R.Venkata Subramani, SO/G, FChD, CG,	IGCAR	30	Rs. 1.5 Lakh
22.	Dr. S.M. Oak, SO/H+, SSLD,	RRCAT	18	Rs. 1.5 Lakh
23.	Dr. K.G.M. Nair, SO/H, MSG,	IGCAR	16	Rs. 1.5 Lakh
24.	Mr. G.V.S. Hemantha Rao, SO/H+,	NFC	12	Rs. 1 Lakh
25.	Mr.Trilok Singh, Head, Cryo-Technology Division,	BARC	11	Rs. 1 lakh
26.	Mr. D.A. Sudheendra Rao, Head, RH & SES,	BARC	9	Rs. 1 Lakh
27.	Mr. B.K. Shah, Head, QAD,	BARC	12	Rs. 1 Lakh

28.	Dr. Vijai Kumar, Associate Director, KMG and Head, SIRD,	BARC	11	Rs. 1 Lakh
29.	Dr. Sunil Sabharwal, Head, RTDD,	BARC	11	Rs. 1 Lakh
30.	Mr. A.K. Singhal, Head, CTD,	BARC	12	Rs. 1 Lakh
31.	Dr. G.D. Jindal , SO/H, Electronics / E&I,	BARC	12	Rs. 1 Lakh
32.	Mr. B.B. Rupani, Head,RCCS, RED, RDDG,	BARC	10	Rs. 1 Lakh
33.	Mr. Vinaya Kumar, Head, FHCS,	BARC	10	Rs. 1 Lakh
34.	Dr. N. Sivaprasad, SO/H,	BRIT	6	Rs. 50,000/-
35.	Mr. R.V.R.L. Visweswara Rao, SO/F, NUOFP (O),	NFC	3	Rs. 50,000/-
36.	Dr. Debranjan Sarkar, SO/H,	VECC	4	Rs. 50,000/-

The Industrial Safety Awards were instituted by the Industrial Hygiene and Safety Section: RSSD. These awards in the form of Industrial Safety Shields are given exclusively to BARC Units. As part of safety promotional activities by Industrial Hygiene and Safety Section of Radiation Safety Systems Division (RSSD), BARC has introduced this Industrial Safety Award Scheme in the form of Director's Safety Shield on rotation, exclusively for BARC units.

The entries from the various Divisions/Sections/ Units of BARC for the year 2008 were invited from three different categories of units/facilities, namely:

A: Operating Plants
B: R&D Labs and Industrial Units
C: Engineering, Projects and Support Units

A thorough scrutiny of the entries were made and a comparative study of all the entries in each Category was carried out based on the different parameters in respect of Safety Statistics and Safety Management Indicators including that of training and motivational efforts.

Mr. P.B. Kulkarni, Chairman, Industrial Safety Award Scheme Committee and Chairman, Conventional and Fire Safety Review Committee announced the winning units for the year 2008, which were as follows:

A: Operating Plants: Rare Materials Project, Mysore
B: R&D Labs and Industrial Units: Reactor Engineering Division, BARC
C: Engineering, Projects and Support Units: N R G Projects, Kalpakkam.

Representatives from the respective units received the shield at the hands of Dr. Srikumar Banerjee, Director, BARC. The award comprised one Rotating Shield and a small replica for retention by the respective winning unit.

On behalf of Rare Materials Project, Mysore, Mr. S. Sarkar, Project Manager (Process) and Mr. Tamizhselvan, Safety Officer received the shield.

Mr. R.K. Sinha, Director, Reactor Design and Development Group and Mr. D.N. Shendre, Overall Safety Coordinator, Reactor Engineering Division received the shield on behalf of Reactor Engineering Division.

On behalf of NRG Projects, Kalpakkam, Mr. Amitava Roy, Project Director and Mr. A. Chinnappan, Safety Coordinator received the shield.

Dr. Anil Kakaodkar, Chairman, DAE releasing the Founder's Day Special issue of the BARC Newsletter

Release of the Founder's Day Special Issue of the BARC Newsletter: Every year, the Special October issue of the BARC Newsletter is dedicated to the memory of Dr. H.J. Bhabha, the Founder of BARC. It carries Award winning papers of BARC Scientists and Engineers, presented at various national and international symposia, conferences and seminars. This year a record number of 54 papers were published in the issue, which was released by Dr. Kakodkar.

Dr. Srikumar Banerjee, Director, BARC releasing the book on Dr. Bhabha

A book entitled "Scientometric Portrait of Homi Jehangir Bhabha: The Father of Indian Nuclear research Programme".was brought out by Dr. B.S. Kademani, Mr. Anil Sagar and Dr. Vijai Kumar from Scientific Information Resource Division, Bhabha Atomic Research Centre, Mumbai to mark the 'Homi Bhabha Birth Centenary Year.

The Book was released by Dr. Srikumar Banerjee, Director, Bhabha Atomic Research Centre, Mumbai. This book highlights various Scientometric aspects of 104 publications published by H.J. Bhabha during 1933-1967 and 1112 citations received to these publications during 1933-2008. This book also identified the areas on which Bhabha worked, the highly cited publications and the areas on which Bhabha's research made impact.

