Founder's Day – 2013

(Wednesday, October 30, 2013)

Address by

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Chairman, Atomic Energy Commission &

Secretary to Government of India, Department of Atomic Energy

Distinguished Seniors, dear Colleagues, Ladies and Gentlemen,

We have assembled here this morning to launch the day long celebrations on the occasion of the 104th birth anniversary of Dr. Homi Jehangir Bhabha. As a part of the longstanding tradition, we start this day by paying homage to our dear Founder by recounting some of our recent achievements that symbolise the fruits of the tree that was planted by this great visionary more than six decades ago.

Among the many remarkable goals realised during the last one year, I would like to begin with the latest one. Kudankulam Nuclear Power Plant Unit-1 achieved its first criticality on 13th July 2013, and after completing all necessary commissioning tests, was test synchronised to the grid, for the first time on 22nd October 2013 at 02.45 hrs at 160 MW power level. The second test synchronisation was carried out at 21.43 hrs. on the 25th October. After operating at 234 MWe till this morning the electricity generation has been suspended for planned cleaning of strainers. After a few more tests, and planned maintenance activities, and step-wise regulatory clearances, the power level will be progressively raised. Commercial operations of this unit are expected to start in December 2013. The construction and commissioning of this unit, which is the largest capacity electricity generation unit in the country today, is a major milestone on the path of accelerated growth of nuclear power generation capacity in our country. The second unit is in an advanced stage of commissioning, and is expected to follow suit about six months later.

I am happy to inform you that nuclear power generation continues to grow due to the improvement in supply of uranium from domestic as well as international sources. The highest annual generation from nuclear power plants in our country was attained last year with the overall capacity factor of 80% and availability factor of 90%. Six of our reactors have logged continuous operation of more than 300 days during the year. In all, today, Nuclear Power Corporation of India Ltd. (NPCIL) is operating twenty nuclear power reactors at six different sites, with unblemished safety record.

On the safety of our operating nuclear power plants, I wish to inform you that the first IAEA Operational Safety Review Team (OSART) mission to India for Rajasthan Atomic Power Station (RAPS) units - 3&4, took place during October 29 to November 14, 2012. The OSART mission team reported a number of good safety practices and gave suggestions to further improve in some areas. As of today, NPCIL has registered over 385 reactor years of safe operation. The observations of OSART endorse the rich experience of NPCIL in operating its plants safely.

The construction of four indigenously designed 700 MWe PHWRs, two each at existing sites of Kakrapar in Gujarat and Rawatbhata in Rajasthan, is progressing on schedule. NPCIL is planning to progressively construct sixteen more PHWRs of 700 MWe at five different inland sites. Eight of these PHWRs, two plants of 700 MW capacity each at four different sites, viz Gorakhpur Units -1&2 in Haryana, Chutka Units -1&2 in MP, Mahi Banswara Units - 1&2 in Rajasthan and Kaiga Units - 5&6 are proposed to be launched during the XII Plan.

As a technology demonstration plant of our second stage of nuclear power programme, the construction of the 500 MWe Prototype Fast Breeder Reactor (PFBR) is nearing completion at Kalpakkam. Erection of all permanent in-core components has been completed. The construction and installation activities have reached over 95%. Filling of sodium in the secondary sodium loop is planned shortly and PFBR is expected to achieve first criticality in September 2014. It is also proposed to initiate activities towards the launch of construction of two units of Fast Breeder Reactors (FBR-1&2), during the XII five year plan.

For the third stage of our nuclear power programme, Advanced Heavy Water Reactor (AHWR), which would be a technology demonstration plant utilising thorium based fuel and with advanced safety features, is also proposed to be launched during the XII Plan.

Dear Friends,

Dr Bhabha laid the foundation of delivering technologies from indigenous Research programmes. His philosophy of Research, Development, Demonstration and Deployment have given us the strength to provide a vast range of key deliverables in all the aspects of use of nuclear energy, and develop indigenous technologies for becoming self-reliant in this field. These programmes have helped the development and growth of our industries and also several research and academic institutions to cater not only to the needs of our Department, but also to the requirements of the country at large.

