Government of India

DEPARTMENT OF ATOMIC ENERGY

Board of Radiation & Isotope Technology

BRIT-DAE Annual Report 2018-2019

Executive Summary

Board of Radiation & Isotope Technology (BRIT), the unit of DAE, is focussed on bringing the benefits of the use of radioisotope applications and radiation technology across industry, healthcare, research and agricultural sectors of the society. Harnessing the spin-offs from the mainstream programmes of DAE, such as R&D programmes at BARC and Nuclear Power plants for generating electricity by NPCIL, BRIT has independently created a separate visible area of contribution to the society.

A. Products

I. Healthcare Products

(a) Radiopharmaceuticals Production (RphP), Vashi

- **Regular production and supply of new ready-to- use radiopharmaceutical injections based on Ga-68 (PSMA-11 and DOTA-TATE) (PET radiopharmaceuticals), useful for the diagnosis of prostate cancer and neuroendocrine tumors (NET) has been started during the reported period of 2018-19. These supplies were possible after the facility for imported ^{68}Ge-^{68}Ga Generator was installed and validated for regular use at BRIT.**

- More than 617 Ci of I-131 products in ~23000 consignments have been supplied to various hospitals in the form of capsules and solution for both, diagnosis and treatment of thyroid disorders including the treating thyroid cancer. This data also includes I-131 radiolabelled mIBG which is being used for diagnosis and therapy of Neuro Endocrine Tumors (NET).

- **New therapeutic product based on I-131 radiolabelling, ^{131}I-Lipoidal injection for the treatment of Liver Cancer, was produced by RPhD, BARC and supplied by BRIT in the reported period.**

- Nearly 47 Ci in 490 consignments of theraputic products, other than I-131 based radioactive products, such as ^{153}Sm, ^{177}Lu and ^{32}P for bone pain palliation, were supplied to nuclear medicine hospitals upto March 2019.

- **Regular production and supply of new therapeutic radiopharmaceutical, ^{177}Lu-DOTA-TATE injection for the treatment of sstr positive neuroendocrine tumors, has been continued for treating NET successfully.**

- 2107 consignments containing approximately 515 Ci of ^{99}Mo in the form of Sodium Molybdate solution for Coltech Generators, Geltech Generators and Solvent Extraction Generator for obtaining Technetium-99m at hospital end, have been supplied to various hospitals in India in the Financial year 2018-19.
- More than 15600 consignments of Technetium-99m cold kits (19 Products; BRIT Code: TCK) for imaging various organs have been supplied to nuclear medicine centres in India. Production and regular supply of new products, ^{99m}Tc-cold kit for the preparation of ^{99m}Tc-Macro Aggregated Albumin (MAA) injection, useful for lung perfusion imaging and ^{99m}Tc-Ubiquicidine (Tc-UBI), used for infection imaging, which started last year, continued, during the reported time.
- **Production of 'Kit for the preparation of ^{99m}Tc-HYNIC-TATE injection', useful for imaging neuroendocrine tumors, started as a part of technology transfer from RPhD, BARC.**

- **Various Tc-99 cold kits were exported to Molecular Supplies SpA, Santiago, Chile. These include kits for the preparation of ^{99m}Tc-Radiopharmaceuticals, such as kits for preparation of ECD injection, EC injection, HSA-Nanocolloid for sentinal node imaging, and Q-Tech kits.**

- A total of 1278 consignments of Radioimmunoassay (RIA) and Immunoradiometric Assay (IRMA) kits were supplied to various pathology laboratories and nuclear medicine centres throughout the country for *in-vitro* diagnosis of thyroid disorders.

(b) Quality Control Analysis & Quality Assurance of Radiopharmaceuticals (Allied Services to RPhP):

- Around 600 batches of radiopharmaceutical samples (which includes TCK kits, ready-to-use radiopharmaceuticals injections and oral solution and capsules) and 48 batches of ^{99}Mo-^{99m}Tc COLTECH Generators were routinely analysed and certified by QC during this period.

