

64th Republic Day of India
26th January (Saturday), 2013
Address by Shri Sekhar Basu Director, BARC

Dear Colleagues,

I convey my warm greetings to one and all assembled here on the occasion of the 64th Republic Day of our country. Every year, as a part of this celebration, we salute our national flag. We remember with reverence the members of our armed forces, who provide vital security to our country.

The function coming in the beginning of the New Year also provides us an opportunity to recall not only the some major achievements made in the past few months, or soon to be achieved in the next few months, but also remind ourselves of the major action plans envisaged for the year 2013. On this occasion today, I intend to touch upon some major recent activities and resultant outputs and cite representative examples of some other development and services, but not touch upon achievements earlier reported at the Founder's Day in October 2012. The text of my speech to be placed on the BARC web-site may contain some more details in a few cases.

- PFBR is one of the most prestigious projects of the department. BARC is a major contributor to this programme. I would like to mention a few of them.
- Fuel pin fabrication is progressing well and 10,000 fuel pins have been fabricated. With the addition of 2nd stream, production rate of pins has improved significantly. This was supported by production, from both PREFRE-2 and KARP, exceeding the present rated capacity during the last calendar year.
- Inclined Fuel Transfer Machine, designed by BARC, for off-power refuelling of PFBR has been manufactured and room temperature testing completed. Hot air testing at simulated fuel handling temperature is taken up for qualifying the machine for reactor use.
- Computer based 8-Channel Ultrasonic under Sodium Imaging System has been designed, developed and supplied to Kalpakkam for detection of growth and protrusion of in core fuel sub-assemblies of PFBR.

We continued with our R&D and delivery in the area of safety.

- A piping loop, pressurized with water up to design pressure, was mounted on a shake-table and subjected to a series of seismic waves using the facility at CPRI, Bengaluru. It took more than 20 cycles of loading to cause a failure in the form of crack producing leakage.
- Ring-type finger dosimeters based on Thermoluminescence (TL) and Optically Stimulated Luminescence (OSL) phosphors have been designed and fabricated for monitoring the doses received by the body extremities in applications likely to involve exposure to the fingers.
- A technique involving Non-linear Least Square Regression was developed to estimate the releases of different radionuclide into the Pacific Ocean resulting from the

discharge of radioactive liquid effluent from the Nuclear Power Station at Fukushima-Daiichi in Japan.

- Inverse modeling technique was used to estimate the releases of different radionuclide into the atmosphere and the releases of I-131 and Cs-137 were estimated as a function of time.
- Class 10000 clean room for Uranium Clean-up Facility and Class 1000 clean room for Femtosecond Coherent Control Facility for laser room were established.

We continued to upgrade and supplement our existing facilities for better performance and continued operation.

- Replacement of the second heat exchanger out of the five 20 MW capacity Process-water/Seawater shell & tube Heat-exchangers (due to tube thinning) was completed for DHRUVA without causing additional outage of reactor for executing the job.
- A scanning extended X-ray absorption fine structure beam line has been commissioned at INDUS. This is suitable for transmission and fluorescence mode operations and for studies of elements ranging from Ca to Am.

In the area of materials development we contributed in the following areas:-

- Prototype gimbal and connect bar of Al-Be composite for use in Very High Resolution Radiometers assembly have been fabricated.
- Large size ceramic to metal seals (about 80 mm dia) have been developed using active brazing alloy. Components with multiple ceramic to metal seals have also been fabricated for use in scanning electron microscope.

Our contribution to societal areas during recent past has also been significant. I would like to mention the following:-

- In view of ICRP recently recommending reduced dose limits to the lens of eye, a new 2-element plastic "Eye Dosimeter" badge, based on $\alpha\text{-Al}_2\text{O}_3\text{:C}$, optically stimulated luminescence (OSL) phosphor has been designed, and a prototype module developed for testing in interventional radiology applications.
- For X-Ray Baggage Scanning Application; Linear array detectors with 16-element PIN photodiode coupled to a 16 element CsI array of geometry matching to the photodiode elements has been indigenously developed and arrays characterized at various X-ray intensities.
- Recently, a Digital Radiotherapy based Simulator, based on indigenous technology has been installed at Tata Memorial Hospital, Parel.
- Radiotracer technology has been successfully applied for the first time in India to measure discharge rate/flow rate using Iodine-131 in Saurashtra Branch Canal at Sardar Sarovar Narmada Limited, Gujarat.

