

*26<sup>th</sup> January (Monday), 2015*

Good Morning,

Dear Colleagues,

Today we are celebrating our 66<sup>th</sup> Republic Day. We have assembled here to salute our national flag, and express gratitude to the armed forces of our country, who make the nation secure. In this year we continue to celebrate the 60<sup>th</sup> anniversary of the Department of Atomic Energy. We have embarked on social outreach programme and we will be inviting the students and members of public to see the various activities, which are being carried out in our campus at Trombay.

I would first tell you about some of the important contributions of BARC in the recent past which are of immediate relevance to the common man.

A.1 Under National Mission for Clean Ganga, Department has accepted the responsibility of 'Water Quality Assessment' along with other national laboratories. Our technologies may be used for decontaminating the effluents discharged to Ganga by the industry.

A.2 As a part of Public Outreach Program, we are providing technical support and guidance to the Department of Urban Development, Government of Jharkhand, for installation of water treatment plant to clean the water body popularly known as 'Holy Shiv Ganga Pond' at Deoghar, Jharkhand, which attracts millions of devotees during the year.

A.3 A system has been developed in collaboration with Neurosurgical Skills Training Laboratory, AIIMS for Neurosurgery training and education for medical students and doctors. This system can grab left and right video images from surgical microscope in operation theatre, where expert doctor is performing operation and broadcast these frames over internet. Anywhere on internet, Medical Doctors/Students can view this surgery being performed in real-time in 3-D with the help of specially developed client software on standard PC.

A.4 A compact, low-cost, cold-plasma device for DNA electroporation of into *E. coli* cells, fabricated in BARC is promising for agricultural and drug development applications as well as in genetic engineering.

A.5 A Portable, Risk Free snapping Tool for Dosimeter Ampoules has been developed for BRIT for Integrated System of Computer Aided Dosimetry (ISOCAD), for gamma radiation sterilization of the healthcare products.

- A.6 Seed developed at BARC is finding increasing application in South India. I would like to share some information which made us happy. Open air jail authorities in Tamil Nadu have multiplied TG 37A variety seed in one of their establishment and is distributing to their other establishments for multiplication.
- A.7 Decentralized treatment of waste from kitchen, abattoir etc. is also gaining popularity. Last year we have established 18 Nisargruna plants taking the total number to 190. These plants not only maintain the cleanliness of the locality, but also produce methane gas and manure and generate employment.
- A.8 Subsequent to achieving no waiting list for Iodine and Luthesium Based treatment at Radiation Medicine Centre the demand has increased by 20%. RMC authorities are able to meet this increased demand without creating a new waiting list.

A.9 A product based on chlorine dioxide releasing polymer has been developed for disinfection of domestic drinking water. This has advantages compared to chlorine based disinfection.

A.10 Turbovita, a novel curcumin based nutraceutical, has been developed through incubation of technology with a private industry. This is a unique phytonutrient formulation containing blend of highest quality of proteins, carbohydrates, fats, fibers, vitamins, minerals and cucuminoids. A single serving of Turbo vita provides about 100 mg of bio-available curcumin.

It is important to tell you about some of the specific developments critical to the success of our multidisciplinary activities.

- B.1 The non-destructive Proton Induced Gamma-ray Emission technique has been successfully employed for simultaneous determination of concentration and isotopic composition of boron in boron carbide and other neutron absorbers. Using this technique, fast and simultaneous determination of matrix elements Lithium, Titanium and Oxygen in sol-gel synthesized lithium titanate was also demonstrated.
- B.2  $^{63}\text{Ni}$  sources (5 numbers), of activity 3.7 GBq each, containing  $^{63}\text{Ni}$  deposited on the inner surface of copper annular ring, were prepared and supplied to various Units of DAE for use as ion source in ion mobility spectrometry (IMS).
- B.3 BARC has fabricated the near theoretical dense Silicon Carbide (SiC) disc for space application. This high dense SiC disc was processed based on pressure assisted sintering technique at temperatures close to 2000°C in  $10^{-5}$  mbar vacuum atmosphere.

- B.4 Alumina-coated trays could be used repeatedly for more than seven cycles of operation and the yttria-coated trays could be used for more than ten cycles of operation, compared to only one cycle with the previously used powder-coated trays. The coatings ensure better purity of the processed fuel, leading to substantial enhancement of the process efficiency.
- B.5 Development of solvent extraction separation scheme for the production of high purity yttrium oxide (>99.9%) from multi heavy rare earth bearing feed by bench scale operations was successfully carried out. Around 3 kg of high purity yttrium oxide was prepared.
- B.6 A multi-stream high effectiveness plate fin heat exchanger has been successfully designed and developed to cater to the series flow of helium gas through turbo-expanders in a Claude cycle based helium refrigeration/liquefaction system.

Dear Colleagues,

In view of technology denial we have to make many critical items in-house so that we can carry on our functions without interruptions. I would like to give two examples.

C.1 One Inductively Coupled Plasma Mass Spectrometer (ICPMS) was delivered for enrichment monitoring.

C.2 Two Thermal ionization Mass Spectrometers (TIMS) built in-house were delivered to divisions in BARC.

R&D efforts in BARC made the following contributions towards fuel cycle activities.

