

**Founders Day**

**Monday, October 30, 2023**

**Venue: Bhabha Atomic Research Centre**

**Address by**

**Dr A K Mohanty**

**Secretary DAE & Chairman AEC**

**Respected Senior Members of DAE family, Dear Colleagues, Ladies & Gentlemen**

Wish you all a very good morning. I welcome you all to the Founder's Day celebration of 114<sup>th</sup> birth anniversary of a great visionary and nation builder, Dr. Homi Jehangir Bhabha. As rightly said by J R D Tata, Dr. Homi Bhabha was a truly complete man, a renowned scientist of international repute, an engineer of extraordinary calibre, master-builder, and administrator, steeped in humanities, in art and music.

Dr. Bhabha was not only the principal architect of our country's nuclear power programme but also had an immense contribution to the R&D programme of our department for developing and implementing the non-power applications of nuclear energy for societal benefits.

An occasion like this not only gives us an opportunity to re-dedicate ourselves to the cause Dr. Bhabha championed, but it is also an occasion to renew our oath in working collectively towards fulfilment of his vision in making our country self-reliant in the field of nuclear energy.

As members of the DAE family, we will always remain indebted to Dr. Bhabha for his far-sighted vision which has helped us achieve many successes and we have become a premier scientific department in our country today.

## Dear Colleagues

I will now share the achievements of various units of our department in the last one year which will be a rightful tribute to the memory of Dr. Bhabha.

***I will start by highlighting the achievements in our Nuclear Power Programme. The leading DAE institutes which contribute towards nuclear power production in our country are AMDER, UCIL, NFC, HWB, ECIL, NPCIL, BHAVINI, BARC & IGCAR***

1. AMD has made sustained exploration efforts and augmented additional Uranium Oxide reserves of 21,000 tonnes, which takes the country's total identified resources to about Four Hundred and Ten thousand tonnes of  $U_3O_8$ .
2. During the last financial year, UCIL has achieved its highest ever  $U_3O_8$  production since its inception. All mines and mills of UCIL are continuing to operate satisfactorily.
3. NFC has been successfully fulfilling all the requirements of our domestic nuclear power reactors with respect to the fabrication of fuel and core structurals.
4. This year on 31<sup>st</sup> August, Kakrapar unit 3 at Gujarat has started full power commercial power production and with this, the installed capacity of our nuclear power plants has reached 7480 MW. KAPP- 3 is the first indigenous 700 MW PHWR to be put under operation and is being followed up by the setting up of many such reactors in fleet mode.
5. Towards the realization of the 2<sup>nd</sup> stage of our nuclear power program, significant developments have happened over the last one year. The filling of the Main Vessel of PFBR of BHAVINI with about 1150 tonnes of liquid Sodium

has been completed in a record time of 5 days in the month of August 2023. All the indigenously manufactured Primary and Secondary sodium pumps have been put in service successfully and at present, liquid Sodium is being maintained at high temperature. The testing of Fuel Handling systems and other sub-components are in full swing.

**In field of health care, DAE continues to contribute to the indigenous development, commercialization & supply of therapeutic/ diagnostic radiopharmaceuticals and Cancer Care. These activities are being pursued at BARC, BRIT, VECC, TMC and also HWB.**

1. HWB has successfully produced medical grade  $H_2O_{18}$  of 95.5 % I.P. which has been validated by end users. This success in production of O-18 water will pave the path for India's self-reliance and give a boost to our healthcare industry.
2. The Fission Molybdenum-99 Plant has been dedicated to the nation by our honourable Prime Minister on the 25<sup>th</sup> anniversary of our National Technology Day on 11<sup>th</sup> May 2023. This makes India one of the few countries in the world producing fission Moly-99 today. The Molybdenum-99 produced at this plant will not only fulfil our domestic demand but will allow us to export the same to neighbouring countries.
3. BARC has successfully enriched Lutetium-176, from its natural abundance of about 2.6% to more than 80% by an indigenously developed laser route. This has been utilised in the formulation of more than 600 doses of Lu-177 for the treatment of cancer in various hospitals across India.
4. BRIT, Kolkata has developed an indigenous technology for in-house production of  $^{68}Ge$  which is used for making  $^{68}Ga$ -PSMA- 11 and  $^{68}Ga$ -DOTA-TATE radiopharmaceuticals. Large-scale production of 'no-carrier-

added' Copper-64 for the preparation of Theranostic Radiopharmaceuticals has been achieved. In addition, Iodine-123 has been produced in India for the first time using the 30 MeV Medical Cyclotron at VECC