It is a matter of great satisfaction that the world today recognises India as a country with advanced nuclear technology and is coming forward to collaborate in our nuclear power programme. Till date, Inter Governmental Agreements or Memorandum of Understanding for Civil Nuclear Co-operation have been signed with USA, France, Russia, Mongolia, Namibia, Argentina, United Kingdom, Canada, South Korea and Kazakhstan. In addition, an old agreement has been revalidated with Czech Republic. Discussions are going on with countries like Japan, Australia and other countries with potential for mutual benefit with cooperation. The discussions of NPCIL with foreign nuclear power plant suppliers, like Areva of France and Westinghouse and General Electric Hitachi of USA, are in an advanced stage. Recently, NPCIL signed a “Pre-Early-Works Agreement” or “Preliminary Contract” with Westinghouse Electric Company (WEC), USA comprising three packages, i.e. (i) Preliminary Safety Analysis Report; (ii) Compatibility of plant design with Atomic Energy Regulatory Board (AERB) codes / guides and safety approach; and (iii) Radiological design development.

Light Water Reactors (LWRs), with international cooperation, each of capacity 1000 MW or more, at another four different sites, viz Kudankulam in Tamil Nadu (KK-3&4); Jaitapur in Maharashtra (JNPP-1&2); Kovvada Unit-1&2 in Andhra Pradesh; and Mithi Virdi Unit-1&2 in Gujarat, are planned to be launched during the XII Plan.

In the area of Uranium exploration, the Atomic Minerals Directorate for Exploration and Research (AMD) of our Department has continued its rigorous efforts in the exploration of Uranium in the country. As a result of using advanced techniques, we have been able to identify new resources of Uranium. During the last year, our reserves have registered an increase of about 5%. AMD has established in-situ resource amounting to 7,324 tonne U_3O_8 during April to September 2013, and a total of 22,611 tonne in XII Plan period (till September, 2013). The country's in-situ uranium resources have now grown to 1,97,621 tonne U_3O_8 corresponding to 1,67,582 tonne Uranium. A major contribution comes from the Tummallapalle area, Andhra Pradesh followed by Singbhum Thrust Belt, Jharkhand, Mahadek, Meghalaya and Rohil, Rajasthan.

AMD has established Rare Metal and Rare Earth (RMRE) Recovery plants at Marlagalla, Mandya district, Karnataka for production of Columbitetantalite (Nb-Ta) and at Siri River, Jashpur district, Chhattisgarh for production of Xenotime (Yttrium, a Rare Earth Element).

Uranium Corporation of India Ltd. has commissioned a new underground mine and a processing plant in record time of five years, at Tummalapalle in Andhra Pradesh. The project for capacity expansion of Turamdih mine has been completed and the mine will be commissioned soon. Mohuldih underground mine in Jharkhand has also been commissioned. The overall supply of indigenous uranium has improved over time, and with the stabilisation of operations at Tummalapalle, the supply of uranium to the non-IAEA safeguarded reactors will improve, thereby leading to increase in their capacity factors, and in turn, improved generation.

The Indian Rare Earths Limited (IREL) is setting up a 10,000 ton per annum Monazite processing plant at Odisha Sands Complex, Chatrapur, Odisha (OSCOM). The plant is expected to be commissioned by January 2014. Capacity Expansion of Mining & Mineral Separation Plant of OSCOM (CEMMU), Odisha has been taken up. Separated High Pure Rare Earths plant has been set up at Rare Earths Division, Aluva, Kerala. Fifty percent of its 2250 tonnes per annum plant capacity has been commissioned. A part of the mixed rare earths chloride produced in the Plant will be processed by IREL's Rare Earths Division, Aluva, Kerala, by using the existing facilities there for producing separated high purity rare earth oxides. Increase in mineral production capacity from existing level of 6.08 lakh tonne per annum (tpa) to 8.70 lakh tpa will be achieved after expansion of capacities of mineral separation units at Odisha Sand Complex (OSCOM), Odisha and Manavalakurichi, Tamilnadu.

As regards the production of PHWR fuel, in the year 2012-13, Nuclear Fuel Complex (NFC) has recorded the highest ever production with a total production of 812 Metric Tonnes (MT), which is an increase of 8% over the previous year. NFC has also developed extrusion process for Inconel-718 and Inconel-690 super alloy tubes for use in steam generators of PWRs. This is of significant commercial importance because of worldwide application of this product.

The Power Reactor Fuel Reprocessing Plant – 2 (PREFRE-2), along with the Advanced Fuel Fabrication Facility (AFFF) at Tarapur have been producing and delivering fuel pins required for the PFBR.

