Independence Day Address

by

Director, BARC

Saturday, 15th August 2015

My colleagues from BARC, CISF and other organizations,

Today we are celebrating the 69th Independence Day of our country. The independence has come to India with the selfless efforts of our freedom fighters, who made it possible to fly our own national flag in our own country. The freedom brought us many expectations, which included freedom from exploitation and freedom from poverty, hunger and diseases. We can make our freedom permanent only if we emerge as a strong nation. This will necessarily mean that we behave as disciplined, united and responsible employees to make our country economically strong and military power.

BARC campuses located all over the country are doing everything possible to fulfill the dreams of our nation. We have contributed in multi-disciplinary areas and let me bring out a few of our recent achievements.

Material development for critical applications is a priority activity for us. Some achievements in this area are :-

B-1 A high field magnetization unit for indigenous production of rare earth magnets with high magneto-crystalline anisotropy was developed.

B-2 $Ti_3AlC_2$ and $Ti_3SiC_2$ MAX phase high temperature machineable carbides, SiC nanoparticles and SiC fibre have been successfully prepared on the laboratory scale for developing high temperature structural composites for nuclear applications.

B-3 A new technology was developed for preparation of Pb-Li alloy. 100 kg of Pb-Li alloy has been produced successfully by this newly developed technology.

We have developed critical components for various applications. Some of these are:-

C-1 Gamma Compensated Ion Chamber with hanger assemblies was supplied for Compact Reactor Project.

Fabrication, assembly, testing and delivery of sensors and electronic converters completed.

C-2 Achieved trouble-free run for more than a year of a small trial cascade of carbon fibre-epoxy composite High Speed Rotor Machines.

We continue to participate in international arena in multiple disciplines and were recognized in diverse areas.

D-1 National Centre for the Compositional Characterization of Materials (NCCCM) of BARC at Hyderabad has been validated as a 'supplier' (of services) by European Commission for homogeneity, stability and characterization of major element content and trace element content in food.

D-2 Feed Cap and End Cap assembly of Cryo-Module Test Facility (CMTF) for testing 1.3 GHz Superconducting RF cavities designed, developed, tested and supplied to Fermilab, USA.

D-3 Experimental data on piping components and systems were transferred for OECD Benchmark Exercise on Metallic

Component Margins under High Seismic Load (MECOS); 23 organisations participated in this exercise.

We continue to create, operate and upgrade important facilities in our campuses. Some of these activities are :-

E-1 Successful irradiation testing of modified fuel assemblies for Dhruva has been completed and the reactor will be progressively loaded with modified assemblies to gain much needed reactivity and also improved safety margins.

E-2 Advanced Heavy Water Reactor critical facility was operated as per user requirements for testing of materials and detectors.

E-3 Beryllium Facility at Vashi has successfully supplied intricate shapes of metal beryllia for various applications.

E-4 The Indus-1 beamline for Infra Red studies on materials has now been adapted to facilitate measurements up to liquid helium temperature.

E-5 The angle dispersive x-ray diffraction arm of Extreme Conditions beamline at Indus-2 has been augmented with high temperature furnace to study materials up to $1200^0$C.

E-6 A facility has been established to carry out time resolved Raman studies on laser shocked materials.

E-7 Electron Beam Accelerator ILU-6 capacity was upgraded to 5 MeV, 15 kW. Thicker materials can now be irradiated.

E-8 Radiation Ageing Test Facility has been commissioned to study the radiation ageing effects on Instrumentation & Control (I&C) cables, components and materials used in Nuclear Power Plants.

E-9 Debris bed coolability test facility for AHWR core catcher performance validation and scaled facilities for Validation of passive moderator systems (PMCS) and passive end shield cooling system (PECS) of AHWR were commissioned.

E-10 A scaled experimental set up for in-calandria retention of corium for PHWR-700 was designed, fabricated, commissioned and experiments were carried out by pouring simulated melt at 1200°C.

E-11 The centralised LLW storage and transfer system (Delay Tank) at Kalpakkam was hot commissioned and is now in regular operation.

