GOVERNMENT OF INDIA
DEPARTMENT OF ATOMIC ENERGY
RAJYA SABHA
UNSTARRED QUESTION NO. 2084
TO BE ANSWERED ON 21.12.2023

Measures to promote nuclear education and research

2084 # Smt. Kanta Kardam:
Ms. Kavita Patidar:
Shri Neeraj Shekhar:

Will the PRIME MINISTER be pleased to state:

(a) the measures taken by Government to promote nuclear education and research in the country during the last five years;
(b) the progress made by the country in developing indigenous nuclear reactors and ensuring self sufficiency; and
(c) the manner in which Government is ensuring percolating of the benefits of the nuclear sector advancements to reach other fields like medicine, agriculture, etc.?

ANSWER

THE MINISTER OF STATE FOR PERSONNEL, PUBLIC GRIEVANCES & PENSIONS AND PRIME MINISTER'S OFFICE (DR. JITENDRA SINGH):

(a) Bhabha Atomic Research Centre (BARC) under Department of Atomic Energy (DAE) has been running its Training Schools for Training Young Engineers and Science Postgraduates through its OCES (Orientation Course for Engineering Graduates and Science Postgraduates) programme. Every year around 200 Engineering Graduates and Science Postgraduates are trained to become Nuclear Scientists. The coursework done by the Trainee Scientific Officers (TSOs) earns them credits towards an M.Tech degree done under the aegis of Homi Bhabha National Institute (HBNI).

The BARC Training Schools have DAE Graduate Fellowship Scheme (DGFS-M.Tech) wherein a few selected candidates are allowed to pursue M.Tech in a few designated institutes known for their academic excellence and are paid stipend by DAE. Additionally, their tuition fees is reimbursed by DAE. On

successful completion of M.Tech these candidates are absorbed in DAE. On absorption, these trainee officers undergo four-months course in Nuclear Science and Technology. In last 5 years around 1042 candidates have been selected and trained under these programmes.

DAE conducts doctoral programme [Ph.D/ Integrated Ph.D (Single and Dual Degree)] through HBNI. It has ten (10) Constituent Institutions (CIs) and one (1) Off-Campus-Centre (OCC).

Summer training in Physics and Chemistry is a prestigious flagship programme conducted by Indira Gandhi Centre for Atomic Research (IGCAR) every year since 1995, wherein pre-final Post Graduate Physics & Chemistry students are provided exposure to advanced theoretical & experimental areas. The young researchers are provided scholarship to pursue their research work as Junior Research Fellow (JRF) / Senior Research Fellow (SRF) at IGCAR to contribute to carry out research for their PhD in the areas of physical, chemical, engineering, and environmental and information science. 78 Research Scholars have been pursuing research at IGCAR as at present.

Advanced research on experimental and theoretical nuclear physics, high energy physics and material science are being perused at Variable Energy Cyclotron Centre (VECC).

(b) BARC is engaged in R&D activities related to nuclear reactors including advanced reactors for harnessing nuclear energy from available uranium & thorium resources to ensure self-sufficiency and for providing technical support to other DAE units towards development of new systems, inspection of equipment and systems, life-assessment and life-extension of components. Some of the major research & development areas include fuel, special materials, engineering components and systems, safety devices, reactor physics, thermal hydraulic and safety, remote handling devices and manipulators for these reactors and associated facilities. BARC has been carrying out Design, Development, Construction, Installation, Commissioning, Operation & Maintenance of Nuclear Research Reactors like Dhruva, Apsara-U & critical facility since its inception. The research reactors are built for

performing R&D related to materials including fuels and nuclear science & technology. The progress made in developing indigenous reactors are mentioned below :

i. BARC provided technological support for indigenisation of 220, 540 & 700 MWe Pressurised Heavy Water Reactors (PHWRs). The technological support was for designs & development, complying regulatory requirements, in-service inspection, Post-Irradiation Examination (PIE) and ageing management of nuclear power plants.

ii. Design and development for Isotope Production Reactor (IPR) is in progress for production of medical isotopes through Public Private Partnership (PPP).

iii. High Flux Research Reactor (HFRR) has been designed and developed and project taken up for installation and commissioning of the reactor at BARC Vizag.

India has achieved mastery in all aspect of Pressurised Heavy Water Reactor (PHWR) technology. Indigenous PHWRs have been evolved from unit size of 220 MW to 540 MW and 700 MW and reactors of all these sizes are in successful operation. The Indian industries have also matured and supplied components & equipment and executed works to the required exacting standards for these PHWRs.

IGCAR was established at Kalpakkam to conduct a broad-based multidisciplinary programme of scientific research and advanced engineering development, directed towards establishment of technology of Sodium Cooled Fast Breeder Reactors (FBR) and associated closed fuel cycle facilities in the Country. This focus on the second stage of Indian Atomic Energy Programme towards establishment of indigenously developed technology of Sodium Cooled Fast Breeder Reactors (FBR) and associated closed fuel cycle facilities has reached a reasonable level of maturity.

The design, construction, criticality of Fast Breeder Test Reactor (FBTR) in 1985 and its subsequent successful operation for the last 38 years, achieving the rated name plate capacity of 40 MWt, continued operation at maximum power level of 40 MWt have been important milestones in demonstrating the technological viability of fast spectrum reactors and the indigenous capabilities.

IGCAR has designed the first-of-its-kind 500 MWe Prototype Fast Breeder Reactor (PFBR), the manufacture of many of the components has been from indigenous sources.

IGCAR has commissioned a unique facility KAMINI (Kalpakkam Mini Reactor), a national facility for neutron radiography of critical components in the nuclear and strategic sectors, neutron shielding and neutron activation of materials. This facility is also utilized for conducting neutron beam experiments.

(c) Benefits of the nuclear sector advancement to reach fields like medicines, agriculture etc. for societal use is done through technology transfer and technology incubation through following mechanisms:

i. Technologies for transfer or incubation are advertised through BARC and respective R&D Units website & Board of Radiation & Isotope Technology (BRIT) website for commercialization on non-exclusive basis.

ii. Memorandum of Understanding (MoU) is signed with State Agricultural Universities for multiplication and distribution of BARC developed Breeder Seeds varieties.

iii. Cost effective radio-isotope pharmaceuticals are developed and supplied through BRIT after due approval to various hospitals for therapeutic and diagnostic application.

iv. BARC technologies for societal benefits are published through Kisan Mela, science exhibitions, workshops, seminars and outreach programmes for farmers and students.

As far as IGCAR is concerned, it has done work in Gamma Chamber Facility at IGCAR for irradiation of seeds and plants by various universities for research purposes, ^{89}Sr- a bone cancer palliative for irradiation of yttria in fast reactors, development of a variety of sensors, for carbon, hydrogen, NOx, Piezo electric etc. for applications in many industries, A-TIG welding procedure, Ultra Sensitive Flexi Range Pulsating Sensor based Conductivity Meter, Autonomous Gamma Dose Logger, Portable High Volume Air Sampler, and Replaceable Feed-through connectors for glove boxes.

As regards to VECC, technologies have been developed for societal applications like production of radiopharmaceuticals for cancer diagnostics, which are of direct relevance for the mankind. Radioisotopes/ radiopharmaceuticals for cancer diagnostics are regularly produced from the 30 MeV Medical cyclotron facility at VECC.

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