

Annual Report 2008 - 2009
Board of Radiation and Isotope Technology

Executive Summary

CH 4 Radiation Technologies & Applications

During 2008-2009, more than 52,000 consignments of various isotope products and round the clock radiation processing services were provided to customers across the length and breadth of the country as well as some located abroad bringing in a sales turnover of over Rs. 4500 lakhs.

New Radiation Processing Plants in Private Sector



6th Radiation Processing Plant comes up in the Private Sector by Agrosurge Irradiators Pvt Ltd, Vasai

Two more Radiation Processing Plants were commissioned with the help of BRIT this year – one by M/s. Agrosurge Irradiators (India) Pvt. Ltd. at Vasai near Mumbai and the other by M/s. Gamma Agro Medical Processing Pvt. Ltd. at

Hyderabad. With this, now there are seven such plants fully in private sector

in the country. Apart from this, four plants are under various stages of construction. In addition, site clearance has been given by Atomic Energy Regulatory Board for seven more parties for such Plants in various parts of the country. Two more MOUs were also signed with private parties this year for setting up of such plants.



7th Radiation Processing Plant in the Private Sector by Gamma Agro Medical Processings Pvt Ltd, Hyderabad

Contract for Multipurpose Gamma Irradiator at Colombo, Sri Lanka



Agreement with Min. of Sc & Tech for 3 Mci Multipurpose Irradiator, Sri Lanka

An agreement has been signed between Ministry of Science & Technology, Sri Lanka and M/s. Symec Engineers (India) Pvt. Ltd., Mumbai for construction of a 3 MCi Multipurpose Gamma Irradiator Facility at Colombo, Sri Lanka. M/s. Symec Engineers (India) Pvt. Ltd., Mumbai had submitted a joint bid after taking a quotation from BRIT for 150 kCi of Co-60 source pencils and radiation related expert services. The

total contract is worth US\$1340,000 crores of which BRIT's part is US\$430,000.

Also the Atomic Energy Research Establishment, Bangladesh has placed an order for additional Co-60 source and associated works worth US\$244,869.

Health Care

16,500 consignments of ready to use radiopharmaceuticals of Iodine-131, Phosphorous-32, Chromium-51 and Samarium-153 were supplied to various Nuclear Medicine centers. Majority of these contained Iodine-131 radiopharmaceuticals, which amounted to about 550 Ci; 15000 consignments. 400 Ci of Mo-99 (TCM-2) was supplied for extraction of Tc-99m at hospitals. In addition to this various accessories of Tc-99m-Solvent extraction generator system and other products were supplied. About 52,000 Cold Kits for the formulation of Tc-99m radiopharmaceuticals (Code-TCK; 11 products) were supplied to various Nuclear Medicine centers worth Rs. 3.0 crore.

The ongoing work of monoclonal antibody (ch TNT 1/B) labeling with iodine-131, for M/S. Peregrine Pharmaceuticals Inc., USA is continuing. During 2008, labeled product worth US\$ 217,000 were made. In 2008, for the production and supply of ^{131}I -mIBG (therapeutic doses) was regularized.

About 10,000 kits of RIA and IRMA were supplied during the year to 300 immunoassay laboratories throughout the country.

Nuclear & Biotechnological Tools

At BRIT, a solid phase immunoradiometric assay (IRMA) Kit for the estimation of Ferritin in human serum based on magnetizable cellulose separation system, a quick, user-friendly assay system with ready to use reagents which can be carried out in laboratories with bare minimum facilities in remote and rural areas (without continuous power supply) has been developed.

Custom synthesis of several ^{14}C , ^3H and ^{35}S labeled compounds was carried out successfully. The supply of enzyme, Taq DNA polymerase prepared at JONAKI, Hyderabad was continued through Labeled Compound Laboratory and sales showed a steady increase during the year.

Nuclear Medicine: Cancer diagnostic & treatment services

19 teletherapy sources had already been sold upto December 2008 and it is expected that another 4 sources will be supplied to Cancer Hospitals in India fetching a sale value of Rs. 6 Crore by March 2009. 700 cm (3 Ci) ^{192}Ir -Pt wire has been supplied and 500 cm (2.5 Ci) is expected to be prepared and supplied to various hospitals and medical research centres for the treatment of cancer.



Radioisotope Sources

During April-December 2008, sealed radiation sources of total activity of about 500 kCi were fabricated, processed and supplied for use in various types of industrial applications. BRIT has entered into an MOU with BSF, Gwalior for supply of tritium filled sources for different type of equipment used by them. BRIT has also helped BSF, Gwalior

*MoU with BSF, Gwalior
for Supply of TFS Sources*

to set up a dedicated TFS Facility at their Tekanpur, Gwalior Complex.