Development of new products procedures and their applications were continued.

F-1 A high throughput slit collimator based segmented gamma scanner has been designed and fabricated for routine non-destructive assay of plutonium in waste drum.

F-2 A simple, sensitive and non-destructive method based on particle induced gamma-ray emission (PIGE) using 4 MeV proton beam from 6 MV folded tandem ion accelerator (FOTIA) has been optimized for simultaneous determination of total boron and its isotopic composition in various neutron absorber samples like $B_4C$ and diborides of Zr.

F-3 High quality plastic scintillators of cylindrical shape are synthesized and used to develop portable hand-held radiation monitors for use as low range survey meter and monitoring of contamination.

F-4 A detector set-up has been developed to record the temporal profiles of pulsed X-ray sources. The detector consists of a fast scintillator crystal Barium Fluoride ($BaF_2$) and a matching Photo Multiplier Tube (PMT).

F-5 A methodology for joining stainless steel to Zircaloy 4, based on a novel Ga-assisted diffusion bonding technique, was indigenously developed. Sound joints, free from pores, discontinuities and cracks at the bond interface, were produced using this technique. The bonding parameters were optimized to obtain shear strength in the range of 170 - 214 MPa.

F-6 A foam based highly efficient layered and emulsified oil/water separator was developed using a radiation assisted one step synthesis. The material can be used for cleanup of large oil spillage. The developed material has the capacity to take up 30 to 70 times of it's weight depending on the nature of oil.

F-7 To study the compatibility of fusion reactor structural materials in lead-lithium eutectic, an electromagnetic pump driven Pb-Li Loop with coupons of Indian Reduced Activation Ferritic Martensitic Steel (RAFMS) has been operated

successfully for 5000 hours. Corrosion rate for material exposed in flowing Pb-17Li at 500°C was determined.

F-8 A mass spectrometer for measurement of isotopic ratio of hydrogen has been developed, fabricated and delivered to RRCAT, Indore.

F-9 Custom built Retrieval System for picking-up broken Self Power Neutron Detectors (SPNDs) from the Carrier Tubes of vertical flux units of TAPS-3&4 was designed and developed and used in TAPS-4.

F-10 A comprehensive methodology was developed for generating Design Basis Ground Motion (DBGM) for Vizag and Tarapur sites using probabilistic seismic hazard estimation procedures and the input for Vizag site was finalized.

F-11 An indigenous Verification Tool for verification of Very Long Hardwired Description Language (VHDL) design for Field Programmable Gate Array (FPGA) was developed.

F-12 A thermoplastic elastomer based composite having radiation resistance up to 1300 kGy of gamma radiation which

remain unaffected up to 90°C for 5 months have been developed. This will find application as gasket, cable insulation and other similar applications.

F-13 A new DAE-Emergency Response Centre (ERC) has been set up at UCIL, Turamdih making total number of DAE-ERCs to twenty-three. Police personnel from Mumbai Police, whose patrolling vehicles are fitted with radiation alarm units from BARC, were trained on detection, prevention and response to radiological emergencies.

Technology transfer for various types of components and systems continued.

G-1 Two technologies for testing components of advanced missiles were successfully transferred to industry.

G-2 The hydrogen recombiner developed at BARC has been extensively qualified in Hydrogen Recombiner Test Facility (HRTF), at Tarapur and the technology for large-scale manufacture of the recombiners for installation in PHWRs has been transferred to ECIL.

G-3 Synthesis protocols of nano-lithium iron phosphate carbon composite as cathode material and nano-lithium titanate as anode material for lithium ion battery were developed and optimized, and the technology was transferred to a private party in Satara.

G-4 Towards the development of affordable drugs against various human diseases, using the treasure of the Indian biodiversity, two indigenous phytochemicals have been formulated as prophylactic and/or therapeutic radioprotectors. An incubation technology of one of these radioprotectors has been transferred to a private party in Bangalore.

We celebrated various national days for popularization of Science and Technology.

