

Founder's Day Address

Wednesday, October 30, 2013

by

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Dr Sinha, Chairman, AEC, Senior Members of the DAE Family, Distinguished Invitees, Media representatives, my Colleagues and friends,

I extend a warm welcome to all of you to this Founder's Day functions. On this day we pay respectful homage to our visionary Founder, Dr Homi Jehangir Bhabha, on his 104th birth anniversary. We have assembled here to reflect upon our performance and achievements in the past year, and rededicate ourselves to make best efforts in ensuring maximum benefit to the nation from nuclear applications.

To begin with let me tell you about the performance highlights and achievements of BARC during the last one year.

Most exciting news came on August 10, 2013, when reactor on board nuclear submarine 'Arihant' went critical; a major milestone in national security was achieved. The vessel presently undergoing harbour trials have opened up the possibility of serial production of nuclear submarines. The project, which originated at Trombay campus, involved a large number of personnel from BARC, DRDO and Navy, who worked with total dedication over a long period of time to make this dream come true. The programme saw its first success

when the land based prototype at Kalpakkam became operational in 2006. The day is not far when India will have its nuclear fleet patrolling the oceans.

Dear colleagues,

Today we are focusing our activities towards achieving logical end to our R&D projects. This would involve deploying the output of our R&D efforts in some of our high technology activities and also exploit the technology for commercial and societal applications.

A.1 Technical support was provided to NPCIL to find the root cause of component failure in double check valves of ECCS and development of suitable components for replacement in Kudankulam Nuclear Power Plant. Modified design of valve with indigenously designed components was qualified at Kalpakkam facility.

A.2 The improved Weld Inspection Manipulator was successfully deployed in TAPS-2 during its 23rd refueling outage. The inspection data was analyzed for structural integrity assessment. AERB permitted restart of the unit based on this assessment.

A.3 Computer based 8-Channel Ultrasonic Imaging System has been designed, developed and supplied to IGCAR. The system has been successfully tested for detection of growth and protrusion of under-sodium dummy fuel sub-assemblies at 180°C.

A.4 Microcomputer based Control Systems for "Inclined Fuel Transfer Machine" and "Cell Transfer Machine" for PFBR have been delivered.

A.5 The Low Temperature Technology of Fresh Water Generator utilizing waste heat for sea water desalination was transferred to an industrial house for expanding the deployment potential.

A.6 An ultra filtration system based on membrane cartridges was developed to produce pathogen free water with 0.01 ppm turbidity. This system is suitable for deployment in any hospital.

A.7 Digital Radiotherapy Simulator (*Imagin*) was developed as a vital supplement to the earlier launched indigenous teletherapy system, Bhabhatron (34 units are in use). The 3rd *Imagin* recently installed at Tata Memorial Hospital (TMH), Parel was inaugurated by Director General of IAEA.

A.8 Freeze-dried cold kits of EDTMP (Ethylenediamine Tetra Methylene Phosphonic) and ready-to-use Lu-177-EDTMP, a therapeutic product for palliative therapy of metastatic bone cancer, has been developed and supplies commenced.

A.9 De-silting of Lake No. 10 near Plutonium Plant at Trombay was completed for augmenting the capacity of the lake for rain water harvesting.

A.10 The technology developed for "Inductively Coupled Plasma Mass Spectrometer (ICP-MS)" has been transferred to a private agency in Hyderabad. This is a versatile analytical instrument capable of ultra-trace and isotope ratio analysis in aqueous samples.

A.11 "Variable Refrigerant Volume" air-conditioning system at Uranium Metal Reduction Technology facility at South Site has been commissioned.

A.12 Linear thermoelectric modules based on PbTe (p- type semiconductor) and TAGS (n- type semiconductor alloy of Te, Ag, Ge and Sb) with ~6% power conversion efficiency were supplied to ISRO for simulated testing with regard to application in radioisotope generators.

A.13 A suspendable servo-manipulator has been developed and supplied to NPCIL for emergency operations on the reactor deck plate of TAPS-3&4.

A.14 All-Terrain Robot with Teletector has recently been used for testing HEPA filters at WIP, Trombay.

