GOVERNMENT OF INDIA
DEPARTMENT OF ATOMIC ENERGY
RAJYA SABHA
UNSTARRED QUESTION NO.321
TO BE ANSWERED ON 04.02.2021

USE OF RADIATION TECHNOLOGY FOR SOCIETAL USES

321. SHRI SAMBHAJI CHHATRAPATI:

Will the PRIME MINISTER be pleased to state:

(a) whether Government is using radiation technology developed by nuclear scientists for societal uses in a big way;

(b) if so, the details thereof;

(c) whether Government has created a global cancer care network for the cure of cancer; and

(d) if so, the countries which have joined the network and the extent of interaction between them?

ANSWER

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

(a) Yes, Sir.

(b) Department of Atomic Energy (DAE) is having excellent infrastructure for advanced Research and Development with expertise covering the entire spectrum of usages of atomic energy. DAE is involved in peaceful usage of atomic energy in the field of agriculture since last four decades. Farmers are benefited through agricultural and preservation related research while municipal bodies and many private, government and corporate sectors are getting benefited through solid biodegradable waste research activities. Some of the technologies developed in these areas are:-

1. **Food, agriculture & solid waste management:**
    i. **Agriculture:**

    Using radiation induced mutagenesis along with cross breeding, Bhabha Atomic Research Centre (BARC) has developed 47 varieties in oilseeds (groundnut, mustard, soybean and sunflower), pulses (urdbean, mungbean, pigeon- pea and cowpea), rice and jute, which have been released and notified for commercial cultivation across the country. Some of the desirable traits in these crops include higher yield, seed size, improved agronomic and quality traits, early maturity and resistance to biotic and abiotic stresses.

Raja Ramanna Centre For Advanced Technology (RRCAT) has established an Agricultural Radiation Processing Facility (ARPF) at Devi Ahilya Bai Holkar Fruit and Vegetable Mandi, Indore for societal applications of electron beam processing. The heart of this facility is two 10 MeW energy, 5kW power linear accelerators, developed indigenously at RRCAT. FDA licence for radiation processing of Risk Class–A medical devices has been obtained in December 2020. The facility is available for providing electron beam processing services for sterilization of medical devices. This is the first 10MeV electron beam facility in the country licensed by AERB and FDA with ISO certifications for radiation processing of medical devices.

The facility is also available for providing irradiation services for mutation breeding of new crop varieties(pulses, wheat, rice, millet, etc.), improvement in functional properties of semiconductors switching devices, colour modification of gems, damage assessment of solar cells and other sensors for research in space applications.

ii. Food preservation:

Preservation of food forms another important area for National Food Security. Radiation processing of food is very effective in treating the agricultural products including flesh foods. Extension of shelf life of these produces is very much dependant on the produce, variety and storage conditions. For many fresh agro produce subjected to irradiation and proper storage, substantial shelf life extension has been achieved. A total of 20 commercial radiation processing plants have been established **(Annexure-1).** This includes two plants set up by Central Government, one each by Maharashtra and Gujarat Governments, based on the technology developed by BARC.

iii. Solid biodegradable waste management:

BARC has developed Nisargruna technology using biphasic biomethanation process which takes care of the biodegradable waste by converting it into two useful byproducts in the form of biogas and manure. Biogas is rich in methane contents and can be used for a community kitchen, hotel kitchen or it can be converted into electricity.

iv. Municipal waste Sludge Hygienisation:

BARC has set-up the first dry sludge Hygienisation Plant at Ahmedabad, Gujarat for an installed capacity of 110 ton/day dry sludge. This plant which is operational now would enable use of safe sludge for agricultural applications.

2. Health Care

i. Radioisotopes:

The Radiation Medicine Centre (RMC), Parel, Mumbai is in the forefront of practicing Nuclear Medicine for health care.

Nuclear Medicine uses radioactive isotopes (radio-isotopes) for the non-invasive diagnosis of several human diseases, including cardiology, oncology (cancer), neurology, psychiatry and infectious diseases and for the treatment of thyrotoxicosis, thyroid cancer, neuroendocrine tumours, neural crest tumours, bone-pain palliation etc. The benefit to the patient from an early and improved diagnosis and treatment far outweighs the risk from the radiation exposure due to the administered radiopharmaceutical. Ceasium-137,a prominent fission product, is deployed in blood irradiator devices in hospitals. Extraction of Stronium-90, another fission product, from waste has also been demonstrated on laboratory scale using indigenously developed novel extractants. Stronium-90 has been extracted and deployed for generation of Yttrium-90, which has use for radiotherapy in medical industry. Ruthenium-106 has also been extracted on laboratory scale which has potential for eye-cancer treatment. Recovery of all these radio-isotopes from waste is planned on an industrial scale, so as to make use of these waste constituents for different societal applications.