Portable Radiography Exposure Device ROLI-III launched



BRIT has launched a 20Ci ¹⁹²Ir portable radiography exposure device which was developed indigenously. This will compliment 35 Ci mobile device already being manufactured and supplied by BRIT.



*Portable Radiography
Device Development*

Gamma Radiation Processing Services

ISOMED continued to offer prompt and efficient gamma sterilization services to large numbers of customers spread all over the country. About 5000 cubic meters of different types of products were processed between April 2008 and December 2008 generating a revenue of Rs. 207 lakhs. By March 2009, the plant is expected to process around 8300 cubic meters of medical products yielding a revenue of Rs.280 lakhs.

In KRUSHAK Plant at Lasalgaon, mango processing was carried out in Public Private Partnership mode during the last season. During this period the plant operation was very smooth. In 60 working days, 255 tonnes of mangoes were irradiated. The turnover during the mango season was Rs. 28.7 lakhs.



*PPP Agreement for
Mango Irradiation
at KRUSHAK*

Radiation Processing Plant, Vashi provided radiation processing services to more than 125 customers from all over the country. During the current financial year, about 857 MT of spices and allied products were processed till November 2008 generating a revenue of about Rs.52 lakhs. This plant is expected to process around 1500 MT spices and allied products in this financial year yielding a revenue of about Rs.100 lakhs.



A specially chartered flight of Qatar Airways took one Gamma Chamber to Republic of Yemen on January 16, 2009 as part of an IAEA Order worth US\$235000. This is the first time that GC-5000 has been sent by air and that too by a chartered flight. The GC-5000 has reached safely.

*GC-5000 goes by chartered
flight to Yemen*

Customer Support Services Cell

During the year 2008-09, Customer Relationship Cell (CRC) continued serving customers and made it more convenient to customers to interact with the officials of BRIT and regulatory authorities in matters relating to procurement and use of radioisotope products and equipment. The retail outlet for supply of cold kits set up for the benefit of nuclear medicine user institutions in and around Mumbai continued serving customers. In addition to the retail outlets existing at Project House and Hyderabad, another retail outlet was started at RCR, Delhi.

The transportation of about 52,000 consignments of radioisotope and allied products, majority of them by air, was carried out in a safe manner. Major transportation activities carried out during the year includes movement of kilocurie amounts of radioactive sources from RAPPCOF, Kota to Mumbai, Mumbai to Vadodara and Mumbai to Ambarnath ; teletherapy sources from Mumbai to various cancer hospitals in the country and Gamma Chamber and Blood Irradiator units to various research centres and hospitals.

Radioisotopes and allied products supplied by BRIT

Sr.No	Item	Actual between April-December, 2008	Expected to be achieved April,2008 – March, 2009
1	Consignments	43110	≈ 52000
2	Activity	459 kilo curies	≈ 800 kilo curies
3	Sale Value	Rs.3028 lakhs	>Rs.4500 lakhs

Annual Report 2008 - 2009
Board of Radiation and Isotope Technology

Descriptive Part

CH 4 Radiation Technologies & Applications

Board of Radiation & Isotope Technology (BRIT) continued its mandate towards progress by regular production and supply of a vast array of high quality radioisotope products which include sealed radiation sources of activity ranging from few microcuries to millions of curies mainly for medical and industrial use; radiation technology equipment such as gamma radiography camera, gamma chamber units, Blood irradiators; radiopharmaceuticals, immunoassay kits, radiochemicals, labeled compounds, labeled biomolecules, ^{99m}Tc generators, 'cold' kits, oligo nucleotides, self-luminous compounds, etc. As a service provider, BRIT also operates plants for radiation sterilization of medical products (ISOMED) at Trombay; Radiation Processing Plant at BRIT Vashi Complex for radiation processing of spices and allied products, KRUSHAK for radiation processing of low dose products including mangoes and runs Co-60 handling facility (RAPPCOF) at RAPS, Kota, JONAKI Laboratory at Hyderabad and has other Regional Centres located at Bangalore, Delhi and Kolkata and Dibrugarh. BRIT runs a Food Analysis Laboratory at Vashi for detection of radioactivity in products.

The various activities carried out by BRIT related to the production and supply of radioisotope and allied products and radiation technology equipment for use in Healthcare, Industry, Agriculture and Research during the period of this report are as follows:

4.5 Healthcare

4.5.1. Radiopharmaceuticals

16,500 consignments of ready to use radiopharmaceuticals of ^{131}I , ^{32}P , ^{51}Cr and ^{153}Sm were supplied to various Nuclear Medicine Centers. Majority of these contained ^{131}I radiopharmaceuticals, which amounted to about 550 Ci; 15000 consignments. 400 Ci of ^{99}Mo (TCM-2) was supplied for extraction of ^{99m}Tc at hospitals. In addition to this various accessories of ^{99m}Tc Solvent extraction generator system and other products were supplied. About 52,000 Cold Kits for the formulation of ^{99m}Tc radiopharmaceuticals (Code-TCK; 11 products) were supplied to various Nuclear Medicine Centers worth Rs. 3.0 crore.

