

**Founder's Day Address 2021**  
**by**  
**Director, BARC**

Respected Shri K.N. Vyas, Chairman AEC & Secretary DAE, distinguished invitees and guests, senior colleagues and members of the DAE family, representatives of media, ladies and gentlemen.

We are gathered here today to celebrate the 112<sup>th</sup> Birth Anniversary of our visionary founder Dr. Homi Jehangir Bhabha. I extend my greetings to all of you on this occasion which is celebrated as the Founder's Day of our organisation. As has been our tradition, on this day every year, we pay homage to our visionary founder, celebrate the milestones and achievements of the last one year and pledge our collective commitment to future endeavours.

Dr. Bhabha laid a roadmap to harness the benefits of nuclear science and radiation technology and its applications across multiple domains such as health care, agriculture, food preservation, electricity generation, environment etc. in a self-sufficient manner. He also initiated associated R&D activities

within the organisation in various disciplines to support our programmes. The seeds were thus sown for a vast gamut of activities at AEET, as it was then known. The success of our organisation owes much to the strong foundation laid by Dr. Bhabha and his contemporaries. We have strived to build upon this foundation, constantly adapting to the emerging needs, without ever wavering from our mission- 'Atoms in the service of the Nation'. The fruits of our multi-disciplinary contributions are not merely confined to serve DAE, but also find applications in numerous other areas requiring front ranking technological inputs. This will become evident as I present some of our salient achievements of the last year. This has been a COVID-19 affected period, and the DAE family has not remained untouched by the pandemic. Many of us have suffered the loss of colleagues or family members during the period and I offer my sincere condolences to all bereaved persons on behalf of the DAE fraternity. Our scientific and technological quests have however remained undiminished despite these challenges, which is a tribute to the dedication of our workforce.

I shall now be presenting some of the notable achievements in various areas during the year.

**A. The Indian nuclear programme follows a closed fuel cycle and I shall now present some of the important activities and achievements in the front end and back end programmes**

1. Research reactor Dhruva and ApsaraU continued to operate with a high level of safety and availability. The overall Availability factor for Dhruva was 70 % and that for ApsaraU was 88%.
2. Dhruva reactor recorded the lowest ever collective dose since its commissioning.
3. 550 samples were irradiated in during the year. Supply of medical isotope like Mo-99, I-131 & Cu-64 from ApsaraU to BRIT has been started.

4. All the required engineering services to operate Special Plate Facility have been installed & commissioned. These are operating as per the functional requirement of the facility.
5. Post Irradiation Examination (PIE) of Pressure Tubes from Tarapur Atomic Power Station (540 MWe) and Kakrapar Atomic Power Station was completed.
6. PIE investigations on the pressure tube and aluminium bundle from KGS-1 have been completed.
7. Manufacture and supply of required numbers of Fuel Assemblies to Dhruva and Control Blade Assemblies for TAPS-1&2 was continued.
8. Process flowsheet has been developed for recovery of uranium from low-grade poly-metallic uranium ore of Rohil-Ghatewsar, Rajasthan. It has been adopted by UCIL for commercial mill.

9. Sustained and continuous Plutonium Plant (PP) operations for the recovery of special nuclear materials from Dhruva spent fuel was continued.
  
10. Operation of WIP was continued for treatment of High-Level Liquid Waste. Waste Management Facilities such as Effluent Treatment Plant (ETP), Decontamination Centre (DC) and Radioactive Solid-waste Management Site (RSMS) were operated un-interrupted to cater to the management of waste.
  
11. 3 MeV beam of Low Energy High Intensity Proton Accelerator (LEHIPA) has been used for over 500 hours for materials science experiments. 100 kV, 20 A regulated power supply for the klystron has been commissioned.

**B. Development of new technologies has always been one of our core domains which has made BARC a technology powerhouse. I shall now draw your attention to some of the important and noteworthy contributions in this regard.**

12. Import substitute technologies for 10 MeV RF LINAC, Electron beam welding/melting, High coulomb switch and Pulsed UV source were transferred to private entrepreneurs.
13. Indigenous Passive Catalytic Recombiner Device (PCRD) for management of hydrogen under accident conditions was commissioned at KAPS-3 and commercially produced by ECIL.
14. A Neutron Irradiator System for fast and thermal neutron irradiation has been developed.
15. Installation and commissioning of indigenously designed import substitute Flight Motion Simulator has been completed where performance evaluation of small size equipment on stabilized platform can be done.
16. A Thyroid Uptake System with Detector Probe has been developed, fabricated and installed at RMC.

