

**Founder's Day 2014**  
**(Thursday, October 30, 2014)**  
**Address by**  
**Dr. Ratan Kumar Sinha**  
**Chairman, Atomic Energy Commission &**  
**Secretary to Government of India, Department of Atomic Energy**

Distinguished Invitees, Respected Seniors, Dear Colleagues, Representatives from the Media, Ladies and Gentlemen,

We have assembled here this morning to commence the day-long celebrations on the occasion of the 105<sup>th</sup> birth anniversary of Dr. Homi Jehangir Bhabha. We celebrate this day as our Founder's day. On this occasion, we take stock of our recent performance and achievements, and rededicate ourselves to realise the vision of our Founder by sustaining the required momentum and continuing the progress along the road map drawn by our Founder.

The year 2014 marked several landmarks for the Atomic Energy programme in our country.

The Department of Atomic Energy (DAE), established on August 3, 1954, has completed sixty years of service this year and we are into the Diamond Jubilee Year of our Department.

India's first reprocessing plant, 'Plutonium Plant' (PP), entered its Golden Jubilee year in 2014. The establishment of the Plutonium Plant was the first major step for the second stage of Indian nuclear power programme, involving plutonium-based fuel use in Fast Breeder Reactors.

The year 2014 also marks the 40<sup>th</sup> anniversary of the Peaceful Nuclear Experiment conducted at Pokharan on May 18, 1974.

At the beginning of this year, we also reached the milestone of the fortieth anniversary of the commissioning of the ISOMED plant, India's first gamma radiation processing plant for sterilisation of medical products. ISOMED handled in the last year over 60,000 cubic meters of medical products sterilisation.

During the last year two very high dignitaries visited BARC, Trombay

On 15<sup>th</sup> November 2013, Honourable President of India visited BARC for the Graduation Function of the 56<sup>th</sup> Batch of BARC Training School. The President remotely inaugurated five facilities and also dedicated to the nation the most popular crop mutant variety of Groundnut seed, called TAG-24, developed by BARC.

On 21<sup>st</sup> July 2014, Hon'ble Prime Minister of India visited BARC for obtaining a first-hand familiarisation with several aspects of our programmes. Hon'ble PM has given specific directions for enhancing public awareness of the important contributions of the DAE.

Let me, now cite some of our major achievements during the last year.

**Nuclear Power Corporation of India Ltd. (NPCIL)** achieved the highest generation ever 3533 crore units (35,333 Million Units) in 2013-14, with overall capacity factor of 83% and availability factor of 88%. Till date, NPCIL has logged over 405 reactor years of safe operation and this is reflected in several other operating achievements.

The Unit-5 of Rajasthan Atomic Power Station completed 765 days of continuous operation on September 6, 2014. This is the highest in the world in the last two decades, and the second highest in the entire 60-year history of nuclear power. Such performance is a singular testimony for the strength and maturity of the Indian Nuclear Power Programme.

The operation of RAPS-5 has also helped in avoiding 4.25 million tonnes of carbon-dioxide emission to the environment. Moreover, the sale of electricity produced by this plant over nearly four and half years of commercial operation has already met the cost of its construction. Madras Atomic Power Station Unit-2 (MAPS-2) achieved 370 days of continuous run on October 4, 2014, prior to being shut-down for planned maintenance. This is the 15<sup>th</sup> time one of our power reactors has recorded over one year of continuous operation.

The first unit of the Kudankulam Nuclear Power Plant was synchronised to the grid in October 2013. It reached its rated capacity of 1000 MWe on 7<sup>th</sup> June this year. The Unit has cumulatively generated 282.5 crore units (2825 MUs) of electricity. It was shutdown on September 26, 2014, to attend to inspection and subsequent maintenance activities on its steam turbine, and expected to be brought on line by the end of November 2014.

As a part of DAE's commitment towards implementing the highest standards of safety in the Indian nuclear power plants, DAE had invited the IAEA Operational Safety Review Team (OSART) for peer review of Rajasthan Atomic Power Station (RAPS) units - 3&4. A 'follow up mission' of OSART was conducted in this Plant during February 3 to 7, 2014. The OSART team assessed that in many cases the station has done much more than what was intended in the OSART observations.