The ongoing work of monoclonal antibody (ch TNT 1/B) labeling with ^{131}I , for M/S. Peregrine Pharmaceuticals Inc., USA is continuing. During 2008, the labeled product worth were US\$ 217,000 made.

In 2008, for the production and supply of ^{131}I -mIBG (therapeutic doses) was regularized. Under the XIth plan a new project for the production of $^{99}\text{Mo}/^{99m}\text{Tc}$ column generator using high specific activity ^{99}Mo has been initiated. An order has been placed on a German Company for the same.

^{99m}Tc Column Generator Production Facility (TcGPF)

Production feasibility, operational safety and process were repeatably demonstrated to satisfaction. 252 Geltech generators were produced in 26 batches at fortnightly intervals, till December 2008.

Market acceptability with respect to product utility and quality was demonstrated to satisfaction. 216 generators were supplied to hospitals in Mumbai, Ludhiana, Ahmedabad, Coimbatore, Vishakapatnam, RCR's Bangalore and Delhi.

Practicability of recycling of generators, a cost effective and environmental-friendly initiative, was demonstrated to satisfaction. Generators were supplied to all outstation hospitals on the condition that they bear the onus of returning spent generators. The practicability of this initiative has been demonstrated to satisfaction the whole year through.

In-house service to QCP / TCK group for easy access to ^{99m}Tc was provided. 24 generators were retained in-house for QC of generator performance as well as provide a means of easy access to ^{99m}Tc for TCK cold kit analysis and development work. Over 95% of cold TCK kits analyzed in 2007 for physico-chemical parameters were performed using Geltech generator eluted pertechnetate.

4.5.2 Nuclear Medicine : Diagnostic & Treatment Service

About 10,000 kits of RIA and IRMA were supplied during the year to 300 immunoassay laboratories throughout the country.

Liquid handling system required for the production of antibody coated tubes was indigenously fabricated and commissioned at BRIT Vashi Complex. This high throughput system is capable of automatically handling all the steps required for the production of antibody-coated tubes such as accurate dispensing in micro liter levels, aspiration and washings of the test tubes. Liquid Handling System along with well-equipped laboratory specifically designed for the said purpose is functional.

At present, the system is being evaluated rigorously and trial batches of antibody coated tubes are being produced. Commercial supplies of T4 RIA Kits with antibody-coated tubes produced from this system will be launched shortly.

Ferritin is the major intra-cellular iron storage protein found in the body. Estimation of serum Ferritin is important in the diagnosis of iron deficiency and excess for the successful management of conditions and treatments posing a threat to iron balance. Immuno radiometric assay (IRMA) for serum Ferritin is a superior, practical and non-invasive means for the routine clinical evaluation of patients with suspected iron deficiency and overload.

At BRIT, a solid phase immunoradiometric assay (IRMA) Kit for the estimation of Ferritin in human serum based on magnetizable cellulose separation system, a quick, user-friendly assay system with ready to use reagents which can be carried out in laboratories with bare minimum facilities in remote and rural areas (without continuous power supply) has been developed. The assay does not require an incubator, shaker or centrifuge and

can be carried out in 90 minutes time. The test covers the standard range from 0 - 1000 ng/ml without high dose hook effect upto 2000 ng/ml and hence minimises the need for sample dilution. The developed product has been approved by the radiopharmaceuticals committee for regular supply.

The Regional Centres located at Bangalore and Delhi processed ready-to-use ^{99m}Tc radiopharmaceuticals for use in the host medical centres apart from supplying the products to other hospitals in the region. RCR, Bangalore carried out 4530 RIA investigations and supplied 69,700 mCi of ready to use Tc-99m formulations. RCR, Delhi produced 45000 mCi of ready-to-use ^{99m}Tc radiopharmaceuticals. R & D studies were further pursued on the development of new column based alternate ^{99m}Tc



*Retail Outlet at RCR, Delhi
inaugurated by Director, INMAS*

Generator based on the utilization of indigenous reactor produced low/medium specific activity ^{99}Mo molybdate using solid phase extraction technology method developed by RCR, Delhi. The method utilized SPE matrix column for the separation of ^{99m}Tc from indigenous reactor produced ^{99}Mo . A second SPE column was used for the purification of ^{99m}Tc . The elution efficiency

of ^{99m}Tc was > 85%. Tests on quality of ^{99m}Tc were as per pharmacopoeia requirements. The new technology is aimed to provide a useful alternative to the commercial ^{99m}Tc column generator which uses fission produced ^{99}Mo . Development of prototype ^{99m}Tc generator is in progress. A retail outlet for supply of cold kits for the preparation of various ^{99m}Tc Radiopharmaceuticals was also started in RCR, Delhi.