17. Technology for manufacturing Brushless DC (BLDC) motors up to 30 HP, has been demonstrated and deployed in high-speed applications.
18. A Quick Scan Whole Body Monitor has been indigenously developed to meet the requirements for quick & efficient monitoring of radiation workers for internal contamination for deployment at DAE facilities, Defence and NDRF. This technology has been transferred to private entrepreneurs.
19. Calciothermic reduction process (CTR) based technology for the production of Nd-Pr metal required for making NdFeB permanent magnet has been successfully developed from indigenously produced Nd-Pr oxide. A tri party memorandum of agreement (MoA) was signed to produce 3Tons/Year Nd-Pr metal in the country.
20. Technology for the production of phase pure Titanium diboride ( $TiB_2$ ) powder by boro-carbothermic reduction of titanium oxide was successfully demonstrated and transferred to a private industry.

21. BARC fabricated multi-filamentary Nb<sub>3</sub>Sn-based Cable-in-Conduit Conductor (CICC) and sent to IPR, Gandhinagar towards National Fusion Programme.
  
22. Advanced instrument such as a compact Thermal Ionization Mass Spectrometer has been developed indigenously for the precise isotopic ratio measurements. Similarly, two Process Gas Mass Spectrometers were developed, qualified for their performance parameters and commissioned.
  
23. Plasmonic colorimetric nanosensor for specific detection of a widely used organophosphorus insecticide chlorpyrifos has been developed with efficient colour change in real vegetable and fruit samples.
  
24. A new promotional scheme to popularize the BARC spinoff technologies has been introduced where fee has been reduced by up to 75 %. It was introduced on October 2, 2021 and will remain in force till September 30, 2023.



**C.I shall now bring out some of the recent developments in the area of nuclear medicine and health care**

25.  $^{68}\text{Ga}$ -PSMA-11, a *Positron Emission Tomography* (PET) based imaging agent used for diagnosis of prostate cancers was synthesised in-house in BARC as import substitute with a quality comparable to that of the commercial imported equivalent.
26. A portable and field-deployable CRISPR based method to detect SARS-CoV-2 infections, named BARC-CRISPR-CUBE, has been developed and technology has been transferred to two private entrepreneurs.
27. In a step towards 'Atma-Nirbhar Bharat', technologies of five different types of high-quality respiratory face mask were developed. The technologies were transferred to private entrepreneurs for large scale production.
28. Recovery of about 1 lakh Ci of Cs was achieved, which can be used for the production of Cs pencils. Ru-106 Plaques were supplied to Ramakrishna Eye Hospital and AIIMS.

29. Three different formulations of Yttrium-90 were developed and deployed. These included Y-90 labelled glass microsphere, called Bhabhaspheres, for liver cancer treatment, Y-90 labelled hydroxyapatite particles for treating arthritis and Y-90-acetate solution for radiopharmaceutical applications.

30. An indigenous, cost-effective technology for synthesis of o-tolylbenzotrile (OTBN), an advanced drug intermediate was developed.

31. A novel, compact, helical shaped modified Nisargruna based waste converter has been developed for smaller housing societies and restaurants and technology has been transferred.

**D.It has always been our strong intent and important mission to contribute for the food and water security of the country. Some important developments in this area are as follows**

32. 303 quintals breeder seeds of Trombay groundnut and 23 quintals breeder seeds of pulse varieties, were produced & distributed.
33. Trichoderma and tamarind seed-based TrichoBARC formulation was developed and technology was transferred. The formulation was applied in seven locations across five states and resulted in 63% average yield gain over control.
34. An improved Trichoderma mutant-based “Rapid biocomposting technology” was developed.
35. Preservative free, Shelf Stable Natural Jamun Product recently achieved commercial deployment and is available on various online platforms.
36. A gluten free premix was developed using cereals and millets by Gamma irradiation and used for improving the functionality of the food hydrocolloids. The technology has been transferred to private industrial domain.

