

**Founder's Day**

**Wednesday, October 30, 2024**

**Venue: Bhabha Atomic Research Centre**

**Address by**

**Dr A K Mohanty**

**Secretary DAE & Chairman AEC**

**My Respected Seniors, Dear Colleagues, Ladies & Gentleman,**

A very good morning to all of you. I am delighted to be here this morning with you all to commemorate the 115<sup>th</sup> birth anniversary of Dr H J Bhabha - the founder of Indian Nuclear Program. The culture of celebrating the birthday of our founding father every year as Founder's Day at BARC is quite unique, thanks to the wisdom of our predecessors who established this culture. Dr Bhabha will always remain etched in public memory as one of the architects of modern India. Dr Bhabha was a true Karmayogiby virtue of his vision, objectivity and the ability to manifest. Today is an occasion for us to get inspired while reminiscing the works and life of Dr. Bhabha. Our achievements today are a testament to the virtues of this great visionary and I strongly urge all of you to imbibe these virtues. It has been a continuous stream of concerted actions through which his vision got fructified, leading to foundation of several institutions under the DAE umbrella. We have entered the 70<sup>th</sup> year celebrations for our department and it is time to self-evaluate ourselves on how tall and firm we stand up to the vision of Dr Bhabha. With this in mind, I intend to share with you a list of our achievements since last Founder's Day. A detailed account of BARC activities was shared a while ago. I will

highlight a few major achievements in all the thematic verticals from all the DAE units, including BARC.

**A. *I will start with the progress in our Nuclear Power Programme, in which AMDER, UCIL, NFC, HWB, ECIL, NPCIL, BHAVINI, BARC and IGCAR have played a major role. I will highlight a few achievements which can be seen as a major milestone in our journey for self-reliance in nuclear power.***

1. Since last October, AMD's continued efforts have resulted in augmentation of 15,598 tonne uranium oxide resource in the states of Andhra Pradesh, Jharkhand and Rajasthan. The total uranium oxide resource of the country is updated to 4,25,570 tonne U<sub>3</sub>O<sub>8</sub>.
2. A significant discovery of new deposit in India's oldest Uranium Mine, the Jaduguda Mines, has been made in and around the existing mine lease area. This will increase the life of an otherwise depleting mine by more than fifty years.
3. First two units of the indigenous 700 MWe PHWR at Kakrapar, Gujarat (KAPS – 3 & 4) have started commercial operation in FY 2023-24. Rawatbhata Atomic Power Project (RAPP) Unit 7 – the 3rd indigenous 700 MWe PHWR in a series of 16 sanctioned reactors, has completed initial fuel loading and achieved First Criticality.
4. Closed fuel cycle being the cornerstone of Indian nuclear power program, the country's first Prototype Fast Breeder Reactor (PFBR 500 MWe) had a very eventful year achieving many of the milestones, viz., Primary Sodium filling in Main Vessel, purification of the filled sodium and commissioning of all the four Sodium pumps (2 Primary Sodium Pumps & 2 Secondary Sodium

Pumps).Core loading was commenced in the august presence of Honourable Prime Minister with loading of first reactor control rod on 4th March 2024.

5. The 'Sub-assembly level Metal Fuel Fabrication Facility' which fabricates 1.0-meter long sodium-bonded metal fuel pins for sub-assembly level irradiation in the FBTR was inaugurated on 28th May 2024. A new experimental facility for demonstration of pyro-processing operations using U-Pu-Zr alloy was also inaugurated. Online Isotope Monitoring System consisting of dedicated detectors for detecting alpha, beta and gamma radiations and associated electronics has been installed by IGCAR in one of the pre-dominant wind sectors of Kalpakkam site. This first of its kind system in DAE provides online detection of radioactive aerosols such as Iodine, Cesium, and noble gases such as Xenon and Krypton in the event of any emergency.
6. NPCIL and NTPC have signed a supplementary Joint Venture agreement to develop nuclear power facilities in the country. The JV named ASHVINI will function within the existing legal framework of the Atomic Energy Act 1962 (amended in 2015) and will build, own, and operate nuclear power plants, including the upcoming 4x700 MWe PHWR Mahi-Banswara Rajasthan Atomic Power Project.