At the Regional Centre, Kolkata, significant progress has been made in the DAE Medical Cyclotron Project. Piling work for the construction of the building has been completed. Construction of superstructure is initiated. The first lot of shipment containing various cyclotron systems and radioisotope production equipment from IBA, Belgium has been received. Hot Cells for the radioisotope processing are being fabricated by M/S. Comecer, Italy and these would soon be ready for inspection and acceptance tests. The project is expected to be completed by the next year.

Electroplating of high power Ni targets for irradiation in cyclotron. Standardization of a method for the separation of Ge and Ga using SnO_2 column chromatography was carried out. This a vital step for the manufacture of ^{68}Ge - ^{68}Ga generator using the upcoming medical cyclotron. A novel ^{99}Tc delivery system has also been developed. The new system works with low specific activity ^{99}Mo , but have certain advantages of column generators.

Regional Center, Dibrugarh provided RIA & IRMA diagnostic service for the needy patients of the entire North-Eastern region. More than ten thousand patients of the region avail the services from this center. Apart from medical colleges, patients also come from the nearby tea garden hospitals, Civil hospitals etc., For the ICMR national

project on Hypertension & Salt intake, 600 assays of serum, Aldosterone and Renin activity was carried out. A Blood Irradiator BI-2000 is being installed at RCR, Dibrugarh.

4.3.2 Nuclear & Biotechnological Tools

4.3.2.1 Labeled Compounds

Labeled Compounds Group is engaged in the synthesis and supply of a variety of ^{14}C , ^3H and ^{35}S -labelled products and oligonucleotides (DNA primers). Ready-to-use non-radioactive (cold) kits are also assembled here for supply to users as and when required, through JONAKI, BRIT, Hyderabad. These kits are essentially used for labelling DNA and RNA to make $^{32}\text{P}/^{33}\text{P}$ -radiolabelled probes. All these products are powerful and versatile tools for fundamental research and are used as radiotracers in diverse investigations in the fields of biology, agriculture, medicine and chemistry. In addition, the group has been concentrating on the production and supply of tritium filled sources of various types as per the orders received. This work is a defence oriented programme especially undertaken to cater to the demand and requirements of defence establishments and army workshops in the country for the illumination of various types of military gadgets and instruments. Tritium Labeling Service (TLS) was carried out to meet the specific requirements from a few researchers .

Details of the products despatched during the year 2008 is given below. (corresponding data for the year 2007 is also given for comparison).

Sl.No.	Product Category	Total No. of Consignments	
		Year 2008*	Year 2007
1.	^{14}C -products	60	53
2.	^3H -products	44	69
3.	^{35}S -products	87	103
4.	Kits	05 (53 Kits)	63
5.	Oligonucleotides	42 (373 nos)	33 (413)
6.	Custom synthesis/TLS	11	10
7.	TFS & TTS (Tritium Sources)	23 (3105)	18 (4459)
9.	^{14}C -urea capsules	02 (40)	01 (50 nos.)
10.	Taq DNA Polymerase	15 (38300 U)	10 (11250)

*figure upto November

Highlights

As part of the contract manufacturing job with M/S. Peregrine, USA, the quality control assay of the ^{131}I -labeled antibody was carried out with respect to its ion contents. A few batches were successfully analyzed during the period. An MOU was signed with BSF for the supply of Tritium Filled Sources. Custom synthesis of several ^{14}C , ^3H and ^{35}S



labeled compounds was carried out successfully. The supply of enzyme, Taq DNA polymerase prepared at JONAKI, Hyderabad was continued through LCL and sales showed a steady increase during the year.

*MoU with BSF, Gwalior
for Supply of TFS Sources*

4.3.2.2 JONAKI Laboratory at CCMB Campus, Hyderabad

JONAKI, the Labeled Biomolecules Laboratory of BRIUT at CCMB campus at Hyderabad has been involved in the production of ^{32}P and ^{33}P labeled nucleotides. The laboratory meets the requirement of researchers of about 100 research institutes all over the country working in molecular biology and biotechnology. In addition to the radio-nucleotide program, a beginning has been made to expand the activities of JONAKI in the field of molecular diagnostics.

During the current year, agrose gel based PCR kits for the detection of *Mycobacterium Tuberculosis* has been introduced into the market. Development of this kit was taken up in collaboration with LNMS, RMC, BARC. Further, four new molecular biology kits for isolation of chromosomal DNA, Plasmid DNA and purification of PCR product and DNA from gel band has also been introduced into the market.