Development activities in the other areas involved the following:

- For high temperature reactor a process for preparation of UO₂ based triso coated fuel

particles has been developed. Tri-isotropic (triso) coating of sol-gel derived UO₂ particle fuel has also been developed and characterised by SEM and optical microscopy.

- The upgraded TACTIC telescope at Mt. Abu has observed a rare flaring episode at a statistically significant level from Active Galactic Source, Mrk 501. This is referred as an Orphan Flare.
- BARC has developed a 4 cubic meter hot zone operating at 1500 K temperature and 10-5 milli bar pressure for evaporation and recirculation of actinides. The hot zone has been efficiently operated for more than 400 hours in the commissioning runs during the year.
- The ion-beam facility (IBA) at FOTIA was utilized in Proton Induced Gamma Emission mode to analyze boron in the structural rods; 4 MeV, 50 nA proton beam, extracted in air, was used to bombard the samples. The gamma spectra were acquired using HPGe detector-based gamma ray spectrometry system.
- An Indigenously designed and manufactured 80 kV, 12 kW Electron Beam Welding Machine, was integrated and tested.

Action for treating liquid radioactive waste in BARC campus is progressing well. I would like to mention some of them.

- Processing of legacy wastes of alkaline nature from reprocessing origin stored over 40 years has been taken up. 700 cubic meters of this waste has been successfully treated and emptied out. This was made possible by deploying specific sorbents developed in-house.
- Thorium lean raffinate waste generated during reprocessing of irradiated thoria fuel has been successfully processed by ion exchange route. The eluent from the ion exchange process containing fluoride has been successfully vitrified.
- Advanced HLW Vitrification facility at Tarapur is working efficiently and has produced 26 canisters in 1st, 3 1/2 months of operation. Thermowell replacement has been carried out without problem.

BARC is taking up new activities in the following areas:

1. BARC will participate in the development of the Indian Pressurised Water Reactor (IPWR) planned by NPC. At present concept design and planning of R&D work is being pursued.
2. We have taken action for design and installation of a 2 MWe solar power tower at IIT Jodhpur. Beam down approach used in this design enables high temperature of coolant and use of natural circulation instead of pumps. Thermal energy storage, steam generator as well as the receiver has been integrated into a single unit saving cost.
3. Before concluding, I would like to acknowledge the considerable volume of services rendered by various agencies, e.g. Medical Division, Administration, Accounts, Floriculture and Landscaping Section, Cosmetic Maintenance Section, Security, both departmental and CISF and the Engineering Services Group.
4. The journal publications of BARC during the year ending December 2012 are more than 1470. This is the highest in last five years.

5. I am also very happy to inform that Dr. Sharad P. Kale, Head, TT&CD has selected for Padma Shri Award. We congratulate Dr. Kale and wish him many more laurels.

Concluding Remarks

- I understand that there will be a budget cut for BARC both in this financial year and in the next financial year. Although this will create some constraint in our activities but this is also an opportunity for us to concentrate on the more useful activities and trim the less useful ones. We will prioritize our activities on the following lines:-
 1. Operating the plants which have been strategic and societal importance, at their highest possible capacity.
 2. Many of our projects, which are important for our activities, are nearing completion. They are to be completed at the earliest.
 3. Many good small projects have progressed and there is a need for taking them to logical conclusion. We would emphasize these areas also.
 4. In XII Plan, we are taking up many new projects and we will concentrate on preparatory activities leading to construction.
 5. We will also follow the Government directives on the austerity measures.
- In spite of these constraints, let us resolve to continue to put our best efforts to sustain the BARC tradition of excellence with relevance and values.
- So far we have done well in our deliveries and should continue to do well in future in a disciplined and harmonious way. I appreciate the co-operation from my colleagues and associations in this regard.
- Friends, therefore, on this day, let us all rededicate ourselves to continue contributing to one or more facets of the Indian nuclear programmes and remain abreast with the frontier areas of nuclear science and technology, and also strive for the betterment of the quality of life of the large population of our country.

Thank you and Jai Hind.