**Founder's Day Address**
**Thursday, October 29, 2015**
by
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Senior Members of the DAE Family, Distinguished Invitees, Representatives from Media, my dear Colleagues and Friends,

I extend warm welcome to all of you to this Founder's Day functions. Today, we will collectively pay respectful homage to our visionary Founder, Dr. Homi Jehangir Bhabha, on his 106$^{th}$ birth anniversary.

This is a day on which we reflect on our performance and achievement in the current year and also rededicate ourselves for further improvement with extra efforts so that our nation benefits from the applications of nuclear science and technology.

To begin with let me tell you about some of the specific achievements during this period.

I start with some of the achievements in power and research reactor sectors.

A.1 Four $UO_2$ fuel bundles of PHWR and two MOX fuel bundles of PHWR were examined (PIE) in the RLG's New Hot Cell Facility commissioned last year.

A.2 The hydrogen recombiner developed at BARC has been extensively qualified at HRTF, Tarapur. Technology for large-scale manufacture of the hydrogen recombiner for installation in PHWRs has been transferred to ECIL.

A.3 An expert system developed by BARC for health monitoring of operating turbine blades was implemented on NTPC`s 250 MWe power plant operating at Bhilai. In September 2014, the system predicted in advance, short life, for the blades. In January 2015, the plant experienced a major accident due to blade failure as predicted by the system, in turn providing a major endorsement and validation of the expert system developed at BARC.

A.4 A methodology for joining stainless steel to Zircaloy 4, based on a novel Ga-assisted diffusion bonding technique, was developed for High Flux Research Reactor.

Notable developments in the health care sector are:-

B.1 RMC has been recognized for conducting MD (Nuclear Medicine) course from 2015 by the Medical Council of India, following an inspection of premises, faculty and curriculum. This is a very important achievement for high-calibre manpower development for nuclear medicine.

B.2 A new technology of a Micro-flow Processor for post-hybridization processing microarrays and membranes has been developed. This automated, programmable and highly repeatable system with controlled flow of sub-millilitre volumes of reagents in an iterative fashion is very useful in identifying pathogenesis of diseases including various types of cancers. The new instrument is

the first of its kind developed in India with a cost reduction by about 40%, compared to that in the international market.

B.3 An indigenously designed Alpha particle irradiator, BARC Bio Alpha, has been fabricated to irradiate cells under sterile culture conditions at a precise dose using its built-in software-interlocked high speed shutter speed, user-defined source speed and collimator parameters and will provide adequate data for effective use of Alpha particle irradiation as a safe and target-specific therapeutic mode in cancer management. Such instrument is not commercially available in the world.

B.4 Seismology Division of BARC detected seismic signal from Nepal earthquake event on 25.04.2015 and reported it to the authorities within 17 minutes of the origin time. They also reported the event in Hindu Kush region of Afghanistan in short time.

We have been able to reach new heights in the field of chemistry and chemical technology.

C.1 High purity quartz reference material developed by National Centre for the Compositional Characterization of Materials (NCCCM) has received the Indian Reference Material Number BND 4101.01. This is the first certified reference material from DAE to receive the BND status.

C.2 NCCCM has been validated as a (service) supplier by European Commission for homogeneity, stability and characterization of major element content and trace element content in food.

C.3 In the ultra-purification of germanium, another landmark was achieved by preparing 9N material at kg level. This is the highest purity material developed in the country.

C.4 The direct denitration of uranyl nitrate solution (at conc. of 300 gm/l of U) was demonstrated in bench scale fluidized bed

reactor using $U_3O_8$ as bed material. The product $UO_3$ was screened and size fraction <53 μ was successfully converted into $UF_4$. This will considerably reduce nitrogenous effluent generation at front and back end of fuel cycle.

C.5 Simulated NOx concentration in the off-gas of reprocessing plant was oxidised using ozone for absorption in scrubber. The demonstration carried out in pilot plant level could effectively recover 95% of NOx as nitric acid. This will be useful in reduction of NOx release during dissolution both for front and back end of fuel cycle.

C.6 Chemical and physical processes for converting diamond industry waste into useful product were developed under technology incubation with a private industry.

In the field of waste management our team at Trombay did commendable job.

D.1 Management of 20 $m^3$ of legacy High Level Liquid Waste has been successfully completed at WIP using solvent extraction as pre-treatment step followed by vitrification of active components in suitable glass matrix. Only 4 VWP canisters have been generated, for the treatment of 20 $m^3$ of HLW, as compared to 60 canisters in case of direct vitrification which was practised earlier.

D.2 Process for separation of Sr-90 of radiochemical purity from High Level Liquid Waste has been established for generation of carrier free Y-90 required for radiopharmaceutical applications. Y-90 has been supplied to Radiopharmaceuticals Section for medical application. Process for separation of bulk quantity of Sr-90 from High Level Liquid Waste for its application in space programme has also been established.

Some other developments of interest are:-

E.1 Neutron Radiography Facility using accelerator based

D-T neutron source for Vikram Sarabhai Space Centre (VSSC), Trivandrum, has been commissioned under VSSC (ISRO) - BARC MOU.

E.2 A high field pulsed magnetization unit and field press magnetiser for indigenous production of rare earth magnets with high magneto-crystalline anisotropy has been developed and installed at Rare Earth Development Section of BARC.

