GOVERNMENT OF INDIA
DEPARTMENT OF ATOMIC ENERGY

LOK SABHA
UNSTARRED QUESTION NO – 497
ANSWERED ON 23/07/2025

APPLICATION OF ATOMIC ENERGY IN VARIOUS SECTORS

497. SHRI RAJEEV RAI

Will the PRIME MINISTER be pleased to state:-

(a) whether it is a fact the application of atomic energy has been considered beneficial to multiple sectors of our economy being cost-effective, if so, the details thereof;
(b) whether there has been an increase in agricultural production due to use of atomic energy in the field of agriculture; if so, the details thereof;
(c) the extent to which the atomic energy is being used in food conservation and whether any food conservation centre based on the use of atomic energy has been established in the State of Uttar Pradesh, if so, the details thereof; and
(d) whether the Government is considering to expand the use of atomic energy in agricultural production and food conservation in the country and if so, the details thereof?

ANSWER

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

(a) Yes, atomic energy has been considered beneficial in the sector of Agriculture, Food Preservation, Defence & Security, Healthcare, Water Treatment etc., besides meeting the energy demand of the nation. Major contributions of atomic energy in various fields are mentioned below:

Nuclear Agriculture:

Radiation induced mutagenesis and cross breeding have enabled development of 71 new crop varieties including rice, pulses, oilseeds, jute, sorghum, wheat etc. for commercial cultivation. These varieties developed by Bhabha Atomic Research Centre (BARC) a constituent Unit of Department of Atomic Energy (DAE) have attributes like high-yield, early maturity, biotic & abiotic stress-tolerant, climate

resilience etc. These varieties are being cultivated across the country, providing economic benefits to the farmer community.

The Board of Radiation and Isotope Technology (BRIT), an industrial unit of DAE produces and supplies Co-60 based sealed radiation sources for radiation processing of food and agricultural products.

Food Preservation:
Radiation processing has been effectively used to extend the shelf life of agricultural produce, fish and spices. The shelf-life extension of mangoes up to 35 days has enabled cost effective export of mangoes by sea route. The shelf-life extension of onion & potatoes up to 7.5 months and 8 months respectively reduces the spoilage and economically beneficial to the farmers. The radiation processing of various food items is also approved by Food Safety and Standards Authority of India (FSSAI).

Raja Ramanna Centre for Advanced Technology (RRCAT) a constituent Unit of DAE has also developed 10 MeV, 10 kW food irradiation linac useful for setting up food irradiation facilities within the country. Technology of the food irradiation linac is available to the Indian industries and institutes.

Sheetal Vahak Yantra - "SHIVAY" Technology" has been developed for transportation of fruits and vegetables under combination of controlled Temperature, Humidity and inert atmosphere to maintain freshness during transportation. The technology is patented at India and China. The technology uses liquid nitrogen for refrigeration source. Therefore, it is economic, 100% eco-friendly with no consumption of diesel or electricity for cooling. The technology has been transferred to M/s Tata Motors, Pune under incubation mode and to M/s Furmech, Indore for development of standalone liquid nitrogen based refrigerated containers.

"MATSYA" system, which is derived from "SHIVAY" technology is developed for transportation of fisheries. The system is installed on Sagar Harita, fishing vessel of Central Institute of Fisheries Technology (CIFT), Kochi for trials of storage of fresh catch of fish in controlled temperature, controlled humidity and inert atmosphere for freshness.

Defence & Security:

BARC has indigenously developed a spin-off technology of lightweight and cost effective Bhabha Kavach, a bullet-proof jacket qualified for threat level III+ [Bureau of Indian Standards (BIS) Level 5 protection], now in use by Border Security Force (BSF), Central Reserve Police Force (CRPF), Central Industrial Security Force (CISF), Indo-Tibetan Border Police (ITBP), and Indian Army. The technology has been successfully transferred to Indian companies for commercialisation. Indigenous Cargo Container Scanner system has been successfully designed, developed & demonstrated. This import substitute technology is available for field trials and subsequent deployment.

Healthcare:

In BARC Radio isotopes for health care are produced either through research reactors or separation of useful isotopes from processing of spent nuclear fuel. BARC has indigenously developed import substitute & cost-effective Ruthenium-106 (Ru-106) eye plaques for treatment of eye cancer. These plaques are produced from Ru-106 extracted from nuclear waste. Other useful radio-isotopes extracted from the nuclear waste is Strontium-90 (Sr-90) and Caesium-137 (Cs-137) for production of Yttrium-90 (Y-90) for cancer treatment and Cs glass pencil for blood irradiator. BARC also produces several radioisotopes like Iodine-125 (I-125), Iodine-131 (I-131), Lutetium-177 (Lu-177), and Samarium (Sm-153), for radio-pharmaceuticals and supplies to various hospitals through BRIT for cancer diagnostic and therapeutic applications.