A.15 A new technique, using Proton Induced Gamma Emission (PIGE), has been established for accurate estimation of elements like Boron, Beryllium and Fluorine in structural material to tens of ppm order.

Dear Colleagues,

Some of our activities have progressed well and has come to a stage where we are working towards up-gradation of these initiatives for application in various fields.

B.1 A prototype 100kW axial electron beam melting (EBM) gun has been developed for deployment at NFC in the proposed twin gun 300 kW EB melting furnace.

B.2 Subcritical neutron multiplying assembly driven by an indigenously developed deuteron accelerator has been commissioned at BARC. The measured multiplying factor is consistent with the predicted value of 0.89. This experimental facility is a step towards implementing the Accelerator Driven System.

B.3 A 400 keV Radio Frequency Quadrupole (RFQ) has been successfully tested by accelerating proton (H^+) and H_2^+ beams. The 400 keV RFQ is designed for D^+ (H_2^+) beam. 60 kW tetrode based RF power source was coupled to the RFQ through an indigenously developed RF coupler with power coupling of more than 99%.

B.4 A Tele Distress Alarm Device, named Nirbhaya, has been developed. The technology of the device has been transferred to ECIL for mass production.

B.5 Laser techniques involving picoseconds sum-frequency generation, and femtosecond laser-induced breakdown spectroscopy, were developed for trace element analysis and for remote monitoring of chemical species in atmosphere and hostile environment.

B.6 A 9-meter long cylindrical multi-cathode magnetron sputter coater was commissioned for fabrication of multilayer Super-Mirrors catering to the needs of efficient neutron and synchrotron beam transports. The automated system has the capability to deposit several hundreds of nano layers of metal, dielectrics, ceramics and composite materials with graded thickness on varieties of substrates.

B.7 The basic biophysical studies on mosquito-larvicidal proteins had led to design and synthesis of a novel protein complex that is more toxic than any combination of binary toxins known so far.

B.8 A time-domain based low-coherence fiber-optic interferometer has been developed for depth-resolved tomography imaging of scattering samples for material science research.

B.9 Recovery of uranium from lean acidic stream at 60 litre/hour, using dispersion type liquid membrane in micro-porous Hollow Fiber cluster was successfully demonstrated.

B.10 A large volume calorimeter has been developed for non-destructive assay of special nuclear materials.

B.11 A Full-range vacuum gauge capable of measuring pressure continuously from 1 bar to $10E-12$ bar has been developed.

B.12 Three Copper Vapour Laser, Master Oscillator and Power Amplifier chains of UCUF project, each operating at 9kHz and at about 130W have been commissioned.

B.13 Ring type Finger dosimeters based on Thermoluminescence (TL) and Optically Stimulated Luminescence (OSL) phosphors have been designed and fabricated in the form of plastic ring and adjustable band/strap for the measurement of the doses received by the body extremities.

B.14 A 5 kW RF amplifier and 7 & 10 KW power amplifiers at 325 MHz has been built and tested at BARC.

B.15 Solar cell arrays consisting of 25 dye sensitized solar cells with 4% efficiency were fabricated.

B.16 A 2.45 GHz, 2 kW, microwave plasma CVD facility has been developed, and deposition of continuous Diamond Thin Films on silicon substrates has been demonstrated.

B.17 A four channel Time-to-Digital Converter (TDC) ASIC has been developed in 0-35 micron, CMOS technology.

Dear Colleagues,

We are also initiating, some major projects in the following areas:-

C.1 Suitability of Tarapur site was examined for Advanced Heavy Water Reactor with regard to Natural Events, Seismo-tectonic & Foundation Conditions. A report has been submitted to DAE Standing Site Selection Committee for its consideration. Agreement has also been reached with M/s BHEL for the development of turbine and steam cycle conditions specific to AHWR.

C.2 Drawing upon the experience of the development of Indian compact LWR, conceptual design of 900 MWe Indian PWR was prepared. The IPWR will be a joint effort of NPCIL and BARC. Site selection and detailed design work is being taken up.

C.3 Infrastructure development for Inter-institutional Centre at Madurai, a forerunner to Indian Neutrino Observatory at Pottipuram is in progress.

BARC is also expanding its activities towards the development of alternate energy sources.

