

**Republic Day Address
of
Director, BARC
2023**

Distinguished invitees, dear Colleagues and ladies and gentlemen,

It is a pleasure to welcome you all to this gathering on the occasion of the 74th Republic Day of India. I extend my greetings to all members of the DAE family on this solemn occasion.

On this day in 1950, the country adopted a forward-looking Constitution, which has been the beacon and guiding force in the governance of our sovereign nation. India is today the largest and most vibrant democracy of the world, largely on account of the tenets, practices and values of justice, liberty, equality and fraternity laid down in our constitution by our founding fathers. These are ideals and values which have unified our country while maintaining its vast diversity.

Soon after independence, India decided to chart a path for development in a manner that the fruits of development should reach every citizen. Establishing a strong science and technology infrastructure was considered an essential step for bringing about rapid socio-economic progress. Atomic Energy was recognised as one of the front ranking technologies requiring active pursuit and mastery, and the programme was thus seeded in 1954, under the leadership of our visionary founder Dr. Homi Jehangir Bhabha. Our Centre has worked relentlessly since its inception to achieve self-reliance in all sphere of nuclear technology and its applications. The sustained efforts of our scientists, technologists as well as other auxiliary and support personnel has been instrumental in the complete mastery of the nuclear fuel cycle as well as the delivery of

several societal applications of great value to the nation and its citizenry. The path has been challenging and daunting at times, but the dedication and determination of the BARC family has been successful in overcoming difficulties and delivering on multiple fronts.

Our mandate remains broad based with emphasis on basic and applied research, technological development and deployment of core and spinoff nuclear technologies for the benefit of society.

I shall now reflect upon some of the successes and milestones achieved during the last one year.

The nuclear fuel cycle related activities at this centre, namely fuel fabrication, reactor operations, fuel recycling and waste management, are the foundational activities of BARC and I shall begin with a brief report on these activities

1. Research reactors, Dhruva and Apsara-U, continued to operate with a high level of safety and availability. The overall Availability factor for Dhruva in 2022 was around 73 % and it was 52.7% for Apsara U at rated power. About 600 samples were irradiated.
2. After satisfactory commissioning trials, regular irradiation of fission moly has commenced in Dhruva.
3. Critical Facility for Advanced Heavy Water Reactor (AHWR) was operated on 66 occasions for experiments, testing of nuclear

detectors and activation of large volume samples for Neutron Activation Analysis (NAA).

4. Regular production of fuel for research reactors Dhruva and FBTR was continued to ensure desired reactor power including 100% power for FBTR.
5. Fuel Fabrication Plant at Tarapur has successfully completed fabrication of 1 lakh PFBR fuel elements. Stringent technical specifications required for PFBR fuel elements have been achieved with consistency.
6. The alpha bearing stream was converted into Low Level effluents. It has helped in separation of actinides and achieving a Decontamination Factor of 5000 for actinides.
7. A prompt fission logging probe using an indigenously developed sealed D-T neutron source has been assembled and tested for on-site detection of uranium ore concentration at AMD, Jaduguda, up to a depth of 150 m.
8. An innovative technique, based on artificial intelligence has been developed and commissioned at NFC, Hyderabad for automated inspection of PHWR fuel bundle end plate weld joints.
9. The in-house developed Monte Carlo code has been successfully coupled with the burnup code McBURN to perform detailed burnup analysis of reactor cores using parallelising techniques. The

integrated code has been benchmarked for the 220 MW(e) PHWR and typical VVER cores.

Several technology initiatives and projects have achieved important milestones and reached completion. Some of these activities are as follows

10. First time LINAC based n-source has been fully developed and n-radiography results are obtained with good contrast and sensitivity using indigenous 9MeV Linac and in house designed Be- based n-target at ECIL, Hyderabad.
11. Indigenous cargo scanner has been used for identification of many special materials and has been qualified for deployment for field trials.
12. A Hybrid low pressure Scroll compressor of a novel design has been developed & fabricated in-house. It is superior to the internationally available Single/Tri Scroll compressors in terms of pumping performance & cost.
13. An Automated Drum Handling System for handling Heavy Water Drums has been developed and commissioned to mitigate the risks involved in handling of contaminated drums & to reduce man-rem dose.
14. An indigenously developed online reactivity meter was installed & commissioned in experimental reactor facility. A compact table-top

version of Fast Neutron Dosimetry System has been developed for inhouse use.