Let me now mention some of our special achievements, made possible by the efforts of large number of my colleagues.

**SP-1** Nuclear Submarine 'Arihant' started its first sea voyage on December 15, 2014 and subsequently demonstrated operation at full power. Further, sea trials are progressing well and the boat is getting ready for induction.

**SP-2** For integrated testing and qualification of C&I systems of compact LWR, an Integrated Test Facility (ITF) has been set up at CnID, BARC.

**SP-3** A Compact Electrolyser Plant, consisting of cell module and process skid, has been developed for use as a life support system for nuclear submarine.

**SP-4** On 29th November 2014 DHRUVA reactor was taken to its full power, 100 MWth. The reactor completed 30 years of its criticality in August 2015. Since then it has been achieving highest ever capacity factor and lowest ever fuel failure rate. Plant is operating fine and produced record amount of radioisotopes of high specific activity. Fuel fabrication facilities ensured timely supply of fuel for continued operation at high capacity factor. Irradiation of special fuel assembly was started.

**SP-5** Construction of new facility was started in October 2014 and contract is being awarded for the balance activities. LEU based

U3Si2 plates in aluminium matrix and clad in Alloy required for this facility was also made.

**SP-6** Warm commissioning of P3A at Kalpakkam was started with the chopping of DDU bundles. Commissioning activities are progressing in full swing in all the areas in the plant.

**SP-7** BARC is working on the development of complete fuel cycle for Thoria based system. It got a major boost with the active commissioning of Power Reactor Thoria Reprocessing Facility (PRTRF). This step will take us to the forefront of Thoria based reprocessing activity.

**SP-8** Reprocessing plant PREFRE 2 at Tarapur and KARP at Kalpakkam continue to give excellent performance. Both these plants gave their best ever performance in 2014 and is expected to do well this year also.

**SP-9** Waste Immobilization Plant at Tarapur also worked as well in 2014 and set all time record by working at 120% capacity. The plant continues to perform equally well this year.

**SP-10** Government approval for the project 'Physics and Advanced Technologies for High Intensity Proton Accelerators' was obtained and details of collaboration arrangement has been worked out. First batch of Indian scientists have proceeded to Fermilab joint design activities. Equipment developed in India are undergoing test trials at Fermilab, USA.

**SP-11** Supply of fuel pin for Prototype Fast Breeder Reactor was continued in full swing. 90% fuel pins for the core has been fabricated.

**SP-12** Disposal of orphan radioactive sources was started with the treatment of 73 sources in Trombay. The process will be continued and we are preparing to treat all the sources that are collected by AERB.

**SP-13** A high-spin spectroscopic study of the nucleus $^{188}$Pt using the Indian National Gamma Array (INGA) spectrometer at the Pelletron Linac Facility at TIFR, Mumbai, has revealed the rare and unusual coexistence of both shape- and high- isomeric states.

**SP-14** Special efforts made by doctors and staff in BARC hospital has brought down the waiting list for appointment in non-emergency cases to two weeks.

**SP-15** Separation of large quantity Cesium-137 from legacy High Level Liquid Waste (HLLW) using indigenously developed novel solvent extraction process was established and fabrication and delivery of the first set of ten pencils of vitrified Cs-137 pencils took place. These pencils are being used in BRIT's Blood Irradiator. This technology is being used for the first time in the world in commercial domain. Further production activity is continued.

**SP-16** Depleted uranium from reprocessing plant was used for the first time for upgradation.

**SP-17** At WIP Kalpakkam Uranium Separation Plant was hot commissioned and separation of Uranium from HLW and further volume reduction was carried out. HLW from one storage tank of KARP has been treated. The ILW tanks at KARP were emptied.

**SP-18** BARC has designed and developed Portable X-ray Baggage Inspection System (PXBIS) in collaboration with ECIL. This product will now serve the security needs at public places like airports, railway stations as a low-cost substitute for imported instrument.

**SP-19** Special cladding material development was completed and production at IF3 continued.

**SP-20** All special material production facilities continued to perform very well.

**SP-21** Liquid helium was produced at $4.5^0$ K for the first time in a pilot plant made indigenously. This is a big step forward for Cryogenic Technology Development.

**SP-22** Proton beam was accelerated to 1.2 Mev at Low Energy High Intensity Proton Accelerator (LEHIPA) for the first time. It is one of the milestones for ADSS programme in India.

Dear Colleagues,

All these achievements of BARC were possible because of our unsung heroes, who work behind the scene. My special thanks to administrative, accounts, health care, fire services, engineering services, security, association/union and several other areas, that made all our progress and achievements possible.

Before concluding I wish to inform that the BARC Family Relief Scheme support to the bereaved family is being increased from Rs.1.3 lakh to Rs.1.5 lakh.

As you would have noted that over the last few years there is considerable improvement in our delivery, which has been possible

because of our focus on serving the nation. We have made commendable achievements in completing activities which are going on for some time and also achieved remarkable improvement in the functioning of various critical facilities.

New initiatives have been taken in the development of medicines, creation of high technology research facilities, etc.

While acknowledging these achievements we must agree that we have to do much more in the other spheres of our activities.

Although some of the areas in which progress is not good are attributable to reasons beyond our control but in other areas we need to do focus for improvement of delivery.

For us today is the right day to rededicate ourselves to accelerate the pace of delivery at an early date.

**Jai Hind**