37. A 150 KLD treatment capacity hybrid granular sequencing batch reactor (hgSBR) plant for treating sewage was commissioned in Kalpakkam. Four companies have signed technology transfer agreement for implementing hgSBR technology.
38. Under the DAE Project on “Deployment of water purification technologies in 50 villages in India”, a 2000 LPH capacity fluoride removal plant was installed, commissioned and handed over to the Sagargaon Gram Panchayat in Odisha. The plant is catering to the drinking water requirements of 4 villages.

**E.BARC also works in forefront of basic sciences and supports indigenous industry.**

39. BARC has recently installed Asia's largest gamma-ray telescope, called Major Atmospheric Cerenkov Experiment (MACE), at Hanle, Ladakh. Located at the highest altitude in the world among the existing telescopes of this class, MACE had its first light in April 2021 with successful detection of the high energy gamma-ray photons from the Crab Nebula.

40. The Indian Scintillator Matrix for Reactor Anti-Neutrinos (ISMARAN) is fully set up in Dhruva Reactor Hall. ISMRAN is designed for reactor monitoring through anti-neutrinos and looking for possible signatures of Reactor Antineutrino Anomaly.

41. BARC-TIFR Pelletron Linac Facility has resolved the origin of large alpha production in reactions involving weakly-bound nuclei.

Dear colleagues

As we all know, the physical presence of personnel at our facilities was considerably curtailed during the pandemic period to break the chain of Covid-19 infections. However, steps were taken to ensure that the digital resources were made available to our scientists working from home. Based on the backbone of BARC Secure VPN Technology, access to portals like APAR, AAIIS, MMS and E-Office is now provided to employees. A document sharing system 'Anudocs', authorizing employees to share documents was developed and deployed. A portal called 'Teeka' for facilitating online registration, appointment scheduling of COVID-19 vaccination for

BARC/DAE employees and their dependents was also developed and deployed.

On infrastructure front, New Fire Station building and New Wing of BARC Hospital was completed. More than 97% overall availability of all Civil, Electrical & Mechanical utility services was maintained.

As is evident, BARC has made significant contribution in several sectors which are core as well as spin off areas of nuclear energy applications. BARC has always emphasized on high standards of work. The excellence of research is reflected in outstanding quality and quantity of our published work which scores high in citation and other indexes.

Our work has been appreciated by other scientific bodies. The Mutation breeding team of BARC has been awarded *Outstanding Achievement Award* by the IAEA in recognition of radiation-based mutation research. IAEA also conferred the *Young Scientist Award* on Shri P. Dhanasekar for his work on mutation breeding. Dr Dhiman Chakraborty was awarded

INSA Young Scientist Award 2021 for his contribution in salinity and oxidative stress tolerance in cyanobacterium. Ms Sutanvi Lahiri was awarded Outstanding *Young Chemical Engineer 2021* by Indian Institute of Chemical Engineers. This year Dr. Prasun Mukherjee has been elected as the fellow of the highly prestigious Indian National Science Academy (INSA).

I have presented only few achievements our Centre has made during the year. This could be achieved only due to the sustained efforts of our scientists and technologists. I would like to take this opportunity to acknowledge the role played by every individual, section, division, group, who have contributed collectively to this magnificent team effort.

Sincere expression of gratitude is also extended to personnel of auxiliary services and support personnel who have worked tirelessly behind the scenes and ensured that the machinery and ecosystem of BARC runs without any hiccups. This included services provided by Medical Group, Engineering Services Group, BARC Safety Council, Scientific Information Resources Division, Personnel & Accounts Divisions, Security Section, CISF, Fire Services Section, Landscape and Cosmetic

Maintenance Section, Transport & Catering Sections and many more who individually and collectively contributed silently to the success of this organization. Our acknowledgements are also due to the other service providers such as BARC Credit Society, State Bank of India and Indian Post who are stationed at our campus and provided services to our employees. Special thanks are also due to the unions and associations for their support and cooperation.

**Thank you and Jai Hind**