5. The National Cancer Grid, created in 2012 with the broad vision of creating uniform standards of cancer care across India has grown into the world's largest cancer network. Today it has 305 members comprising cancer of centres, research institutes, patient advocacy groups, charitable organizations and professional societies. Between the member organizations of the NCG, the network treats over 800,000 new cancer patients, which is over 60% of India's total cancer burden.
6. From 740 beds in 2017, TMC has grown to 2450 beds in 2023 and this capacity will further increase to 2800 beds by early 2024. ACTREC, which had 100 beds till last year, has expanded to 500 beds this year and will expand to 900 beds by early 2024. Currently, TMC is treating about 125,000 new cancer patients annually which is approximately 10% of India's total cancer burden.

**I will now briefly touch upon the achievements in the Industry & Mineral Sector where AMD, IREL, HWB are making a significant contribution.**

1. For the first time, production of Rare Earth Permanent Magnets in the Country has been started by IREL at the BARC Campus, Vizag. This facility was also dedicated to the nation by Hon'ble Prime Minister on the occasion of 'National Technology Day'.
2. AMD has augmented about 4 lakh tonnes of Rare Earth Element Oxides in Ambadungar, Gujarat and Bhatikhera in Barmer district, Rajasthan. With this, the augmented Niobium Oxide reserves at Ambadungar and Bhatikhera now amount to about 1,24,000 tonnes and 4000 tonnes respectively.

3. IREL has started commercial production of Co-Sm permanent magnet at Vizag and has also paid the highest ever dividend of about ₹ 242 Cr to DAE for the last financial year.
4. HWB has exported Heavy Water to Japan, South Korea and USA for non-nuclear applications and around 220 MT of HW export orders are under approval process. HWB is gearing up to support the upcoming demand of Deuterium, Heavy Water and Deuterium Depleted Water for non-nuclear applications.

**Next sector where DAE institutes are making their presence felt is in application of radiation-based technologies for Agriculture & Food Preservation. Work is being done in this area at BARC and the positive impact that it has towards food security is now being recognised by various stakeholders in the country.**

1. This year, six Trombay crop varieties have been Gazette notified for commercial cultivation which includes one variety each of sorghum, mung bean & black gram for Karnataka, one sorghum variety for Maharashtra & two Urad bean varieties for Madhya Pradesh.
2. 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.
3. BRIT has exported about 2400 kCi Co-60 source for gamma irradiation applications in Radiation Processing Plants across the globe , including South Asian countries like Malaysia, Sri Lanka, Vietnam and also to UK. This is besides fulfilling the domestic requirement of 4.3 MCi of Co-60 source. Our exports cater to about 7 % of the global requirement.

**I will also touch upon on the progress made as spin-offs and technology transfer from non-power applications of nuclear energy for societal benefits like water treatment, waste management, post-harvest cold chain, etc. BARC, IPR, IGCAR and RRCAT are making steady progress in this area.**

1. RRCAT has used the 10 MeV, 6 kW linear accelerator for Electron Beam Sterilization of more than 1.2 million Risk Class-B medical devices which were earlier required to be taken abroad for sterilisation.
2. Water purification technologies have been deployed in 116 villages of India.
3. Advance Effluent Water Treatment Plant based on ozonation technology was commissioned with 750 LPH capacity at ONGC Mehsana for field demonstration to treat oil contaminated effluent water and make it suitable for agricultural use in rain parched adjoining area.
4. Three numbers of hybrid-granular Sequencing Batch Reactor (hgSBR) technology-based Sewage Treatment Plants with capacity ranging from 50 to 150 kLD have been operationalized at Surat, Shirdi and Tiruchirapalli for treating municipal waste water. Ten more private companies have entered into agreement during the year for commercialization of the same patented technology.
5. M/s Tata Motors have developed the first 20 ft Liquid nitrogen based refrigerated container integrated on Tata's commercial vehicle based on Liquid Nitrogen based cooling 'SHIVAY' Technology developed at RRCAT. This is a patented technology of DAE which was shared with M/s Tata Motors Ltd.
6. Agreements on the incubation of laser additive manufacturing technology have been signed with two startups and one public Ltd company.
7. The technology for fire detection, the 'Agni Rakshak' - Raman Optical Fiber Based Distributed Fire Sensor System has been transferred to industry.