In November 2013, India participated for the first time in the IAEA's largest nuclear and radiological emergency preparedness exercise called ConvEx-3. In this exercise 57 Member States and 10 international organisations had registered for participation. During the simulated exercise, a radiological emergency was triggered by a nuclear security event in an IAEA Member State. Following the alert, performance of the participating countries was assessed on the basis of their response, exchange of information, and capability to provide international assistance. At the end of the 25-hour exercise, the Indian performance, coordinated by the Crisis Management Group (CMG) Secretariat at DAE, was adjudged

“Excellent” under all the six categories of evaluation in the IAEA’s final performance evaluation sheet.

In the first week of this month, **AERB** and DAE held a preparatory meeting with the IAEA experts for the proposed review of our nuclear regulatory system under the IAEA’s Integrated Regulatory Review Services (IRRS). The IAEA IRRS mission is scheduled in the first quarter of 2015

Towards the completion of the construction of the 500 MWe **Prototype Fast Breeder Reactor (PFBR)** at Kalpakkam, erection of all critical, permanent in-core components has been completed. The reactor is now expected to achieve its first criticality by March 2015. The required fuel pins using mixed oxide of plutonium and uranium, manufactured at Tarapur by BARC, have been delivered.

Construction work on four 700 MWe indigenously developed PHWRs at Kakrapar (KAPP-3&4) and Rawathbhata (RAPP-7&8) has been progressing well. On January 13, 2014, the foundation stone was laid for the Gorakhpur Haryana Anu Vidyut Pariyojana in Haryana. The first phase of this Greenfield project will have an installed capacity of 2x700 MW PHWRs, (at an estimated cost of about Rs. 20,594 crore) and would be commissioned by the year 2020-21.

R&D endeavours on all aspects of **Thorium-related reactor technologies** and allied fuel cycle are continuing. The process of selection of a site for the construction of 300 MWe AHWR, as a technology demonstrator of Thorium utilisation, is in an advanced stage. In this context, I will like to add that the basic nuclear physics principles warrant that Thorium can be used only with added fissile material, such as, enriched Uranium-235, or Plutonium, or Uranium-233 (obtained by irradiation of Thorium). Considering the modest uranium resources in our country, our three stage nuclear power programme, therefore, provides for achieving sustainable energy independence by producing the required fissile material, plutonium or uranium-233 in our fast breeder reactor programme, prior to introducing Thorium on the required large scale .

**Atomic Minerals Directorate for Exploration and Research (AMD)** has established 2,11,473 tonnes of Uranium Oxide ( $U_3O_8$ ) resources in India. AMD has also progressively established resources of about 11.93 million tonnes of Monazite (source of Thorium), and about 33.71 million tonnes of Zircon (source of Zirconium) in our country.

UCIL has been continuously improving its production capacity.

The Jaduguda facility of UCIL bagged the prestigious Golden Peacock Global Award for Corporate Social Responsibility (CSR) for delivering tailored CSR projects for communities around its operational areas. This Award, founded by the Institute of Directors and one of the prestigious corporate recognitions in various fields, was given on January 17, 2014 in Bangalore.

Very recently, UCIL also bagged the maiden 'India Today PSUs Awards 2014' in recognition of its performance in two categories (out of seven possible): (i) Most Eco-Friendly PSU; (ii) Best in Corporate Social Responsibility and Sustainability. UCIL is the only PSU in this 'Other PSUs' type (*other types are: Maharatna; Navratna; Miniratna*) to bag awards in two categories. Earlier in 2013 UCIL's Turamdih mine had won the Silver Award of Greentech Foundation, New Delhi for 'Outstanding Achievement in Environment management'. The ISO 14001:2004 Environment Management System (EMS) certification of UCIL's Narwapahar Colony makes it one of the very few mining townships to have received such recognition. UCIL has also been getting the 'Overall Championship' award in the National All India Mines Rescue Competitions every year since 2010.

The performance of our fuel cycle facilities reached their highest levels last year. **Nuclear Fuel Complex (NFC)** achieved an increase of 18% of PHWR fuel production compared to the previous year. NFC has been increasing its production capacity by modernising its manufacturing facilities at its Hyderabad site, and to meet the expanding nuclear power programme needs, work has commenced for setting up a new fuel manufacturing facility at Kota.