15. A GIS based National map on natural background radiation was generated from countrywide survey data. This map is aimed to help in public dose assessment, setting benchmark levels and policy decisions.
16. An automated facility for handling neutron sources has been designed and developed to reduce exposure to working personnel during calibration of neutron monitors.
17. Technology for preparation of high purity low-carbon ferro-boron required for making rare earth permanent magnets has been demonstrated.
18. An indigenous method has been established for preparing high purity magnesium hydride from magnesium powder. A magnesium hydride based portable hydrogen storage device has been fabricated and demonstrated.
19. A hydrometallurgy technology-based process flowsheet is developed for the recovery of rare earth from the micro-granite type hard rock REE deposit in Rajasthan, which is relatively richer in high value heavy rare earths. The mixed REE-fluoride compound obtained is of 90% purity with good recovery.

20. BARC has developed liquid helium Dewars of different capacities and the technology has now been transferred to Indian industry with the aim of import substitution.
21. Two import substitute highly sensitive gas sensing technologies for Hydrogen (H₂) and Hydrogen Sulfide (H₂S) have been successfully developed and transferred to private entrepreneurs.
22. Sodium Iodide (NaI:TI) single crystal based import substitute detector was developed for incorporation in the Backpack Gamma Spectrometer System (BGSS). Eight units of such detectors have been made, tested and delivered.
23. Digital Modular Radio System for VHF communication has been augmented with more capacity, diagnostic and geo tagging capabilities. Anushaktinagar Security and CISF have been brought under this technology with integrated Network Management from Network Management Centre at BARC.
24. A device named as, 'Isolated multi-channel DAQ system for multi-stack system' has been developed indigenously as an import substitute to monitor and control system of multi-cell stack systems. The technology is available for transfer.

I shall now mention some of the noteworthy R&D contributions and initiatives

25. The protocol for preparation of silver impregnated zeolite for iodine capture was standardized and a batch of 1.0 Kg zeolite loaded with 10% (w/w) silver was supplied to NRB.
26. The third drift-tube linac tank (DTL3) of the Low Energy High Intensity Proton Linac (LEHIPA) has been successfully tuned and vacuum tested, and readied for beam acceleration from 11 to 15.5 MeV.
27. Geo-polymer, a novel matrix has been developed for the management and containment of Technetium (Tc99)-bearing waste stream to address long half-life and highly mobile nature of Tc.
28. The recently commissioned MACE telescope has detected a rare very high energy gamma-ray signal from the radio galaxy NGC 1275 located at a distance of 230 million light years. This signal was also detected by the international observatories located on the Canary island, Spain.
29. The new Atomic Molecular and Optical Science (AMOS) Beamline being developed at Indus-2 Synchrotron has been fully installed, tested and validated. This beamline will be useful for advanced research in photophysics, photochemistry and material science.
30. The three large scale facilities of BARC, namely National Facility for Neutron Beam Research (NFNBR) in Dhruva reactor, Synchrotron beamlines at Indus-1 and Indus-2, and BARC-TIFR PelletronLinac Accelerator facility have been utilized effectively by users from a large number of universities and research organizations across the country.

The contribution of BARC to missions of societal cause have always been one of our important mandates and I shall now like to draw your attention to achievements in this important segment of our activities and programmes.

31. For preservation and value addition of a highly perishable Chiku fruit, a shelf stable product namely “Chiku Fruit Bites” has been developed using radiation technology. The technology is now available for transfer.
32. Trichoderma mutant-based formulation, developed at BARC, has been recommended for chickpea seed treatment by Indian Council of Agricultural Research based on superior performance in All-India multilocation trials.
33. BARC signed an MoU with National Mission for Clean Ganga, for technology demonstration of waste water treatment using electron beam accelerator and associated pre and post irradiation solution for tennary water.
34. A 12500 LPH capacity water purification unit was deployed at Sandeep Border Outpost, Indo-Pak Border, Kutch, Gujarat for the potable and non-potable requirements of BSF personnel. Water purification units have been deployed in 81 rural/remote sites of India based on BARC-developed know-how.