In the field of reprocessing and waste management of Fast Reactor Fuel, a co-located Fast Reactor Fuel Cycle Facility (FRFCF), to reprocess and re-fabricate the fuel from PFBR, is being set up at Kalpakkam. Recently, Government has given Financial and Administrative sanction to this project. Necessary site infrastructure has already been created and preparations for launching this project have been taken up on priority.

Excellent performance has been recorded by our Heavy Water Plants during the last financial year. The plants have recorded the highest ever production of heavy water with lowest specific energy consumption. The Heavy Water Board (HWB) has executed five export orders for supply of heavy water worth more than USD 10 million to USA, France and South Korea. The Heavy Water Board has also bagged five more export orders, worth more than USD 15 million, for supply of heavy water to the U.S. and France. These orders will be executed before March 2014.

Heavy Water Board is also engaged in the development and delivery of critical solvent and raw materials for our second stage nuclear power programme. The production of solvents has also exceeded the targeted annual production. These solvents are used in reprocessing and waste management. The production units under the Board have consolidated technology for production of elemental Boron, and have operated the plant at more than 100% of its capacity. Enrichment of oxygen to an extent of 95.5% Oxygen-18 (O^{18}) has been achieved in a pilot column. Oxygen-18 is a target isotope for production of fluorinating for medical applications. An industrial scale plant to produce O^{18} is now planned to be set up at HWP, Manuguru.

At our Indira Gandhi Centre for Atomic Research (IGCAR), the Fast Breeder Test Reactor (FBTR) has continued to operate smoothly, providing valuable operating experience as well as technical inputs to India's fast reactor programme. Post-irradiation examination of the test fuel subassembly for the Prototype Fast Breeder Reactor (PFBR), which was irradiated in

FBTR, has provided valuable data and generated confidence in the design and manufacture of the FBR fuel. The direct determination of solidus-liquidus temperatures of MARK-I carbide fuel by a novel spot technique has been accomplished for the first time. Irradiation of indigenously fabricated sodium bonded metallic fuel pins and studies to understand the irradiation behaviour of the sphere-pac MOX fuel pin including segregation have also been initiated.

Steady State Superconducting Tokamak (SST-1) at the Institute for Plasma Research (IPR) has been successfully commissioned with the attainment of the first plasma in this facility on June 20, 2013. With this achievement, India now joins the select group of countries, where research in `Superconducting Tokamak' is currently being carried out.

Our programmes and activities relating to the development of Fusion reactor technology had been the driver for India joining the largest scientific collaboration project International Thermonuclear Experimental Reactor (ITER) project being built in France. This project aims at harnessing the energy in atoms by the same atomic reaction 'fusion' as taking place in the Sun. ITER uses the Deuterium-Tritium (DT) fusion reaction to demonstrate that controlled fusion reaction can be sustained for long enough duration. The Cryostat is the 2nd confinement barrier of the ITER machine which holds the vacuum vessel, the superconducting coils and many other sub-systems. It is roughly 28m in diameter and 28m tall. Once built, this will be the biggest vacuum vessel in the world meeting relevant nuclear safety standards. The

Indian partner in the ITER Project viz. ITER-India, hosted by the Institute of Plasma Research (IPR), an autonomous institution under DAE, has been given full responsibility for the design, development and supply of this major system of the ITER. Very recently, contract for manufacture of this very high technology equipment has been awarded to a major Indian industrial house following a globally competitive bidding process. This demonstrates the prowess of Indian industries for undertaking such complex manufacturing work. The work for manufacturing cryostat has already started.

As part of the efforts towards indigenous development of newer high performance structural materials, development of India specific reduced activation ferritic-martenistic (INRAFM) steel for test blanket module of ITER has been completed at IGCAR. This is an IPR, IGCAR and Industry collaboration work.

An important milestone of Indus-2 synchrotron radiation source at Raja Ramanna Centre for Advanced Technology (RRCAT), Indore was reached on January 24, 2013 with the operation of Indus-2 at 158 mA current at design energy of 2.5 GeV. Indus-2 is being operated regularly in three shifts at a beam current up to 150 mA at 2.5 GeV energy.

At RRCAT, ten beamlines on Indus-2 and five beamlines on Indus-1 are operational, and the same are available to researchers from all over the country, besides a large number of M.Tech. and PhD students at RRCAT.