Founder's Day Guest Lecture
TRIP DOWN LASER LANE

U.K.Chatterjee

Work on lasers began in India and at BARC in 1964. Starting with a GaAs crystal, a laser was developed and a communication link was established between Trombay Hill and TIFR in 1965. Dr. H.J. Bhabha witnessed the very first operation of this link. Since then, lasers have made phenomenal progress. In this talk, we dwell upon the extreme limits of only two measurables, temperature and time that lasers allow us to approach.

High power lasers are used in industry, and at multi megawatt continuous powers, they constitute defence weapons. However, a single 4 nanosecond pulse propagating through a chain of amplifiers, when focused, can produce temperatures upto several million Kelvin or even reach fusion temperatures. On the other extreme, cesium vapour can be confined in a magneto optic trap and, using lasers, can be cooled down to several micro Kelvin.

Using suitable electro and acousto – optic techniques, a helium – neon laser can be stabilized to 1 Hz, a stability exceeding 2 x 10^{15}. On the other hand, starting with mode locked pulses, and successively amplifying and producing harmonics in non – linear media, one can produce sub – femtosecond pulses.

One can, thus, visualize the temperature and time ranges in which lasers are capable of operating.

Coming back to communications, today secure communication between two laser stations is possible using signal modulated chaos. Using two lasers in Master – Slave configuration, information could be retrieved at the receiver end whereas, an eavesdropper will be unable to extract any information.

Future areas of promise in the field of lasers are, Quantum Computing, X – ray Holography, Laser Fusion and Accelerators.

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Mr. U.K. Chatterjee, Former Head, L&PTD, BARC, delivering the lecture

बी एआरसी न्यूज़लैटर
BARC NEWSLETTER

भा.प.अ. केंद्र के वैज्ञानिकों को सम्मान
BARC SCIENTISTS HONOURED


Mr. S. Chaurasia

श्री शिवानंद चौरसिया, लेजर एन्ड न्यूट्रान भैतिकी वर्ग, ने वर्ष 2008 का भैतिकी एसोसियेशन का एस.एन.शेषादरी मेमोरियल इंसट्रूमेन्टेशन पुरस्कार (यंग सांइटिस्ट अवार्ड) प्राप्त किया। इस पुरस्कार में 20,000 रुपये नकद तथा एक प्रशस्ति-पत्र शामिल है। 40 गिगावाट पीक पॉवर, 500 पिकोसेकंडस पल्स ड्यूरेशन एनडी: ग्लास लेज़र सिस्टम फॉर लेज़र प्लाज्मा इंटरेक्शन के स्थानीय विकास में योगदान को मान्यता देने हेतु इन्हें यह पुरस्कार प्रदान किया गया। आपने विभिन्न स्टेट-ऑफ-दि-आर्ट निदानकारी उपकरणों की रूपरेखा एवं विकास हेतु अत्यंत महत्वपूर्ण भूमिका निभाई हैं जिनको लेज़र-प्लाज़मा एवं लेज़र चालित प्रघात चिकित्सा के क्षेत्र में उपयोग में लाया जा रहा है।

श्री शिवानंद चौरसिया का जन्म जुलाई 10, 1976 को तथा वर्ष 1999 में बनारस हिन्दू विश्वविद्यालय से भौतिकी विज्ञान में कुशलता प्राप्त की। तत्पश्चात इन्होंने आरआरसीएटी प्रशिक्षण केंद्र के प्रथम बैच का कार्यभार संभाला। प्रशिक्षण को सफलता पूर्वक पूर्ण करके आपने वर्ष 2001 में भाभा परमाणु अनुसंधान केंद्र के लेजर एन्ड न्यूट्रान भैतिकी वर्ग का कार्यभार संभाला। गत आठ वर्षों से आप उच्चताप लेज़र प्लाज़मा में उच्च ऊर्जा एनडी ग्लास लेजंर विकास हेतु अनुप्रयोग के क्षेत्र में काम कर रहे हैं।

Mr. Shivanand Chaurasia of Laser and Neutron Physics Section, received the Indian Physics Association's S.N. Seshadri Memorial Instrumentation award (Young Scientist award) for the year 2008. The award includes a cash prize of Rs. 20,000/- and a citation. He has been conferred with this award for his outstanding contributions to the indigenous development of a 40 Gigawatt peak power, 500 picoseconds pulse duration Nd:Glass laser system for laser-plasma interaction studies. He has also played a pivotal role in the design and development of various state-of-the-art diagnostic tools, which have been used for experiments in the frontier areas of laser-plasma and laser driven shock physics.

Mr. Chaurasia was born on July 10, 1976 and completed Master of Science (Physics) in 1999 from Banaras Hindu University. Soon after, he joined the 1st batch of RRCAT training School. After successfully completing training, he joined the Laser and Neutron Physics Section of the Physics Group of BARC, in 2001. His work for the past eight years has been in the area of development of High power Nd:Glass lasers for applications in high density high temperature laser plasmas.

In recognition of his expertise, he has been invited to participate in the experimental work of some of the advanced laboratories of the world (Sandia National Laboratory, USA; University of York, UK, Cairo University, Egypt for experimental work). He has to his credit more than 50 publications in peer reviewed journals and international / national conferences.

Sketch by Dr. Homi J. Bhabha (Year 1947)

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