H-1 National Science Day was organized as "Physics Utsav-2015" within BARC campus. A total of 883 students and teachers were invited from 31 schools and colleges within Mumbai for the celebrations, spread over four days from 27th February to 2nd March 2015. The programme comprised of quiz, film show on frontier research in BARC and inspiring lectures delivered by eminent scientists. This was followed by

visit to research facilities and an exhibition of posters and models.

H-2 National Technology Day was organized on May 11, 2015 with a focus on Physical Sciences and a poster exhibition depicting technologies developed by BARC in Physical Sciences.

Major part of our efforts was dedicated towards the development in the fields important to societal activities.

I-1 BARC mung varieties TJM-3, TMB-37 and TM-96-2 accounted for 24% and pigeon pea variety TJT-501 for 18% of total national breeder seed indents for respective pulses during 2014-15.

I-2 Mango irradiation for export at Krushak plant (of BARC at Lasalgaon) continued. For the first time, 16 tonnes of garlic was irradiated based on market demand.

I-3 $^{188}$Re-HEDP kit for metastatic bone pain, have been developed and is being used in hospitals.

I-4 Environmental isotope fingerprinting of few springs in Sikkim was done to study the recharge and its origin.

Development and upgradation of infrastructure is being carried out on a continuous basis.

J-1 New chemical incinerator at BARC was commissioned. Central water chilling plant at Common Facility Building has also been commissioned.

J-2 BARC campus wide network backbone upgraded to 10Gbps. The desktop user's connectivity also upgraded to 1Gbps speed.

J-3 Under rain water harvesting program, desilting of lake numbers 9 & 10 (located near PP and the other at foot hill of Trombay Hill) has led to capacity augmentation of 35 million litres.

J-4 Upgradation of Ward IIA and Dental OPD was completed at BARC Hospital. New Hospital Information System was commissioned.

Before I end let me bring out the special achievements which are in the first time ever category and make us proud.

SP-1 Reprocessing plants at Tarapur and Kalpakkam continued to give excellent performances and surpassed all earlier performances.

SP-2 Commissioning activities of the new reprocessing plant PREFRE-3A is in full swing. Charging and chopping of DDU fuel bundles were successfully demonstrated. Uranous Nitrate production unit and the new Process Control Laboratory were hot commissioned.

SP-3 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 pencil sources took place. These pencils will be used in

BRIT's Blood Irradiator. This technology is being used for the first time in the world in commercial domain.

SP-4 Depleted uranium from reprocessing plant was used for the first time for processing.

SP-5 Vitrification plant at Tarapur continued to work at over 100% capacity factor on a continued basis.

SP-6 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.

SP-7 Research reactor Dhruva has been operated at full power level since November 2014 with lowest ever coolant activity and fuel failure rate. It achieved an availability factor of 80% and the highest ever capacity factor during this period. More than 700 samples with higher specific activity and quantity of radioisotopes were supplied to BRIT. On 7th August 2015, Dhruva completed 30 years of criticality and giving its best ever performance.

SP-8 Second intermediate level waste treatment plant became operational yesterday at Tarapur. Plant capacity is adequate for progressive reduction of total ILW inventory at Tarapur.

SP-9 Fabrication and supply of MOX fuel pins for PFBR continued. The plant at Tarapur has given excellent performance in the last three years.

It is obvious to mention that the real achievers in BARC are my colleagues, who have worked behind the scene to make all these achievements possible by keeping our vital services operational like a well oiled machine. These achievers include Engineering Services Group, Medical Divisions, Administrative and Accounts Group. Special thanks to Landscape and Cosmetic Maintenance Section, who have maintained the beautiful ambience of Trombay campus and at other Centres. BARC Security and CISF personnel have made commendable contribution towards the physical protection of this establishment. I must also express my appreciation for the BARC Fire Service personnel, who have made the campus safe. My colleagues have worked with sincerity and dedications to make all these possible. Finally, on this auspicious day, we once again salute the patriots, who gave us the freedom. We can show our gratitude to these freedom fighters and those who are working towards achieving greater heights for the nation by working towards inclusive growth for our countrymen.

Thank you and Jai Hind