D.1 A robotic system has been developed for automated radiation monitoring of HEPA filters installed at various nuclear fuel reprocessing and radiological labs. This has resulted in reduced man-rem consumption and replacement of only unhealthy filter banks.

D.2 Post Irradiation Examination was done on two PHWR fuel bundles in the recently commissioned new hot cell facility at Trombay.

We continued our design and development activities for various reactor types.

E.1 Comparative study of batch and on-power fuelling was carried out for AHWR reference core and it was established that it is possible to adopt batch fuelling with a refueling frequency of 3 months for both AHWR-LEU and AHWR-Pu options.

E.2 Fatigue Crack Growth rate (FCG) curves for SS304LN material under simulated water environment, operating temperature and pressure for typical BWRs have been generated with different levels of dissolved oxygen in water. The results indicate that FCG rate under reactor coolant environment is significantly higher compared to that in air environment and

marginally lower compared to that of room temperature water environment.

Extra efforts are being made to make our technologies available to the Indian industries.

F.1 The following MoUs were signed for incubation of technology:

- Technology for Nano Particles of Lithium Titanate ( $\text{Li}_4\text{Ti}_5\text{O}_{12}$ ) and Core Shell Nano Particles of Lithium Iron Phosphate ( $\text{LiFePO}_4$ ) Coated with Graphene manufacturing process
- Projectile Velocity Measurement technology

F.2 12 Technologies (including 4 new technologies) were transferred to 26 parties. They include:

- Nirbhaya and
- 12 Channel ECG

Upgradation of facilities for employees is a continuous process.

Let me mention some recent developments.

G.1 A separate parking lot for buses has been constructed at North Gate to decongest the area in front of North Gate, which helped in smooth regulation of traffic outside North Gate and addressed the security concerns.

G.2 At BARC Hospital Posterior Segment Services in the department of Ophthalmology have been fully commissioned. The CHSS beneficiaries can now avail of full treatment for their medical retinal diseases in-house.

Dear Colleagues,

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

1. Nuclear Submarine 'Arihant' started its first sea voyage on December 15, 2014 and subsequently demonstrated operation

at full power. We are well on our way towards the creation of nuclear triad.

2. On 29<sup>th</sup> November 2014 DHRUVA reactor was taken to its full power, 100 MWth. Last year it achieved the highest ever capacity factor. Plant is operating fine and produced record amount of radioisotopes of very high specific activity. Irradiation of special fuel assembly was started last week in this reactor.
3. Construction of new facility was started in October 2014 and contract is being awarded for the balance activities. LEU based U<sub>3</sub>Si<sub>2</sub> plates in aluminium matrix and clad in Alloy required for this facility was also made.
4. Warm commissioning of P3A at Kalpakkam was started with the chopping of DDU bundles. Commissioning activities are in progress in all the areas in the plant.

5. BARC is working on the development of complete fuel cycle for Thoria based system. It got a major boost with the starting of active commissioning of Power Reactor Thoria Reprocessing Facility (PRTRF) on 12<sup>th</sup> January, 2015. This step will take us to the forefront of Thoria based reprocessing activity.
6. Hot commissioning for separation of U, Cesium from the rest of the high level waste was started on the same day at Trombay. This facility will be used for the production of vitrified cesium pencil, which will be used in the blood irradiators.
7. 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.
8. Waste Immobilization Plant at Tarapur also worked as well in 2014 and set all time record by working at 120% capacity.

9. To create a world class facility in Neutrino research, India based Neutrino Observatory (INO) will be built at Pottipuram in Theni District of Tamil Nadu. I am glad to announce that Government sanction was obtained last month and consultancy contract is being issued for the detailed design.
10. Government approval for the project 'Physics and Advanced Technologies for High Intensity Proton Accelerators' was obtained and details of collaboration arrangement are being worked out.
11. Supply of fuel pin for Prototype Fast Breeder Reactor was continued in full swing. 75% fuel pins for the core has been fabricated.
12. Disposal of orphan radioactive sources was started with the treatment of 73 sources in Trombay. The process is continued and we are preparing to treat all the sources that are collected by AERB.

13. A high-spin spectroscopic study of the nucleus  $^{188}\text{Pt}$  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.
  
14. This year we will be celebrating Physics Utsav on National Science Day. Apart from lectures on various topics, school and college students will be invited to visit various physics experimental facilities inside BARC.

Dear Colleagues,

These days we are going through fund crunch phase. Next year also it is likely that position may not improve much. So we will re-orient ourselves towards the utilization of existing facilities, rather than the creation of new facilities. Our scientists have to be innovative in planning quality experiments with the given facilities.

In the end I must thank all my colleagues, who have worked behind the scene in keeping the vital services operational in our campuses all over the country, they include Engineering Services Group, Medical Division; Administrative Group, who take care of all functions in the fields of administration, establishment, manpower planning and personnel data management; Finance and Accounts. I also thank Floriculture, Landscaping and Cosmetic Maintenance groups for the beautiful ambience of this venue and our gardens. Special thanks to all the association in BARC for extending supports in achieving all this. Campus security is of prime concern for our Centre's all over the country. BARC security and CISF personnel have made commendable contribution in keeping this establishment incident free. Special thanks for the Fire Services personnel in our campus for protecting our personnel and equipment. All of them have worked with dedication and sincerity, which made these achievements possible.

Thank you

Jai Hind