**B. *In the area of Health Care, DAE contributes toaffordable Cancer Care and indigenous development, commercialization & supply of Radio-pharmaceuticals. In this mission, TMC, BRIT, VECC, HWB, BARC and IGCAR have played a crucial role.***

1. The National Cancer Grid, now a 362-member network across the country, spearheaded by Tata Memorial Centre, treats approximately 60 % of country's total cancer load. The NCG has supported the establishment of SEACanGrid - a

- network of countries / cancer centres in the WHO South East Asia region which is being coordinated by WHO South-East Asia Regional Office. The aim is to share best practices developed by the NCG with other South-East Asia Region countries to improve cancer control in South East Asia.
2. Several new facilities have been inaugurated at HBCH&RC, Punjab which include a CT scan, PET Scan, state-of-the-art Operation Theatre 'SUSHRUTA II' and a fully equipped Nuclear Imaging Department.
  3. BARC's patented nitric oxide (NO<sub>x</sub>) releasing dressing for wound healing in diabetic foot ulcer patients, which was earlier transferred to Cologenes Private Limited for commercialisation, completed the Phase III clinical trials and received regulatory approvals from the Drug Controller General of India for launching the product. NO<sub>x</sub> releasing wound dressing is the first of its kind in India approved for use and expected to benefit large number of diabetic patients.
  4. Towards indigenization, commercialization and supply of radio-pharmaceuticals, HWB is regularly supplying Deuterium Depleted Water (DDW) of around 125 ppm deuterium in the domestic market to healthcare industries. Recently, DDW unit of 100 Te/Annum capacity located at HWP, Kota has been inaugurated.
  5. BRIT demonstrated the technology for the isolation of medical grade no carrier added (NCA)<sup>177</sup>Lu from irradiated 95.0 % enriched<sup>176</sup>Yb target using extraction chromatography-based separation system. The enriched<sup>176</sup>Yb target was produced by BARC. NCA<sup>177</sup>Lu-DOTA-TATE and NCA<sup>177</sup>Lu-PSMA-617 formulated with the NCA<sup>177</sup>LuCl<sub>3</sub> produced, were successfully evaluated clinically.

**C. *DAE continues to prioritise basic and directed research and our scientists and engineers are not only delivering on several front-end research areas but are also shaping and guiding the contour and path of the country's vision towards scientific research.***

1. As a part of the Platinum Jubilee year celebrations of the Department, the indigenously built Major Atmospheric Cherenkov Experiment (MACE) Observatory at Hanle, Ladakh was inaugurated on 4<sup>th</sup> October 2024. MACE is the largest imaging Cherenkov telescope in Asia located at the highest altitude of about 4300 m in the world.
2. The GRAPES-3 experiment in Ooty, India, discovered a kink in the cosmic-ray proton spectrum at around 166 tera-electron-volt (TeV). The new feature will advance our understanding of the origin and propagation of cosmic rays, which is a century-old unresolved problem. The study was performed using a subset of nearly eight million cosmic ray showers recorded with an array of scintillator detectors and a large muon detector in the energy range of 50 TeV to 1.3 peta-electron-volt.
3. A near-field Scanning Terahertz Microscope has been developed indigenously at the TIFR Mumbai campus. It is only one of its kind in India. This instrument is able to detect near-field Terahertz radiation with 0.01mm precision, which is 1/30th the wavelength of light used. One can study metamaterials using this instrument. The software for it has also been fully developed in-house.
4. ECIL has developed a Gamma Ionization Chamber for the purpose of high gamma radiation detection during accident conditions in Light Water Reactors. The pre-eminence of the detector is that it was designed and developed to monitor gamma exposure rates in the wide range of 100 mR/hr to 107 R/hr. Also, another Gamma Ionization Chamber was designed and