Radio-isotope Production: The indigenous production of Strontium-89 (Sr-89) is an important societal need and a valuable import substitution; it is a pure beta emitter with a half-life of 50.5 days and used for palliative care of bone metastatic cancer. Production of Sr-89 with high specific activity at Fast Breeder Test Reactor (FBTR), Kalpakkam was successfully demonstrated. The product satisfied all the Quality Control Parameters as per the US, European and International Pharmacopeia. Bio-distribution study has been completed. This technology ensures increased availability and complete import substitution.

The radioisotopes produced at Medical Cyclotron Facility (MCF) are used for cancer diagnostics and therapy. The radioisotopes/radiopharmaceuticals, produced in collaboration with BRIT, are supplied to various hospitals/Nuclear Medicine Centres, on regular basis, which have reduced the cost of treatment of common man.

Linac for irradiation: RRCAT has indigenously developed 10 MeV industrial electron linacs, process technology and electron beam radiation processing facility for terminal sterilization of medical device. First of its kind facility in the country, this is operating in commercial mode at Indore with Atomic Energy Regulatory Board (AERB) and Food and Drug Administration (FDA) licenses and is regularly providing electron beam processing services for terminal sterilization of regulated medical devices. Since starting operations in year 2021, the facility has provided electron beam services for sterilization of more than 1 Crore medical devices for various medical devices industries.

BRIT remains the major producer and supplier of diagnostic and therapeutic radiopharmaceuticals for early diagnosis of diseases and for cancer treatment.

Water Treatment:
Another spin-off technology of radiation-grafted cotton cloth-based matrix has been developed for effective treatment of textile/ dye effluents for removal of dye. The filtered water can be re-used for industrial purposes. This innovation offers a low-cost, efficient solution for environmental protection. The technology is transferred to private entrepreneur for commercialisation.

Nuclear Power:
Nuclear Power Plants (NPPs) generated about 56681 Million Units (MUs) of clean electricity, contributing to about 3% of the total electricity generated in the country and saved about 49 Million Tons of CO_2(e) emissions into the environment. The average tariff of electricity from nuclear power plants during the year 2024-25 was Rs 3.83 per unit.

Other such significant contributions in various fields:
U-233 fuelled Kalpakkam Mini Reactor (KAMINI) is continuing its successful operation for neutron radiography of critical components for the nuclear and strategic sectors, neutron shielding and neutron activation of materials. This facility is also utilized for conducting neutron beam experiments. The pyro devices used in the space programme were routinely tested in KAMINI.

BRIT manufactures and supplies Iridium-192 (Ir-192) radiography exposure devices to industry and provides isotope application services to the petrochemical and other industries for troubleshooting the issues encountered.

(b) Yes, Nuclear radiation is used to develop improved crop varieties suitable for different agro-ecologies of the country. These varieties exhibit higher yield compared to existing check varieties. These varieties also have better nutritional quality or resistance to biotic and abiotic stresses. Farmers in several states have experienced enhanced crop productivity by cultivating these improved varieties which in turn is helpful for improving farm income. Crop losses due to soil borne diseases can be minimised by using gamma ray-induced Trichoderma mutant strain.

(c) The radiation technology for food preservation is being commercially used across the country. Today there are 28 food irradiation facilities operational in the country, out of which 22 are owned by the private players.

In Uttar Pradesh, a radiation facility, M/s. Solas Industries Private Limited, Kosi Kalan, Mathura is operational for food preservation since 2021. One more irradiation facility is under construction in Lucknow by M/s. Q-Line Health Care Private Limited.

BRIT helps Private/State Government Sectors in setting up gamma radiation processing facilities for food irradiation & medical devices sterilization by providing necessary technical inputs & supplying Co-60 sources. Till date, 39 such facilities have been commissioned in the country. Two such facilities have been commissioned in private sector in the state of Uttar Pradesh and they are providing radiation processing services on demand basis.

(d) Yes, DAE has been involved in the use of radiations and radioisotopes in agricultural production through continuous R&D programmes. These programmes are being conducted in collaboration with various Agricultural Universities in different states and research institutes of Indian Council of Agricultural Research (ICAR). Further, department has planned many more MoUs with existing and new state agricultural universities and other research organizations towards application of atomic energy in agriculture for societal benefit.

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