8. Atal Incubation Centre - BARC has launched its operation with signing of agreements for incubation of 4 prominent spin-off technologies with four MSME industries on December 22, 2022.

**In advanced technology areas such as laser, accelerators, fusion, cyber security etc., DAE institutes such as BARC, RRCAT, IPR, and ECIL have contributed significantly.**

1. At RRCAT, Undulator based X-ray Magnetic Circular Dichroism (XMCD) Beamline (BL-20) has been commissioned in Feb. 2023 at Indus-2. This is the first beamline of its kind in the country.
2. Low Energy High Intensity Proton Accelerator (LEHIPA) has been operated successfully at BARC to demonstrate acceleration to rated energy of 20 MeV on 04th August 2023. Presently, beam intensity of around 2mA has been achieved. Majority of sub-systems of LEHIPA have been designed indigenously and manufactured by Indian industry.
3. For the first time, irradiation of target material has been carried out at a temperature of 400 deg C and 500 deg C, using in-situ 7 MeV proton beam from the cyclotron at VECC.
4. Two major facilities at IPR Gandhinagar - Neutron & Ion Irradiation Facility and the Experimental Helium Cooling Loop have been inaugurated in March 23.
5. IPR has set up a dedicated state-of-the-art test facility, ITER-India Gyrotron Test Facility, for demonstration of 1 MW RF Power at 170 GHz for 1000 sec with an RF efficiency of 50%. Such a facility, the only one of its kind in India, fulfils the requirements of ITER testing.
6. The indigenously developed cyber security solution by BARC Secure Network Access System, has been deployed successfully in prestigious organizations like Indian Space Research Organisation, Defence Research & Development

Organisation and Ministry of Home Affairs. The technology is now available for transfer.

7. The X-Band RF Seeker, developed jointly by BARC, ECIL and DRDO, enhances the efficiency of precision strike missiles. After captive flights and trials, the missile with the indigenous Seeker was successfully tested from sea platform in Apr 2023.

**We continue to prioritise our basic and directed research and our scientists are delivering on several front-end research areas. Few achievements are as follows**

1. Apart from the regular detection of gamma-ray signals from the standard candle Crab Nebula and other potential sources, MACE (Major Atmospheric Cherenkov Experiment) telescope has detected very high energy photons from the radio galaxy NGC 1275 during its recent historical giant gamma-ray flares happened during December 2022 - January 2023. This is the first ever result from the MACE telescope which is well recognized and cited by the international community.
2. The SMARTEX-C experiment in IPR, involving confinement of non-neutral plasmas in toroidal geometry, has reported the highest confinement time of pure electron plasma ever reported in the world exceeding 100 seconds. This is more than an order of magnitude higher than that reported in other countries. Non-neutral plasmas are useful as a test-bed for many open issues in fundamental physics like compressible fluid-dynamics.
3. CEBS has created gold nanoparticles that can effectively deliver therapeutic molecules from medicinal herbs such as Ashwagandha, Brahmi, and garlic to cancer cells. These nanoparticles were found to be more effective than the extract of each herb.



4. As part of a project sanctioned by Office of the Principal Scientific Advisor to the Government of India, a new Ni-base super-alloy for use in boilers operating at high temperatures has been indigenously manufactured through a multi-organisation collaborative effort involving IGCAR, MIDHANI and NFC. The optimised manufacturing process has resulted in high quality billets that meet relevant codes, and will be used for manufacture of seamless tubes at NFC.
5. For the first time, data from an Indian telescope, the upgraded GMRT of NCRA-TIFR has been used for probing low-frequency gravitational waves, an astrophysically rich window in the gravitational wave spectrum.