Development of a PCR – ELISA based and a Real Time PCR based M tuberculosis detection kit has been completed and these two kits are being sent for evaluation.

Quality Control Program

Quality control testing and analysis was carried out on all ready to use radiopharmaceuticals, generator based products, RIA/IRMA kits, inactive raw materials and active raw materials. Up-gradation of the facilities was constantly done by installation of the latest state-of-the-art equipment wherever possible and also by preparing up-to-date monographs for all products being tested.

4.5.3. Nuclear Medicine: Cancer diagnostic & treatment services

19 teletherapy sources had already been sold upto December 2008 and it is expected that another 4 sources will be supplied to Cancer Hospitals in India fetching a sale value of Rs. 6 Crore by March 2009. 700 cm (3 Ci) ^{192}Ir -Pt wire has been supplied and 500 cm (2.5 Ci) is expected to be prepared and supplied to various hospitals and medical research centres for the treatment of cancer.

Industrial Applications:

4.7.1. Radioisotope Sources.

During April-December 2008, sealed radiation sources of total activity of about 500 kCi were fabricated, processed and supplied for use in various types of industrial applications. The following customers were served :

100 kCi for Shriram Institute
200 kCi for for AIPL, Vasai
200 kCi for RPP, Vashi

Cobalt-60 sources were also supplied to load 1 Blood Irradiator and 2 Gamma Chamber 500.

During this period, decayed sources from various Teletherapy units, Blood Irradiators, Gamma Chambers, HDR sources, Iridium and cobalt radiography cameras were removed and disposed/stored. 726 radiography sources were supplied between April 2008 and December 2008. Another 250 sources are expected to be supplied between January 2009 and March 2009.

During the last nine months of year 2008, 45 ¹³⁷Cs sealed sources were supplied to different customers in the country. 7 meters of ¹⁹²Ir- wire were supplied to radiotherapy departments of major hospitals. 55 sources of cobalt 60 sources were supplied to replace the decayed sources in nucleonic gauges. Two Manual after-loading applicator kits with 1440 mCi of ¹³⁷Cs were also supplied. One each consignment of ⁴⁶Sc, ¹⁷⁰Tl and CSK 1 kit were also supplied during the period.

4.7.2. Gamma Radiation Processing Services (GRPS)

4.7.2.1. Radiation Sterilization Plant for Medical Products (ISOMED)

ISOMED continued to offer prompt and efficient gamma sterilization services to large numbers of customers spread all over the country. More than 4914 cubic meters of different types of products were processed between April 2008 and December 2008 generating a revenue of Rs. 207 lakhs. By March 2009, the plant is expected to process around 8300 cubic meters of medical products yielding a revenue of Rs. 280 crores. The plant availability factor and plant utilization factors were maintained well above 93% and 88% percent respectively through meticulous planning of operation and regular servicing/maintenance schedule of the facility by a team of experienced and dedicated staff members. Radiation processing of pet feed was undertaken and application submitted to AERB for the processing of food products for medium dose applications. ISOMED also provided radiation processing solutions to products with diverse applications viz., quartz samples for dose response studies vis-à-vis space application for ISRO and elastics for retail marketing to M/S. Wal-Mart, USA.

Radiation stability testing of materials and equipments was carried out at ISOMED for various DAE units such as NPCIL, BARC, ECIL etc. to assess their suitability for use in various nuclear installations.

Ceric-cerous sulphate dosimeters for routine dosimetry and dose mapping studies and biological indicators using *Bacillus pumilus* spores for microbiological monitoring were produced at ISOMED. These products were also supplied to other irradiation facilities in the country. ISOMED provided the manpower training to those organizations who are in the process of setting up new radiation processing facilities in the country.

The development work for the preparation, standardization and calibration of 3mM ceric-cerous dosimeters has been taken up to facilitate the dosimetry of products exposed to low radiation dose (for eg., Mangoes).

Local Safety Committee meetings were held periodically to discuss, review and improve the radiation and operational safety status of the plant.

An automatic 24 x 7 customer consignment process status enquiry system was made operational this year.

4.7.2.2. Radiation Processing Plant, Vashi (RPP, Vashi)

Radiation Processing Plant, Vashi is providing radiation processing services to more than 125 customers from all over the country. During the current financial year, about 857 MT of spices and allied products were processed till November 2008 generating a revenue of about Rs. 52 lakhs. This plant is expected to process around 1500 MT spices and allied products in this financial year yielding a revenue of about Rs. 100 lakhs. Since its inception this facility has processed about 11,000 tons of products realizing a revenue of about Rs. 550 lakhs. Source replenishment work is scheduled in the month of December 2008 to enhance the source activity from 255 kCi to 455 kCi, hence performance of the plant is expected to go up in the coming months.