- developed for the purpose of low energy gamma radiation detection. The chamber could detect 100 $\mu$ R/hr to 5R/hr with gamma energy as low as 25KeV.
5. Strong Motion Seismic Instrumentation System, vital for monitoring and analysing the vibratory response of structures and equipment in a nuclear power plant during earthquakes has been developed by ECIL. It records ground motion data to determine the necessity for post-earthquake inspections, verifies the adequacy of design through data collection, and triggers alarms in the control room to assess the severity of seismic events and guide plant operations.
  6. At IGCAR, small punch test technique using miniaturized specimens (typically 8 mm diameter and 0.5 mm thickness) has been developed and employed for evaluating mechanical properties of neutron irradiated and service exposed materials. For the first time, Digital Image Correlation technique has been successfully integrated with small punch experiments for online monitoring of the strains and identifying the location of instability during deformation.
  7. IPR has set up and is operating an accelerator-based 14 MeV neutron facility, which can have a maximum output of  $5 \times 10^{12}$  n/sec. The facility has been used for the first time for two kinds of neutron irradiation studies: neutron generators for producing medical radioisotopes (Mo-99, Cu-64, Cu-67 etc.) and radiation induced damage for near-reactor components from fusion reactors.
  8. SINP has installed and commissioned a large scattering chamber of 1-meter diameter to perform experiments deep below the Coulomb barrier, with direct relevance to nuclear astrophysics problems.
  9. NISER has pursued collaboration with SCL, Chandigarh for making p-type silicon pad sensors on six-inch wafers for the Forward Calorimeter (FOCAL) detector in ALICE at LHC-CERN. These will be soon tested at CERN.

**D. DAE continues to pursue cutting edge research, development and application in the area of advanced technologies, materials, critical minerals & rare earths, radiation-based technologies, etc. Wide-ranging activities are being undertaken by several DAE units, including high-end accelerators, laser, plasma, cryogenic, quantum, space applications and radiation technologies for food security, water management, waste treatment and even e-governance.**

1. For the first time, AMD has established a total of about 1800 tonne lithium oxide (Li<sub>2</sub>O) reserves in hard rock terrain of Karnataka.
2. BARC has successfully extracted Neodymium metal, required for mass production of hard magnets, through a commercially viable molten fluoride electrolytic process using rare earth oxide.
3. BARC, in collaboration with NALCO has produced the first indigenous certified reference material (CRM) of Alumina (BARC - B1301) and released it on 16 Aug 2024. Further, an in-house Reference Material (RM) for Boron Alloy is ready to be released.
4. NFC has achieved many a first in the last one year. These are the development of Monel 400 (Nickel & Copper) alloy tubes for cryogenic/ space applications, Hastelloy Ni based alloy Tubes for Molten Salt Reactor, Incoloy 740H for Advanced Ultra Super Critical Boiler applications, Titanium half alloy Seamless Tubes for the Gagan Yaan Project, high Residual Resistivity Ratio Niobium for superconducting applications and ultra-fine zirconium alloy powder for defence applications.
5. A state-of-the-art Magnetite Recovery Plant was successfully commissioned and put to operation in the month of September 2024 at UCIL's Turamdih unit. The plant can recover Magnetite from the barren neutralized pulp after