35. Atal Incubation Centre- Bhabha atomic Research Centre (AIC-BARC) launched its operation with signing of agreements for incubation of 4 prominent spin-off technologies with four MSME industries on December 22, 2022. The technologies are Alkaline Water Electrolyzer for Green Hydrogen production, DC Accelerator for waste water treatment and radiation processing applications, X-Band LINAC based X-ray source for radiotherapy machine and the technology for growth of single large dimension Cesium Iodide Crystal.
36. RF LINAC at Electron beam centres has catered to more than 35 industries for more than 300 hrs of irradiation of various industrial products.
37. A Phase II Human clinical trial using Chlorophyllin at Tata Memorial Hospital has shown highly promising results for mitigation of long-term side effects of Cancer radiotherapy.
38. BARC could successfully enrich Lutetium-176, from its natural abundance of ~2.6% to consistently more than 80% by indigenously developed laser route. The Lutetium-177 produced from this enriched target was utilised in the formulation of multiple doses for the treatment of cancer in various hospitals across India.
39. Nine numbers of Cesium pencils were delivered to BRIT, to be deployed in blood irradiator. Till date, 20 Ruthenium plaques (RuBy plaques) were delivered to various hospitals of India, for eye cancer Brachy-therapy. This year BARC developed and supplied the first Paediatric Plaque for eye cancer treatment of children. Milestone

supply of 100th batch of Y90 to RMC for radiopharmaceutical applications was achieved.

40. A pilot scale unit based on radiation grafted cellulose fabric for removal of dyes from dye industry wastewater streams has treated ~200 kilo litres of dye wastewater without reaching saturation limit.
41. Radiation Medicine Research Centre (RMRC) has been set up and inaugurated in Kolkata for providing state-of-art and low-cost nuclear medicine services for up to 10,000 patient referrals yearly. The Facility will offer National Medical Council (NMC) recognized post graduate degree (MD) and AERB recognized M.Sc. courses and provide human resources for developing and fostering nuclear medicine in the region.
42. Our Engineering Services Group ensured more than 97% overall availability of all Civil, Electrical, HVAC, Mechanical utility, security systems and L&CM services.

I am happy to mention that during last year many of our colleagues were recognized by various scientific bodies for the achievements.

1. Dr. A.K. Tyagi was conferred with the Honorary Professorship by Jawaharlal Nehru Centre for Advanced Scientific Research, Bengaluru.
2. Dr A.K. Tyagi, Smt. Smita Manohar, Dr. (Smt) Gopika Vinod were elected as Fellows of Indian National Academy of Engineering.

3. Dr. S.M. Yusuf has been elected as “Fellow of Indian National Science Academy”.
4. Dr. Srinivas Krishnagopal has been elected as “Fellow of American Physical Society”.
5. Dr. Awadhesh Kumar has been elected as “Fellow of National Academy of Sciences, India”.
6. Dr. Jyotirmayee Mohanty has been elected as “Fellow of Royal Society of Chemistry”.
7. Dr. Biswajit Manna was conferred NASI Young Scientist Award.
8. Dr. Santosh Gupta has been elected as Member, INYAS & Member, NASI.
9. Dr. (Smt) Pallavi Singhal was conferred with Platinum Medal by NASI.
10. Dr. Veerendra K. Sharma has been conferred Indian Physics Association Buti Foundation Award 2022
11. Dr. Dhiman Chakravarty was conferred National Academy of Sciences, India (NASI) -Young Scientist Platinum Jubilee Award.
12. Dr. P.K. Mukherjee has been conferred with INSA Fellowship.
13. Dr. Mohit Tyagi has been selected as a member of the Indian National Young Academy of Sciences (INYAS).
14. Dr. Sugam Kumar has been selected as Associate of Indian Academy of Sciences & also Member of the National Academy of Sciences.

I am happy to announce that Shri R S Agrahari, Deputy Chief Fire Officer of BARC has received Fire Service Medal 2023 of President of India.

Dear Colleagues, I have only been able to present some of the salient achievements of our centre during this period. It is the sustained and dedicated efforts of all personnel from all wings of our organisation, which brings it laurels, and I would like to take this opportunity to acknowledge the role played by every individual of the organisation, who directly and indirectly contribute to the programmes and activities of the organisation. I urge all my colleagues to work shoulder to shoulder as a team in all activities, which should help us in reaching our goals and delivering on our mandates successfully and in optimum time frames.

The role of personnel providing auxiliary and support services are of equal value to the success of our programmes. This includes the Administrative Group, Medical Services Group, Engineering Services Group, BARC Safety Council, Security Services, Fire Safety Services, Landscape and Cosmetic Services, Transport Section, Catering Services and many more. Our thanks are also due to all the personnel of BARC Credit Society, State Bank of India and Indian Post who are stationed at our campus and provide services to our employees. Special thanks are also due to the unions and associations for their support and cooperation.

At the end, my dear colleagues, I would like to once again extend Republic Day greetings to all our employees.

Thank you, Jai Hind