4.7.2.3 KRUSHAK Irradiation Facility (Lasalgaon, Nashik)

KRUSHAK plant, Lasalgaon was initially designed for the radiation processing of low dose items like onion, potatoes, ginger, garlic etc., To increase the scope for better utilization, the facility was upgraded for mango irradiation in 2007 and for the first time mango irradiation was carried out for export to the USA after getting approval from the USDA-APHIS. A team of USDA-APHIS representative visited the facility on the 8th April 2008 for the review of the facility to grant the approval for mango irradiation for the current season.



*PPP Agreement for
Mango Irradiation
at KRUSHAK*

In KRUSHAK Plant at Lasalgaon, mango processing was carried out in Public Private Partnership mode during the last season. During this period the plant operation was very smooth. In 60 working days, 255 tonnes of mangoes were irradiated. The turnover during the mango season was Rs. 28.7 lakhs.

Facility is being modified to carry out radiation processing of products which require vast range of radiation dose (30 Gy to

1500 Gy) without disturbing the source geometry. This will be achieved by providing removable shielding and split source. Cold Rooms are also being provided for the transit storage of amngoes during receipt and dispatch of the consignments.

4.7.2.4 New Radiation Processing Plants in Private Sector



6th Radiation Processing Plant comes up in the Private Sector by Agrosurge Irradiators Pvt Ltd, Vasai



7th Radiation Processing Plant in the Private Sector by Gamma Agro Medical Processings Pvt Ltd, Hyderabad



Construction begins for Jhunsons Irradiator at Bhiwadi, Rajasthan



Radiation Processing Plant by Impartial Agrotech, Unnao

Two more Radiation Processing Plants were commissioned with the help of BRIT this year – one by M/s. Agrosurge

Irradiators (India) Pvt. Ltd. at Vasai near Mumbai and the other by



MoU signed with Friends Ventures Enterprises on Aug 7, 2008 for setting up of a Radiation Processing Plant at Sriperumbedur

M/s. Gamma Agro Medical Processing Pvt. Ltd. at Hyderabad. With this, now there are seven such plants fully in private sector in the country. Apart from this, four plants are under various stages of construction. In addition, site clearance has been given by Atomic Energy Regulatory Board for seven more parties for such Plants in various parts of the country. Two more MOUs were also signed with private parties this year for setting up of such plants.

Contract for Multipurpose Gamma Irradiator at Colombo, Sri Lanka



Agreement with Min. of Sc & Tech for 3 Mci Multipurpose Irradiator, Sri Lanka

An agreement has been signed between Ministry of Science & Technology, Sri Lanka and M/s. Symec Engineers (India) Pvt. Ltd., Mumbai for construction of a 3 MCi Multipurpose Gamma Irradiator Facility at Colombo, Sri Lanka. M/s. Symec Engineers (India) Pvt. Ltd., Mumbai had submitted a joint bid after taking a quotation from BRIT for 150 kCi of Co-60 source pencils and radiation related expert services. The total contract is worth US\$1340,000 crores of which BRIT's part is US\$430,000.

Also the Atomic Energy Research Establishment,

Bangladesh has placed an order for additional Co-60 source and associated works worth US\$244,869.

4.7.2.5 Accelerators

The ILU-6 EB accelerator at BRIT continued to provide R & D services to academic and scientific institutions. In Collaboration with tyre manufacturer and Indian Rubber Manufacturer's Research Association (IRMRA), automobile tyres have been made, for the first time in India, using electron beam processed (precured) tyre components like treads, outer plies and inner liners. The advantages of EB processing in tyre building have been successfully demonstrated to M/s. CEAT Tyres, Mumbai. These include reduced curing time, better homogeneity, better finish and improved endurance on the road.

EB irradiation is being continued for commercial basis for diamond coloration, cross-linking of PE 'O' rings and other plastic bushes used in automobile industry for high temperature stability.



4.7.3. Radiation Technology Equipment

4.7.3.1. Gamma Chamber GC 5000:

A specially chartered flight of Qatar Airways took one Gamma Chamber to Republic of Yemen on January 16, 2009 as part of an IAEA Order worth US\$235000.

This is the first time that GC-5000 has been sent by air

and that too by a chartered flight. The GC-5000 has reached safely.

*GC-5000 goes by chartered
flight to Yemen*

During the current year, one GC 5000 was supplied to IGACAR, Kalpakkam.

By March 2009, the following orders are expected to be executed :

1. IAEA order for Sana'a, Yemen
2. TINT, Bangkok
3. Jadavpur University, Kolkata
4. RSD, B A R C, Trombay, Mumbai
5. Aurigene Discovery Technologies, Bangalore
6. Klenzoides, Mumbai
7. IAEA order for Warsaw, Poland

One GC 1200 is expected to be supplied to NEHU, Shillong by March 2009.