ii. Imaging:

PET-imaging has revolutionized cancer diagnosis by making possible early detection. Several thousand patients are referred to RMC each year and the average for the last three years is close to 25,000 per year. This includes PET-imaging for cancer diagnosis, staging, therapy planning and management. The cost to the patient is the lowest, compared to any other nuclear medicine centre in India. RMC has the largest registry in India for radio-isotope therapy for thyroid cancer and neuroendocrine tumours.

iii. Bhabhatron:

Bhabhatron is an indigenous tele-cobalt machine developed by BARC for cancer treatment with High Source Capacity of 250 RMM (Roentgen/min. at 1 meter). The design of machine is as per the compliance to requirements of International Electrotechnical Commission (IEC) and the extensive clinical trials at Tata Memorial Centre have been carried out successfully. Further, an automated multi-leaf collimator with treatment planning system has been developed and implemented in Bhabhatron-II.

(c) Yes, Sir.

(d) The National Cancer Grid (NCG) is working towards global cancer control by working with other Low and Middle Income Countries(LMICs) grappling with problems with their healthcare systems and infrastructure.

Based on requests from several LMICs, Secretary, DAE launched NCG ”Vishwam”, the global component of the NCG during the General Conference of the 2019 IAEA meeting in Vienna. Partner countries and organizations will be able to share the best practices from the NCG, and also benefit from some of its resources. The NCG Global Cancer Network partners with several countries across the world, working towards reducing the burden of cancer globally.

So far, the following countries have partnered with the NCG: Sri Lanka, Vietnam, Nepal, Afghanistan, United Arab Emirates, Myanmar, Bangladesh, Zambia, Kazakhstan, Russia, Ghana. The extent of engagement involves sharing of evidence- based treatment guidelines, education and training of oncologists and paramedical staff, participation in Virtual Tumor Boards, expert second opinion service and assistance with setting up cancer registries.

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Annexure-1

List of commercial plants in the country are listed below

S. No.	Name of the Plant	Purpose	Commissioning Year
1	Radiation Processing Plant, BRIT, Vashi, Navi Mumbai	Food and allied products	2000
2	*KRUSHAK Irradiator, Lasalgaon, Nashik, Maharashtra	Food Products	2002
3	M/S Organic Green Foods Ltd., Dankuni, Kolkata, West Bengal	Food, Packaging & Medical Products	2004
4	M/S A.V. Processors Pvt. Ltd., Ambernath (E), Thane, Maharashtra	Food & Medical Products	2005
5	M/S Universal Medicap Ltd., Vadodara, Gujarat	Food & Medical Products	2005
6	M/S. Microtrol, Bangalore, Karnataka	Food & Medical Products	2006
7	*M/S Agrosurg Irradiators, Vasai, Thane, Maharashtra	Food, Packaging & Medical Products	2008
8	M/S Gamma Agro Medical Processing, Hyderabad, Telangana	Food & Medical Products	2008
9	*M/S Jhunsons Chemicals Pvt Ltd., Bhiwadi, Rajasthan	Agro, Medical & Packaging Products	2010
10	M/S InnovaAgri Bio Park Ltd., Malur, Dist. Kolar, Karnataka	Food & Medical Products	2011
11	*M/S Hindustan Agro Co-Operative Ltd., Rahuri, Ahmednagar, Maharashtra	Onion & Other Agricultural Produces	2012
12	M/S Impartial Agro Tech (P) Ltd., Unnao, Lucknow, Uttar Pradesh	Food & Medical Products	2014
13	*M/S Gujarat Agro Industries Corpn. Ltd, Bavla, Ahmedabad, Gujarat	Food Products	2014
14	M/s Aligned Industries, Dharuhera, Rewari, Haryana	Food Products	2015
15	*Maharashtra State Agricultural Mktg. Board, Navi Mumbai, Maharashtra	Food Products	2015
16	Pinnacle Therapeutics Private Limited, Ahmedabad, Gujarat (Chilling duct)	Food & Medical Products	2018
17	Electromagnetic Industries, Vadodara, Gujarat	Food Products	2019
18	Avantee Mega food park, Devas, MP	Food Products	2019
19	Jamnadas Industries., Indore, Madhya Pradesh	Food & allied Products	2020
20	Microtrol Sterilization Services Pvt. Ltd., Bawal, Haryana	Food & allied Products	2020

*Facility for low dose irradiation (for mango, Onion, Potato etc.)