NFC has, in addition, manufactured and supplied special materials for end use in Akash missile, Light Combat Aircraft and other Defence use, as well as materials to IGCAR for use in elevated temperature boilers of Advanced Ultra Super Critical Thermal Power Plants.

The heavy water plants continued to perform excellently and achieved the highest production with the lowest specific energy consumption. **Heavy Water Board** has also exported heavy water, including to developed countries like USA and France. Heavy Water Board has also expanded the range of their products and processes, as for example, they have made the Department self-sufficient in bulk solvents for Nuclear Fuel Cycle; developed comprehensive capability in production of Boron isotopes Boron-10 and Boron-11; and successfully test operated prototype closed electrolytic cell at Vadodara for production of nuclear grade Sodium metal.

**BARC's** crucial support to the nuclear fuel cycle programme continued with the reliable operation of reprocessing plants and waste management facilities at Trombay, Kalpakkam and Tarapur, at or above the name plate capacity, in the extraction of plutonium and depleted uranium, as well as in the conversion of the high level radioactive waste to vitrified glass. Director, BARC has already covered some very important developments in the nuclear waste management area, particularly, the successful separation of long life actinides, and recovery of cesium-137.

**Radiation detection equipment** supplied by **ECIL** has been installed at twelve major seaports for monitoring vehicles entering or leaving the port.

**Applications of nuclear and radiation technologies** in the area of food and agriculture, health-care, water, industry and environmental protection continue to expand, delivering wide-ranging benefits to the society.

During this year, two more Radiation Processing Plants - one at Unnao, UP, and the other at Bavla, Gujarat, built under MoU with **BRIT**, have been commissioned. With this, twelve radiation processing plants are under operation,

which are totally owned and operated by private entrepreneurs. More such plants are in different stages of planning and construction.

**BRIT** has been supplying various radionuclides for applications in medicine, industries, agriculture and research. The impact of BRIT supplies to various healthcare institutions is estimated to result in over 2.5 lakhs diagnostic imaging investigations, about 15,000 investigations using Positron Emission Tomography (PET), about 20000 therapeutic treatments, about 10 lakhs in-vitro diagnostic investigations. In its plant, BRIT has also carried out radiation hygienisation of over 4000 tonnes of spices and other food products. Analysis of nearly 9000 food product samples, for their radioactivity content certification, has also been done during the year.

The **Tata Memorial Centre (TMC)**, an autonomous institution under the Department of Atomic Energy, has been awarded the Accreditation for Protecting Research Participants, by the Association for the Accreditation of Human Research Protection Programmes (AAHRPP). The AAHRPP's endorsement places TMC among the world's most respected, trustworthy research organisations, since this accreditation confirms that the organisation follows rigorous standards for ethics, quality, and protections for human research.

**TMC**, in collaboration with BARC, has established techniques, using commercially available monoclonal antibodies, to deliver radioisotopes to specific sites for imaging and treatment of tumours. This approach has been found very effective in cases of Non-Hodgkin's Lymphoma by reducing the treatment period from 9 months to 1 month.

**TMC** will be establishing a National Hadron Beam Facility and Cancer Centre for Women and Children. The foundation stone for this Facility was laid in Mumbai on January 10, 2014. This facility will be the second such facility in Asia, after Japan. **TMC** will also set up the Homi Bhabha Cancer Hospital and Research Centre in Punjab under a new project launched on December 30, 2013.

High quality scientific research activities continue to be carried out in DAE Units and most of them invariably receive wide recognition in terms of publications, their citations, as well as awards.

The synchrotron radiation sources **Indus-1 and Indus-2 at RRCAT** have been operating in round the clock mode and are being used by an increasing number of researchers. Indus-2 reached yet another major milestone of operation at beam current exceeding 200 mA at 2.5 GeV energy. I am happy to note that the beam-line availability schedule for several months is displayed on the internet and users can make advance online bookings for beam time. A growing number of students, both Ph.D. and M.Tech., are also using these facilities.

A multi-purpose beam-line has been successfully set up at the Photon Factory Synchrotron Radiation Facility in Japan, under a DST-sponsored project with **Saha Institute of Nuclear Physics (SINP)** as the nodal centre for its implementation. Researchers from about 25 Indian institutes and universities have performed experiments in this facility.