**Today, the whole country is thrilled with the success of Chandrayan III. DAE shares this joy and is proud to have contributed towards successful space missions of our country.**

1. For the Chandrayaan Mission, ECIL has supplied the 32-meter-Deep Space Network antenna built indigenously in association with BARC and ISTRAC. The antennae facilitated the vital communication support for Chandrayaan mission.
2. The URSC ISRO utilized TIFR balloons with special shapes for testing of the reflector deployment mechanism for the Chandrayaan-3 Lander and Rover mechanisms.
3. For the *Aditya mission*, the indigenous 18-meter antenna set up by ECIL in association with BARC and ISRO at Bylalu village, near Bengaluru plays a significant role in the communication system of Aditya mission.

**Our Human Resource Development institutes are going ahead with capacity building to deliver trained manpower for all radiation applications and nuclear or radiological contingency in public domain in the country.**

1. Based on high-quality publications in Journals, the Nature Index published in May 2023 has placed HBNI in the **first position** with regard to publications in physical sciences and the **third position** among all institutions in India.
2. HBNI is running an Online Course on “Disaster Management - Challenges in Chemical, Biological, Radiological & Nuclear Emergencies”, which is being attended by students from India and abroad.

**As we all know, nuclear energy suffers from a perception bias and it is not only important to find technological solutions but also important to create awareness and build a positive opinion for the use of nuclear energy. Towards this, DAE has taken up various outreach programmes and is implementing the same in mission mode.**

1. “Anu Awareness Yatra - 2023” with the theme of ‘ATOMS IN THE SERVICE OF THE NATION’ is being organized by IGCAR, Kalpakkam in association with the National Council of Science Museum (NCSM), Ministry of Culture, Government of India, VigyanBharathi – Arivial Sangam, Tamil Nadu and Indian Association for Radiation Protection. This awareness program was organized in nodal institutions in 7 districts of Tamil Nadu & 3 districts of Kerala.

***To create an enabling environment towards effective functioning of all our units, DCSEM, DPS and GSO have not only continued to support, facilitate and augment the department’s infrastructure but have also efficiently managed real estate and maintained the landscape and biodiversity in all the DAE campuses.***

***While our professional scientists, technologists and engineers continue their effort to deliver their best, the families of our colleagues have also been making us proud.***

1. This year, more than 15 students have qualified in IIT-JEE Advanced Exam from our schools under AEES.
2. There are individual achievements as well, like – Kumari Venyashree from AECS Mysore winning in 35 kg category at Gautam Buddha International open Karate Championship in 2023.
3. In July 2023, the Indian delegations of students won 10 Gold, 7 Silver and 2 Bronze medals across four International Olympiads (Biology, Mathematics, Physics and Chemistry) which were hosted by different countries. All 19 students who represented India in the International Olympiads returned with medals. India topped the medals tally at the 34<sup>th</sup> International Biology Olympiad of 2023, by virtue of every student winning a gold medal.
4. Two former faculty members of TIFR Prof. Deepak Dhar, Department of Theoretical Physics and Prof. R. Sujatha, School of Mathematics, have been awarded the Padma Bhushan and Padma Shri awards, respectively, by the Government of India.
5. Prof. Basudeb Dasgupta of TIFR was awarded the Shanti Swarup Bhatnagar award for 2022 in the Physical Sciences Category.
6. Prof. Vidita Vaidya was awarded the Infosys Prize 2022 in Life Sciences for her work on understanding brain mechanisms for mood disorders such as anxiety and depression.
7. The Infosys Prize 2022 in Physical Sciences was awarded to Prof. Nissim Kanekar for his investigations of the build-up of galaxies and observational constraints on secular variation of fundamental physical constants.

**Dear Colleagues,**

The programmes of the Department are expanding and are progressing on the lines of our “Vision Program” that has been prepared for next 15 years. I urge all the DAE family members to work with dedication and make our Vision Programme a success.

At the end, I would like to thank all the members of our Scientific & Technical; Administration & Security; and last but not the least, health care professionals; who have worked hand in hand, by putting in all possible efforts, in making the program of the Department a success.

I once again extend my good wishes to all members of DAE and their families on this august occasion.

Thank you very much and Jai Hind.