Since January 2012, 95 publications have appeared in peer-reviewed International Journals based on the work done using these beamlines.

RRCAT has indigenously developed unique Solid State RF amplifiers. During the last one year, the output power of solid state RF amplifiers has been enhanced to 200 kW. This has eliminated our dependence on imported klystrons. Indus-2 is now regularly operated with the support of these solid state RF amplifiers.

As a part of R&D support to the NPCIL by BARC, the improved Mak-2 (MK-2) Weld Inspection Manipulator (WIM-2) was successfully deployed in the Tarapur Atomic Power Station Unit-2 (TAPS-2) during the current 23rd refueling outage of TAPS-2. TAPS-2 Reactor Pressure Vessel was inspected using this manipulator with Ultrasonic Inspection technique. Technical support was also provided to NPCIL, to find the root cause of the failure of some components of Double check valves of Emergency Core Cooling System (ECCS) of Kudankulam Nuclear Power Plant (KKNPP) and working out solutions. Modified design of valve with indigenously designed components has been fully qualified and installed in the reactor.

An indigenously designed and developed Radio Frequency Quadrupole (RFQ) has been commissioned at BARC. This is a significant milestone in the Indian road-map for Accelerator Driven System (ADS). A proton beam was successfully accelerated to 200 keV through this RFQ, with a transmission of 70%, with the results being in excellent agreement with the design values.

Towards the development of ADS, a subcritical neutron multiplying assembly driven by an indigenously developed Purnima deuteron accelerator has been successfully commissioned at BARC. The measured multiplying factor (Keff) is consistent with the predicted value of 0.89. This experimental facility at Purnima building, BARC, uses natural uranium metal as fuel, polythene as moderator and beryllium oxide as reflector. This is the first step towards implementing experimental research leading to Accelerator Driven System (ADS). The Neutron Generator and its Alignment System was designed, manufactured and installed by Centre for Design and Manufacture (CDM), BARC.

In high energy physics, strong international collaborations involving TIFR scientists culminated in the installation of the outer hadron calorimeter at the Large Hadron Collider (LHC) in CERN, Geneva. Fabrication of Resistive Plate Chambers (RPCs), an essential part of the detectors for the India-based Neutrino Observatory (INO), has begun.

Non-power applications of nuclear and radiation technologies in the area of health-care, water, industry and environmental protection are extremely important contributions to the welfare of our society.

BARC is developing technologies for high temperature reactors and hydrogen production processes. The current R&D activities target technologies for high temperature nuclear reactors, capable of supplying process heat at 1000 °C, and high efficiency hydrogen production processes such as thermo-chemical processes and high temperature steam electrolysis. In addition, BARC is also developing hydrogen storage materials as well as fuel cells for applications in transport and power generation sectors. As a contribution to IAEA activities related to nuclear hydrogen production, a software tool called HEEP, which stands for Hydrogen Economic Evaluation Programme, has been developed in India for the International Atomic Energy Agency (IAEA). This tool is being used for economic analysis of nuclear hydrogen production so as to compare various options.

The Board of Radiation and Isotope Technology (BRIT), apart from operating two Radiation processing plants, has helped in the design, construction and operation of nine radiation processing plants in the private sector. Six such plants are under construction and MoUs have been signed with another eight private entrepreneurs. These plants are processing disposable medical items for sterilisation and hygienisation of spices, pet feed and ayurvedic and herbal products for preservation. This year, BRIT executed the single largest order for supply of Cobalt-60 (Co-60) isotope by installing about 900 kCi worth of Co-60 pencils in a plant for sterilisation of medical products near Satara, Maharashtra.

BRIT indigenously developed an extraction tool and successfully completed transfer of Co-60 sources from an old gamma chamber flask at Kandy, Sri Lanka for repatriation purpose.

In the area of health care, Tata Memorial Centre (TMC) has been carrying out research to evolve cost-effective treatment for common cancers in India. The first such example is the low cost screening modality by visual inspection of cervix using acetic acid (VIA). Trials of the innovative low cost approach carried out in TMC have shown a potential for 31% reduction in mortality arising out of cervical cancer in women. This technology and the procedure of training trainers have been shared with the Ministry of Health & Family Welfare for nation-wide implementation. It is anticipated that once implemented, it could save over 22,000 lives of women in India every year and more than 75,000 lives globally. Another important development carried out by TMC has led to a modality of a low cost injection given prior to surgery of breast cancer. This could reduce fatalities arising out of metastases by 28 percent.