- Regular Quality Assurance was performed before the batch release of all the radiopharmaceuticals which were supplied during the reported period. Batch release certificates were issued for a total of 482 batches of TCK cold kits, ready-to-use radiopharmaceuticals injections, oral radiopharmaceuticals. This also includes recently launched radiopharmaceuticals based on Lu-177, Ga-68 and ^{99}Mo-^{99m}Tc COLTECH Generators.

(c) Labelled Compounds (LC)

- This Section of BRIT continued the synthesis and supply of a variety of ^{14}C, ^{3}H and ^{35}S-labelled products and various types of Tritium-filled self luminous sources (TFS). It is also involved in the production and supply of C-14 Urea Capsules. The 'Urea Breath Test' using these capsules is useful in the diagnosis of the infections caused by microorganisms named, Helicobacter pylori, a spiral bacterium, which may be responsible for gastritis, gastric ulcer, and peptic ulcer disease. During the Year 2018-19, more than 14100 TFS sources of various sizes, shapes and tritium content were supplied to defence establishments and used for illumination of various types of gadgets and instruments. Supply of 150 Ci of Tritiated water was supplied to M/s ONGC.

- Based on MoU between BRIT and Heavy Water Board, deuterated NMR solvents were dispensed and supplied to various customers. All the solvents supplied had >99.8% Deuterium abundance.

(d) Medical Cyclotron Facility (MCF)

- The Medical Cyclotron Facility (MCF) of BRIT continued the synthesis and supply of Positron Emitting Tomography (PET) radiotracers, the maximum being [F-18]-FDG. Other PET radiopharmaceuticals include [F-18]-NaF, [18F]-FLT, and [F-18]-FET, which are produced in smaller scales. So far ~300 Ci of [F-18] FDG in 476 consignments have been supplied to various hospitals in Mumbai for PET imaging upto December 2018. More than 15000 patients are benefitted with PET investigations in the reported year 2018-19.

(e) RCR's of BRIT

- Production of Fluorine-18 isotope for the preparation of Fluorodeoxyglucose (FDG) was carried out successfully using Medical Cyclotron, **CYCLONE-30**, at Radiopharmaceutical Facility of **Regional Centre (Kolkata) of BRIT** located at Variable Energy Cyclotron Centre (VECC).

II. Engineering Products

(a) Sealed Radiation Sources

- Twenty teletherapy sources (CTS) of ^{60}Co containing activity in the range of 153 and 232 RMM were supplied to different cancer hospitals in India and abroad during 2018-19.

- **Co-60 teletherapy source of 1MCi was exported to REVISS Services (UK) Ltd. in July 2018. This is the biggest export order executed in the history of BRIT.**

- **Three CTS sources were exported to Sri Lanka and one source exported to IMO, International Health Systems Ltd., Nigeria.**

- Co-60 source with total activity of 55,560 Ci in forty two source pencils were loaded in four units of Gamma Chamber 5000 (GC-5000).

- Seventy two W-91 Irradiator sources of industrial grade & 163 BC-188 Irradiator sources with 3842 kCi activity in 16 consignments were supplied to 14 radiation processing plants within the country during the year 2018-19.

- A total of 646 consignments (with total activity of 24,597 Ci) of ^{192}Ir & ^{60}Co Radiography sources were supplied to NDT user's during the year 2018-19.

- 750 consignments of Co-60 Custom Made Reference (CMR) sources with total activity of 1.38 Ci were supplied to various users upto March 2019.

- Dose mapping of Gamma Chamber - 5000 unit was done with Cs-137 source.

(b) Radiation Equipments

- 47 numbers of Radiography Cameras, ROLI-2 model, were supplied to various NDT users within India and services were provided for 500 numbers of BRIT and imported radiography cameras.

- Four Blood Irradiators – 2000 (BI-2000) units with 15 kCi of Cs-137 source in 24 pencils were supplied to hospitals in India during the year. Replenishment of source to ACTREC was made.

- Gamma Chamber–5000 units with 27,959 Ci have been supplied to IIT, Roorkee, India, and another one was exported to Vietnam for research purposes during 2018-19. The services was provided by BRIT for 10 units of GC-5000. Also, services for decommissioning of five units was given to users.