- extraction of Uranium Tailings. Maximum magnetite quantity that can be recovered is 77 MT/day, which can be directly sold to prospective buyers without any further treatment.
6. Indigenous Development of Prototype Hybrid Ultra High Vacuum Pump, consisting of Triode Sputter Ion Pump with Pumping Speed of 35 l/s and Non-Evaporable Getter with a Pumping Speed of 200 l/s, has been completed by RRCAT.
  7. Scientists from TIFR have completed end-to-end testing of a 6-qubit quantum processor based on cryogenic superconducting circuit technology. The project being executed at TIFR's Colaba campus is a three-way collaboration between TIFR, DRDO Young Scientist Lab-Quantum Technologies (DYSL-QT) and Tata Consultancy Services (TCS).
  8. Pilot-scale facility of four step Copper-Chlorine thermochemical cycle for hydrogen production from water splitting has been installed and commissioned at BARC. Hydrogen production was demonstrated at design capacity of 150 NL/h for 12 hours.
  9. ECIL has successfully delivered the indigenously designed and developed X-band RF Seeker for the Long-Range Anti-Ship Missiles to DRDO, Hyderabad on 30 Aug 2024. The Seeker is the key contributor to the increased effectiveness of the precision strike missile.
  10. MATSYA (Marine Advanced Transportation and Storage Yantra), another variant of SHIVAY (Sheetal Vahak Yantra) developed by RRCAT, has been successfully tested by Central Institute of Fisheries Technology, Thiruvananthapuram on fishing vessel 'Sagar Harita'.
  11. BRIT has developed and commissioned an Irradiator which can be operated at low temperature, using Co-60 radiation source to irradiate marine products at low and sub-zero temperature. The irradiation plant which is first of its kind in



India will not only increase the shelf life of fresh marine products but also provide high quality food by eliminating pathogens. The Irradiator is expected to give a boost to radiation processing of marine products in the country.

12. Recently, BRIT has launched a new product, ROTEX-1 – Iridium-192 based Industrial radiography device, which is a very compact and light-weight and is an import substitute.
13. In agriculture sector, two new high yielding and multiple disease resistant blackgram crop varieties (Trombay Jawahar Uradbean 339 (TJU-339) & Trombay Jawahar Uradbean 130 (TJU-130)) were notified by Government of India for commercial cultivation and two stress tolerant rice varieties have been approved by State Variety Release Committees. A total of 70 varieties have been released by BARC till date.

**E. DAE is making concerted efforts towards development and deployment of technologies, knowledge management, capacity building and human resource development.**

1. Under the AIC-IPR Plasmatech Innovation Foundation (AIC-Plasmatech) of IPR, agreements have been signed with two start-ups: Exxcarbon Private Limited and Ecoplaswa Technology Private Limited for the commercialization of IPR's RAUDRA Plasma Pyrolysis technology and development of products based on IPR's patented Plasma Activated Water technology, respectively.
2. IPR has successfully transferred the know-how of 1 tonne per day plasma pyrolysis technology (RAUDRA) for safe disposal of biomedical waste on non-exclusive basis to M/s Bhakti Energy, Rajkot. This is the 6<sup>th</sup> party to get this technology.

3. BARC has secured a US Patent Publication on “Deuterated-3-3'-Di-seleno-di-propionic Acid (D-DSePA) and its use as an Anticancer or Radioprotective Agent”.
4. In 2024, NPCIL has recruited 410 Engineers which is the highest number so far and has also established a Nuclear Training Centre at Narora, thereby enhancing the training capacity for Engineers.

**F. In the past one year, quite a few National and International Awards and Recognitions have been bestowed upon the DAE fraternity. I would like to share my joy with you for these recognitions.**

1. AMD has been conferred with Excellence Award in the category for ‘Best Heavy Mineral Exploration of the Year’ by Rare Earths Association of India (REAI) and Indian School of Mines Alumni Association (ISMAA), Kolkata Chapter in the forum of International Conference on Heavy Minerals and Lithium for Energy Security (REES – 2024) at Kochi, Kerala on 29th August 2024.
2. Indian students, mentored by TIFR, have registered stellar performances at the 5 International Olympiads in Biology, Mathematics, Physics, Chemistry and Astronomy & Astrophysics and Junior Science Olympiad.
  - a) The Indian team has bagged one gold and three silvers at the International Biology Olympiad in Astana, Kazakhstan.
  - b) All five Indian participants in the 54th International Physics Olympiad held in Isfahan, Iran, during July 21-29, 2024 have bagged 2 Gold and 3 Silver medals.