4.7.3.3. Radiography Camera ROLI-1 & III

BRIT supplied 34 nos. of ROLI-1 radiography exposure devices in April-December 2008. It is expected to sell another 25 cameras by March 2009. BRIT also supplied 695 replacement sources during the year. Another 310 sources are expected to be sold between January-March, 2009.

273 ROLI cameras were serviced during the year. Another 105 cameras will be serviced before March, 2009. 581 decayed sources were removed between April-December, 2009. Another 200 sources will be disposed off by March 2009. 642 imported cameras were inspected by December, 2008. By March 2009, another 214 imported cameras will be inspected.

Portable Radiography Exposure Device ROLI-III launched



BRIT has launched a 20Ci ^{192}Ir portable radiography exposure device which was developed indigenously. This will complement 35 Ci mobile device already being manufactured and supplied by BRIT.



*Portable Radiography
Device Development*

4.7.3.4. Blood Irradiator

The programme of production & supply of Blood Irradiator BI 2000 has been pursued further. During the year 1 blood irradiator was supplied to Assam Medical College, Dibrugarh and 3 more are to be supplied to the following customers before March, 2009.

1. Dr. B L Kapoor Memorial Hospital, Delhi
2. RCR, Thiruvananthapuram
3. The Tamil Nadu Dr. M G R Medical University, Chennai

4.7.3.5. Install & Operate Irradiator

The civil work for the irradiator is in final stages of completion. EOT crane is to be installed. The fabrication of components is completed. Lead filling of cask has to take place. The control system is also ready.

4.7.3. 6 QA of Sealed Sources, Radiometry Scanning and Irradiation Services

Interpretation of the radiographs of welds of GC 5000, BI 2000 and BLC flasks were carried out.

ROLI 1 cameras were tested at the REPF workshop and the Radiological lab of BARC. Density measurements were carried out on cobalt-59 pellets and slugs and also chemical analysis and XRF analysis were carried out for the acceptance of the material for irradiation.

4.14. Supporting Services

4.14.1. Customer Support Services Cell

As the nodal agency for sales and supply, marketing and customer relations, Co-ordination & logistics support were continued to be provided for the regular and uninterrupted supply of radioisotopes & allied products and radiation technology equipment to about 2000 user institutions in the healthcare, industrial, research and agricultural sector.

During the year 2008-09, Customer Relationship Cell (CRC) continued serving customers and made it more convenient to customers to interact with the officials of BRIT and regulatory authorities in matters relating to procurement and use of radioisotope products and equipment. The retail outlet for supply of cold kits set up for the benefit of nuclear medicine user institutions in and around Mumbai continued serving customers bringing in a revenue of approximately Rs. 8 lakhs.

The transportation of about 43,000 consignments of radioisotope and allied products, majority of them by air, was carried out in a safe manner. Major transportation activities carried out during the year includes movement of kilocurie amounts of radioactive sources from RAPPCOF, Kota to Mumbai, Mumbai to Vadodara and Mumbai to Ambernath, teletherapy sources from Mumbai to various cancer hospitals in the country and Gamma Chamber and Blood Irradiator units to various research centres and hospitals.

Radioisotopes and allied products supplied by BRIT

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2	Activity	459 kilo curies	≈ 800 kilo curies
3	Sale Value	Rs. 3028 lakhs	Rs. 4800 lakhs

4.14.2. Engineering Support Services Unit (ESSU)

Engineering Support Services Unit (ESSU) provided the vital infrastructural and utility services to BRIT and BARC facilities at Vashi Complex. Provision of uninterrupted electrical power, air conditioning and ventilation services on continuous basis to the radioactive laboratories, civil and public health services and communication services in Vashi complex are the major challenges faced. Quality service provided by the ESSU have enabled the production units to meet the production and supply schedules as planned.

Status of the Plan Projects

X Plan Projects

BRIT has taken up several projects for execution under the plan project scheme. All these projects have been aimed to enhance its capacity for the development of new products, improvement in quality and also development of infrastructural facilities. Under the Xth plan three major projects were initiated for the execution. These are :

- Integrated facility for radiation Technology (IFRT)
- Revamping and Augmentation of Infrastructural Facility (RAIF)
- DAE Medical Cyclotron at Kolkatta

1) Project : Integrated Facility for Radiation Technology (IFRT)



*IFRT Hot Cell
under Construction*

Objective of the project is to set up a Hot cell at BRIT Vashi complex for handling, storage and fabrication of sealed sources up to 300 kCi of Co-60. The financial outlay of the project is Rs 1519 lakh and completion date is Dec 2009.

This project is in advance stage of execution as Civil construction for administrative building, water pool, Radiometry room etc has been completed. Project is expected to be completed as per schedule.