B. Services Provided by BRIT

I. Consultancy and MoU for Radiation Processing Plant

BRIT signed **NINE** MoU's for setting up Gamma Radiation Processing Plants (GRPF) at various places within the country for disinfestations, shelf-life extension of food products and sterilization applications of healthcare products during the reported year 2018-19.

II. Gamma Radiation Processing Services (GRPS)

(a) Radiation Sterilization Plant for Medical Products (ISOMED)

- 2664 Cubic meters of medical supplies have been sterilized using gamma radiation processing at ISOMED, BRIT during 2018-19.

(b) Radiation Processing Plant (RPP), Vashi

- Radiation Processing Plant extended their services to irradiate about 4340 MT of spices and allied products during the reported time period.

- **Radiation Processing Plant Facility at Vashi was certified for ISO 9001:2015 (Upgraded from 9001:2008 to 9001:2015). Surveillance audits for ISO 22000:2005 (Food Safety Management Systems) and ISO 9001:2008 were also carried out by the certifying agency and found in full compliance with standard's requirement.**

- Plant commissioning dosimetry AMC of 'Dry Sludge Gamma Irradiator' was completed.

- Plant commissioning dosimetry for Class III and Class VI products of M/s Electromagnetic Industries was also completed during the reported period.

- Dose rate certification was provided to four blood irradiators and two gamma chambers which were supplied to various cancer hospitals and research universities respectively.

- Production & supply of ~2 Lakhs Ceric-Cerous Sulphate Dosimeters were done for various gamma irradiators in the country and abroad for the measurement of absorbed dose.

III. Radiation Physics Services

- Source loading pattern was designed for replenishment of Co-60 activity for ten Gamma Radiation Processing Irradiators provided by BRIT under MoU's.

- Shielding evaluations were done for the upgradation of the gamma processing plant belonging to M/s Agrosurg Irradiators (India) Pvt. Ltd. at Vasai, Maharahtra.

- Theoretical dose evaluations were carried out for the new Radiation Processing Plant belonging to M/s Electromagnetic Industries, Vadodra, Gujarat.

- Radiological Survellience was provided to various facilities of BRIT such as, Radiation Processing Plant (RPP) and Decayed Source Removal Facility (DSRF). Regular inspection

for safety systems, contamination checks & personnel monitoring are done followed by sending the Safety Status Reports to AERB by the Radiation Physics Group.

- Probabilistic Safety Assessment for RAPPCOF expansion was carried out during the reported period.

IV. Calibration Services for Portable Radiation Monitoring Instruments

- BRIT is providing calibration services for gamma radiation survey instruments. A total of 190 survey meters, dosimeters and portable area monitors are calibrated upto March 2019

V. Isotope Application Services (IAS)

- Isotope Application Services was provided for Gamma Column Scanning for seven different petroleum industries. Gamma scanning of Process columns and Identification of leaky heat exchangers using radiotracer techniques to trouble shoot different kinds of problems at various industries such as IOCL Mathura Refinery, BPCL, Kochi Refinery, thereby saving crores of rupees for the country.

- Radiotracer study was performed by BRIT for safe disposal of fly ash at NTPC, Talcher, during 2018-19.

VI. Radioanalytical Laboratory (RAL) Services:

- During the Calendar year 2018-19, Radioanalytical Laboratory (RAL) has carried out more than 6844 tests on export/domestic commodities and 910 tests on water samples for gross alpha, gross beta, ^{226}Ra, ^{228}Ra and total uranium content.

- Radioanalytical Laboratory offered services for the measurement and certification for the food items for humans & animal consumption for man-made (artificial) radioactivity, naturally occurring radioisotopes in environmental samples, such as coal, flyash, soil, rock phosphate, phosphor gypsum etc., Total uranium in water samples by assay using fluorimeter, Co-60 contamination levels in steel samples and surface radiation dose of steel consignments at factory premises and warehouses.

C. Customer Support:

- As the nodal agency for sales and supply, marketing and customer relations, co-ordination & logistics support cell continued to provide regular and uninterrupted supply of radioisotopes & allied products, radiation technology equipments to about 2000 user institutions in the healthcare, industrial, research and agricultural sectors.