A **new lectin class of radioprotector** was found to protect mice against supra-lethal doses of ionising radiation. A single injection of the plant lectin offered 100% protection to mice against whole body irradiation (12 Gy) induced death.

BARC's collaborative support to Indian Rare Earths Limited (IREL, Public Sector Company under DAE), has led to IREL developing **Rare Earth metal making processes** for Neodymium metal, using induction furnace, and a process for making Samarium metal, using reduction diffusion furnace.

I am pleased to note that three young scientists of BARC have been selected for the INSA Young Scientist Award this year, a first time record of three scientists from one Centre of DAE selected for the INSA honour.

**DAE Units** continued to register progress in **developing high technology** in many important areas, including nuclear fusion and accelerator related technologies.



Our future major projects on Accelerator Driven System and Spallation Neutron Source would require a large number of **superconducting Radio Frequency (RF) cavities** for the high intensity proton accelerators. RRCAT has set up an extensive infrastructure for fabrication and performance evaluation of such cavities. During the last year, in-house developed single-cell 650 MHz cavity, and a laser welded 1.3 GHz cavity, have shown excellent performance. Further, commissioning of a Vertical Test Stand for the performance characterisation of such cavities has made us more self-reliant.

The SST-1 tokamak of Institute of Plasma Research, an important facility for research in fusion technology, has been commissioned and plasma operations have started. Operations at a Toroidal magnetic Field (TF) of 1.5 Tesla assisted by RF power input at 42 GHz have produced plasma currents of 75 kiloAmperes. The TF coils have been operated routinely for long durations (~20000 s) without interruption also at 2 Tesla.

Environment-friendly plasma technologies are developed at **IPR** for industrial applications, benefiting the society at large. Atmospheric pressure plasma technology is used for biomedical waste disposal. Low pressure plasma is used for incorporation of nitrogen in steels for enhancing surface properties. IPR has demonstrated these technologies and have put up industrial scale reactors.

In India's maiden Mars mission, Mangalyaan, DAE Units ECIL, BARC and RRCAT have made specific contributions. ECIL and BARC provided the 32 meter Indian Deep Space Network (IDSN) antenna that is tracking the Mars Orbiter Mission. The antenna will continue to play an important role in receiving data and photographs from the Mars Orbiter. The high resolution vacuum ultra violet beam-line, set up by BARC at Indus-1 synchrotron radiation source at RRCAT, Indore, was used for calibrating the Lyman Alpha Photometer (meant for measurement of Deuterium to Hydrogen abundance ratio) placed on-board the Mangalyaan

For the May 2014 Lok Sabha elections about 8.5 lakhs Electronic Voting Machines (EVMs) have been supplied by ECIL to Election Commission. This constitutes about 50% of all the EVMs used in the elections.

In the area of **Public Outreach**, we have taken several steps. This year, NPCIL received National Awards for 'Best Communication Campaign (External Public) Animated Films and Comic Series' on "Budhiya" and for 'Best House Journal (English)' "NuPower, an International Journal on Nuclear Power".

DAE Units have been hosting a large number of visitors and also holding lectures and exhibitions in the vicinity of their sites and other places.

For example, NPCIL hosted over 53600 visitors to its plants, with nearly 50% of them received at Kudankulam Nuclear Power Plant (KKNPP) alone. In addition, about 7.13 lakhs printed materials containing information for public awareness were distributed. NPCIL had also briefed 330 Journalists. BARC hosted 2100 students and Faculty from 30 Colleges from different parts of India. BARC also organised events and exhibitions in 35 sites involving nearly 1.5 lakhs visitors and participants.

Dear colleagues, in our history of six decades we have overcome numerous challenges coming in the path of growth of our programme. Each such challenge has given us a greater resolve and determination to work even harder to overcome the hurdles. I am sure that with the contributions from every member of the DAE family and our collaborators, we will carry forward our programme with sustained enthusiasm and vigour in the years to come. Let us remember that each milestone reached in our march to further progress is, in fact, our tribute to our founder Dr. Homi Jehangir Bhabha and the other pioneers of our Department.

Thank you,  
Jai Hind.