- c) All four Indian students have achieved podium finishes at the 56th International Chemistry Olympiad held in Riyadh, Saudi Arabia, during July 21-30, 2024 by winning 1 Gold, 2 Silver, and 1 Bronze medal.
  - d) Indian students have excelled with 4 Gold, 1 Silver, and 1 Honorary Mention at the International Mathematics Olympiad 2024 held in Bath, UK, in July 2024. This was India's best performance to date at the IMO. India secured 2 Silver and 2 Bronze Medals at the 13th European Girls' Mathematical Olympiad (EGMO) 2024.
  - e) The Indian team of five students secured one gold medal and four silver medals at the 17th International Olympiad on Astronomy and Astrophysics (IOAA) held in Rio de Janeiro, Vassouras, Brazil, from August 17 to 26, 2024.
  - f) Indian team won 5 gold and 1 bronze medals in the International Junior Science Olympiad (IJSO) in December 2023.
3. From amongst the National Science & Technology Awards,
- a) Dr. A. K. Tyagi from HBNI and Prof Naba Mandal from SINP have been conferred with the prestigious Vigyan Shri in the field of Atomic Energy and Physics respectively.
  - b) Prof. Vivek Polshettiwar has been awarded Vigyan Yuva Puraskar in the field of Chemistry. These awards are part of the Rashtriya Vigyan Puraskar instituted by the Government this year.
4. This year, DAE has been awarded the Rajbhasha Kirti Puraskar (First Prize) for the year 2023-24 by the Department of Official Language, Government of India for excellent implementation of the Official Language Policy.
5. Prof. Aditi Sen De of HRI, Allahabad got G. D. Birla award. She is the first woman physicist to get this award.

6. Our students from the AEES schools across the country have won recognition in academics, music, painting, sports, athletics and NCC. As an outstanding example, Akshaya Sathi (Class VIII, AECS Kaiga) secured 62<sup>nd</sup> rank in FIDE World Junior (Open & Girls) Chess Championship and Kumari U L Nethra from AECS-2, Kalpakkam was awarded the title of 'Arena Candidate Master' by the International Chess Federation, FIDE.
7. IREL received "10th Greentech CSR Award 2023" for Outstanding Achievements for Welfare of Divyanga organized by Greentech Foundation, New Delhi. IREL has provided intelligent Artificial limbs and Prosthesis to about 39 divyanga-jans under CSR activities. IREL has also received 1<sup>st</sup> Prize for 'Operational Excellence' in Mini-ratna Category at the XIII PSE Excellence Awards organized by Indian Chamber of Commerce, Kolkata.
8. ECIL has been awarded the IETE Corporate Award for Performance in Electronic Instruments and Instrumentation for the year 2024 at the 67<sup>th</sup> Annual IETE Convention held on 14 & 15 Sept 2024 in Bhopal. This accolade acknowledges ECIL's contributions to the nation's self-reliance in this vital sector.

While we continue to strengthen our focus in our mandated areas, our Service Organizations like DCSEM, DPS and GSO have continued to support, facilitate and augment the Department's infrastructure. DPS is bringing many important changes in procurement and stores for improving the proficiency, uniformity and speed in procurement cycle. This includes extension of MMS facility to all DAE units in and around Mumbai in 2<sup>nd</sup> phase and thereafter to all DAE units towards common Purchase and Stores solution to all DAE units. DCSEM has completed major construction of GCNEP Phase II project at Bahadurgarh.

In order to create awareness and build a positive perception about multi-dimensional beneficial effects of nuclear energy to mankind and environment, DAE continues to implement its various outreach programs in mission mode.

I would like to sincerely acknowledge the dedication of our health care professionals, security professionals and administrative/ technical/ scientific staffs. They not only keep us safe, secure & healthy but also keep the system in working order.

In the end, I once again thank you for all your efforts and urge you all to continue to our contributions in the service of nation in the true spirit of 'Atoms-in-service-of-Nation' and stand up to fulfil our responsibilities towards a Viksit Bharat.

**Jai Hind.**