BARC has developed an indigenous technology based Digital Radiotherapy Simulator (DRS) “Imagin” as a vital supplement to the indigenous teletherapy system, Bhabhatron. One of the three DRS Units has been installed at Tata Memorial Centre (TMC). The technology of DRS has been transferred to a private industry for its wider deployment.

In September 2013, the Radiation Medicine Centre (RMC) of BARC, located alongside the Tata Memorial Hospital (TMH) in Mumbai completed 50 years of sustained service in the field of nuclear medicine. RMC-trained physicians and technologists are not only serving all over India, but in several other countries across the world.

The nuclear desalination plant at Kalpakkam, employing the technology of multi-stage flash evaporation, has been supplying high quality de-ionised water to cater to the requirements of the Madras Atomic Power Station.

As part of nuclear agriculture programme, 286 Quintals of Breeder Seed of Trombay Groundnut Varieties has been supplied in the year 2013. During 2013, a large seed Trombay Black Gram variety TU40 has been released. With this, total number of Trombay crop varieties released so far are 41.

Human resource development is another area where we have immensely benefited from the foresight of Dr. Bhabha. However, the challenges posed by the major expansion that we foresee in our programme, new technological areas that we need to work on and the external attractions necessitate new initiatives. Homi Bhabha National Institute (HBNI) continues to register large number of our scientists and engineers for the PhD programme.

The construction of Global Centre for Nuclear Energy Partnership (GCNEP) will start later this year, while off-campus activities are already taking place, involving organisation of different training programmes. A National Programme on Prevention and Response to Radiological Threats was organised from 26-30 August 2013 at GCNEP. During the current year, two other programmes one on Application of Radioisotopes (Food Irradiation) and the second one on Radiological safety were organised.

Dear Colleagues,

In the field of national security, a very important milestone was reached with the achievement of criticality, as well as power operation,. of the nuclear reactor of Arihant.

In the available short time, I have tried to highlight a few of the major achievements attained by the Department of Atomic Energy during the last one year. Today, we stand proud and tall in the international community, solely on the basis of strength acquired through self-reliance. In spite of the technology denial regimes, we have moved ahead and acquired a status of becoming one among the very few countries in the world with advanced nuclear capabilities. The DAE has a mandate to contribute to enhancing the quality of life of the Indian population by providing solutions that address energy security, food security, water security, health security and national security while, on the way, making immense contributions in the domains of industrial growth, scientific research and education. We have been fulfilling our commitments in each of these areas. While our achievements speak for themselves, the message of DAE's commitment and successes has to be communicated loud and clear to counter the propaganda and scare-mongering that is being indulged in by some groups ideologically opposed to nuclear energy, despite the unambiguous reports of all the expert groups, and the clear verdict of the Hon'ble Supreme Court of India. We have taken up this challenge, too, with the seriousness it deserves. To spread this message effectively, the DAE and its various units have launched public outreach programmes in a big way.

Our goal in the Public Outreach programme is to ensure that the Indian population, in all parts of the country, are not only convinced of the benefits flowing out of the activities of DAE, but also whole-heartedly support and facilitate these activities.

In the recent past, the different units of DAE have vastly enhanced their public outreach programmes with visible results. For example, during the last one year period, the NPCIL has organised various events and visits in which more than 7.2 lakh persons from different walks of life have been communicated the benefits of nuclear energy, through direct personal contact programmes, including 958 site visits and 48 exhibitions.

Dear Friends,

Way back in the early 1940s Dr. Homi Jehangir Bhabha, still in his early 30's had a vision of India taking a lead position in the field of atomic energy for the progress of our nation. At that time, with the backdrop of gross illiteracy, poverty and hunger affecting large populations in our country, such a thought could have sounded very strange, if not preposterous. Even so, the young Dr. Bhabha took it as his unwavering mission to systematically face the challenge and realise his vision through sheer grit and determination. History is witness to the fact that Dr. Homi Jehangir Bhabha did succeed. Year after year, while recalling the achievements of the great institution founded by him, we are witness to the fact that the spirit of Dr. Bhabha is still alive amongst us.

Thank you,

Jai Hind