2) Project : Revamping & Augmentation of Infrastructural Facilities (RAIF)

The project is proposed for Revamping & Augmentation of Infrastructural Facilities of BRIT at Vashi to enhance infrastructural support for production facility. The major activities of the project is to procure instruments and equipment for revamping and augmenting production, quality and safety of operations and personnel. Financial outlay of the project is Rs 1592 lakhs and completion date is March, 2010.

Civil construction for Install and Operate irradiator is in advance stage and clean room facility has been commissioned. Apart from this procurement of equipment is in progress and Automated Column scanning system has been procured and also Indent for mobile hot cell has been raised.

3) Project : DAE Medical Cyclotron Project : Pharmaceuticals Facility

A medical cyclotron facility is being installed at VECC, DAE, Kolkata for the production of PET & SPECT radioisotopes to be used for diagnostic and therapeutic purposes.

Order for the equipment have been placed and the fabrication of equipment is in advanced stage of completion. Civil construction has started.

XI plan projects

Apart from the Xth plan project there are 5 more projects which are proposed for execution under XI th plan. These projects are aimed towards development of new products, improvement in quality of existing products and improvement in manufacturing processes. Financial sanction for four of these projects have been received except for the project, Construction of State-of-the Art Immunoassay Facility. Brief description of the XI plan projects is given below.

1) Project : Integrator Irradiator Development Project

Estimated Cost : Rs 300 lakhs

Objectives

To upgrade safety and security features in the RPP, Vashi & ISOMED facilities and to set up an Irradiator Training facility for training of personnel for operation of irradiator.

Progress : Following work has been carried out

- Access control system installed at Vashi
- System for vehicle tracking system finalised and indent is raised
- Early fire warning system for ISOMED is finalized and indent is raised.
- Chilled Air supply system for low dose irradiation at ISOMED has been installed

2) Project : Production Facility for Mo-99-99 mTc column Generators of High specific Activity Mo-99.

Estimated Cost : Rs 750 lakhs

Objectives

Setting up of a new automated facility for production of Mo-99 Tc-99 m Column Generators using high specific activity Mo-99.

Progress : Tendering process completed for supply of production facility of Mo-99 Tc-99 m Column Generators using high specific activity Mo-99, for the Hospitals and order is placed.

3) Project : Construction of State-of-the Art Immunoassay Facility

Estimated Cost : Rs 205 lakhs

Objectives

- a) Development and building up of infrastructure for coated tube technology & state of the art Laboratory with GMP/GLP compliance with a special focus on contract manufacturing.
- b) Development and building up of infrastructure for Immunoassay based on non-isotopic labels.
- c) Development of diagnostic kits for infectious diseases.

Progress : Procurement of following equipments needed for development of isotopic / non-isotopic assays has completed :

1. Spectrophotometer
2. Dehumidifier
3. Multi-well RIA counter

4) Project : Construction of State-of-the Art GLP & GMP compliant Lab

Estimated Cost : Rs 340 lakhs

Objectives

Upgradation of the laboratory for GLP and GMP compliance by following:

- a) removal of the existing corroded 20 years old fume hoods, cut and disposal through WMD
- b) Installation of new fume hoods.
- c) Wear resistant laboratory flooring of laboratory.
- d) Furnish the labs and facelift office for aesthetic look
- e) Introduce the state of the art synthesis facility, enhance the analytical evaluation, quality control of the labeled compounds. Introduction of microwave synthesis and introduction of instrumental analysis.
- f) Augmentation of oligonucleotides synthesis facility
- g) Setting up of state-of-the art lab for C-14 urea capsule production and
- h) Setting up of low background counting lab for food analysis.

Progress : Following work has been carried out

- Decontamination of working tables and fumehoods in two laboratories is completed
- Work order for refurbishment of two fumehoods is released
- Indent raised for procurement of stainless steel fumehoods (12Nos.), new working tables, flooring, paneling etc.
- Indent raised for HPLC instrument
- Indent for UV spectrophotometer raised and Portable liquid scintillation counter procured

- Heliprobe system procured.

5) Project : Indigenous HDR Brachytherapy Equipment (IHDR)

Estimated Cost : Rs 800 lakhs

Objectives

- a) Establishing the complete process and facilities for fabrication of Ir-192 HDR sources for regular production.
- b) Development of indigenous, remote operated high dose rate (HDR) brachytherapy equipment including necessary treatment.

Progress : Purchase order for “Design, development, of IHDR and desired software capable of communicating with all common treatment planning software, Qty-12 sets” has been released. And also following work related to development of equipment has been carried out

- Design, fabrication of dummy source holder has been completed. Various tests are being conducted.
- Enriched Ir-191 pellets are kept in reactor for the neutron absorption studies.
- Conceptual design of the HDR unit has also been completed.