D.1 Isotope Hydrology Investigations on Geothermal Springs at Tural, Rajwadi and Chiplun in Maharashtra are underway in association with a private agency in Pune for development and exploitation of west coast geothermal energy sources for power generation.

D.2 BARC has initiated action for setting up a 2 MWe solar thermal power plant at the IIT Jodhpur site. The design of the plant envisages storage of thermal energy in molten salt. The detailed project report has been submitted to Ministry of New and Renewable Energy for approval of funds.

We are also concentrating our efforts towards total solution in critical areas. I would like to mention an example related to CIRUS.

E.1 After shutdown all the spent fuel from CIRUS has been reprocessed.

E.2 The Uranium Thorium Separation Facility (UTSF) was also operated simultaneously to reprocess the last lot of irradiated 'J' rods from CIRUS. All the Thoria-lean raffinate waste generated during reprocessing of the 'J' rods was also successfully processed at WIP.

E.3 For the first time, High Level Liquid Waste was processed for vitrification at a throughput of 30-35 lph deploying all the three available metallic induction heating furnaces simultaneously.

E.4 One tank full of Intermediate Level Waste has been successfully processed.

E.5 Heavy water from CIRUS is being detritiated for reuse in other reactors.

Dear Colleagues,

The Radiation Medicine Centre (RMC) of BARC reached the 50 year milestone of rendering services on 3rd September this year. The Centre has been pioneering development of clinical procedures in nuclear medicine, as well as human resources development, in addition to providing patient services.

Royal Society of Chemistry has declared BARC as the best contributor of articles across the publishers in India for the period January 2012 to June 2013 in the individual institute category. BARC scientists published 660 articles in Chemistry during this period.

Dear Colleagues,

Last three months have brought unprecedented success for BARC in terms of major accomplishments in areas critical to the goals of DAE.

F.1 Advanced up-gradation facility at Kalpakkam was commissioned last month and is performing very well.

F.2 Research reactor Dhruva continued to operate at an availability factor of about 80%. Recently power of the reactor was raised to 70 MW to increase the specific activity and quantity of radioisotope production. This step would go a long way in our contribution towards the health care for the people of our country.

F.3 The reload core for Aриhant went critical on 11th October at P4 facility. Materials and components for the core were made at Mysore, Hyderabad and Trombay facilities.

F.4 Advanced vitrification system at Tarapur for vitrification of high level waste from PREFRE plant worked beyond design capacity in first year itself.

F.5 This week intermediate level waste was transferred from KARP to Waste Immobilisation Plant at Kalpakkam, beginning the hot commissioning of the waste management facility.

F.6 Hot commissioning of Actinides Separation Demonstration Facility has been started. Performance parameters noted so far has been excellent. Successful demonstration of this technology will go a long way in major reduction of high level waste requiring long term storage.

F.7 Construction of Phase 1 buildings and infrastructural facilities was started at Vizag campus of BARC.

F.8 Special initiative was taken for attracting talents to BARC Training Schools spread in various campuses, which resulted in 30% increase in intake to the Training Schools. This will help in managing the chronic shortage of scientists and engineers for the expanding activities in the area of nuclear fuel cycle, reactor, accelerator, etc. We are waiting to receive Hon'ble President of India as the Chief Guest for this year's Graduation Function scheduled about a fortnight from today.

F.9 The Reprocessing Plant at Tarapur and Kalpakkam exceeded name plate capacity in 2012 and is performing equally well this year also.

F.10 Advanced Fuel Fabrication Facility at Tarapur is also working continuously. 75% of fuel for PFBR criticality has been fabricated.

F.11 Last few months BARC had been working with UCIL for addressing the issues related to commissioning of Uranium production plant at Tummalapalle. All these issues have been addressed and trial production of Uranium was started at a rate of 4T per month.

All of them have long term implication to our programmes and I wish we have similar achievements all year round.

Dear Colleagues,

I appreciate the excellent support from you in administration, accounts, health care, fire services, engineering services, security, association matters and other areas that made all these possible.

On this special day, let us rededicate ourselves towards achieving much more by focusing our efforts towards converting our achievements in research and development into a deliverable for the benefit of the nation.

Thank you