



## NUCLEAR MEDICAL CENTRES OF PAEC

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Pakistan Atomic Energy Commission (PAEC) in the beginning of the 1960's chalked out plans for the utilization of radiations and radioisotopes for health care of the population and setup two nuclear medical centres at Karachi and Lahore in 1960 and 1963, respectively. Since these centres had only diagnostic facilities, the PAEC later on established eleven more centres in various parts of the country, which have both nuclear medicine and radiotherapy facilities. Initially, the manpower for the medical centres was trained in Europe and America, but later on training facilities were developed within the country at what is now the Pakistan Institute of Engineering and Applied Sciences (PIEAS) which has been organizing M.Sc. level courses in Nuclear Medicine, Medical Physics, and Health Physics. Many of these centres are equipped with modern equipment, which includes single and double head gamma cameras, linear accelerators, Cobalt-60 sources, computerized tomography (CT), magnetic resonance imaging (MRI), brachtherapy, simulators, and treatment planning systems (TPS), mammography, ultrasound and radioimmunoassay (RIA). These tertiary care centres are working in close collaboration with major teaching hospitals and providing diagnostic and treatment facilities to about 350,000 patients annually. PAEC has now also started cancer awareness and screening programme; and has established 13 breast cancer clinics in the medical centres. The public has been informed regarding these facilities through electronic and print media.

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The discovery of X-rays at the end of the nineteenth century, and production of artificial radioisotopes in the early twentieth century, provided new tools for diagnosis and treatment of various diseases. The imaging of organs by X-rays and the use of radioisotopes as tracers in studying biochemical and metabolic functions of the body have made significant contributions in the diagnosis and treatment of cancer. The radioisotopes-labeled compounds, when introduced in the body, can specifically accumulate in the cancer affected organs due the high metabolic rate of the cancerous cells. These areas, called "hot spot", can be easily scanned for  $\gamma$ -emitting radioisotopes with the help of "Gamma Cameras". High-energy gamma rays from  $^{60}\text{Co}$  sources and linear accelerators, which can selectively destroy cancerous cell, are used for cancer therapy. These nuclear techniques have increasingly used in health care all over the world.

Pakistan Atomic Energy Commission (PAEC), soon after its establishment, chalked out plans for the utilization of radiations and radioisotopes for the welfare and health care of the public. Consequently, in 1960 the PAEC established the

first nuclear medical centre at the premises of Jinnah Postgraduate Medical College (JPMC), Karachi, in a two-room barrack provided by the Ministry of Health. Initially, it had only one thyroid-uptake system. As the number of patients increased, more facilities were added. Over the years these facilities have been upgraded by the addition of more rooms and new equipment to provide improved nuclear diagnostic services. The centre now has a building of 26 rooms and is providing diagnostic facilities to more than 33,000 patients annually.

The PAEC established its second centre, named the Medical Isotope Institute, in 1963 in the building of Mayo Hospital, Lahore. It initially performed only thyroid-related work and during the first year more than 300 patients were provided treatment facilities. During the last 40 years, the facilities have been upgraded and new equipment including gamma cameras and mammography machines added to provide better diagnostic and therapeutic facilities. It was later renamed as Centre of Nuclear Medicine (CENUM), and it is a currently handling about 21,000 patients per year.

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The basic philosophy in establishing these tertiary care hospitals was to build them in the vicinity of a teaching hospital for better interaction and coordination with other physicians, and to provide facilities for cancer diagnosis and treatment near the general hospitals. Since health is provincial subject in Pakistan, the provincial governments were involved in the establishment of these centres. Land and funds for the construction of buildings are provided by the provincial governments; whereas funds for equipment are usually provided by the federal government.

The first two centres setup by PAEC had only diagnostic facilities. In order to provide both nuclear medicine and radiotherapy facilities, the PAEC established another centre named Atomic Energy Medical Centre, Jamshoro, in 1965. A 50-bed facility for indoor patients was also setup in the ward provided by the Liaquat Medical University Hospital. Initially, it was a small centre and had only three physicians who provided treatment to about 3500 patients in the first year of its operation. Since then the number of physicians and technical staff have increased, and the facilities have been upgraded from time to time. The centre has been renamed as Nuclear Institute of Medicine and Radiotherapy (NIMRA). It is providing nuclear medicine, radio immunoassay (RIA) as well as radiotherapy treatment using  $^{60}\text{Co}$  source and linear-accelerator facilities to more than 26,000 patients from Hyderabad and adjoining areas.

The diagnostic and radiotherapy facilities were extended to the southern Punjab area by establishing Multan Institute of Nuclear Medicine and Radiotherapy (MINAR) in 1968 on the land provided by the Nishtar Medical Hospital and College. The Institute was upgraded in 1976 and in 1979 by the construction of new buildings, and by the addition of new equipment facilities and manpower. Recently, more land has been acquired from the Nishtar Medical College for the expansion of MINAR and a PC-I application for Rs.40 million has been approved to add new facilities. Besides treating about 27,000 patients annually, the institute is also involved in academic and research activities and has organized a number of courses on ultrasound diagnostic techniques.

In order to provide nuclear medicine and radiotherapy facilities to the provinces of NWFP and Baluchistan, the PAEC has setup one centre each at Peshawar and Quetta. The Institute of Radiotherapy and Nuclear Medicine (IRNUM) was

established in 1975 on land provided by the NWFP Government near the Khyber Medical College, Peshawar. This institute has well-qualified physicians and all the necessary facilities for nuclear medicine diagnosis, and treatment by radiotherapy and chemotherapy. It is providing treatment to about 53,000 patients per year from Peshawar, adjoining towns, Northern Areas as well as Afghan patients from across the border. The centre at Quetta named the Centre of Nuclear Medicine and Radiotherapy (CENAR) was established in 1987 adjacent to the Bolan Medical College. The land for this centre was provided by the Baluchistan Government. Initially it was a small centre with limited facilities. Gradually these facilities were upgraded by the provision of new equipment and addition of well-trained manpower. Presently it is providing diagnostic and treatment services to about 12,000 patients per year, including Afghan nationals. The Centre is also engaged in academic and R&D activities.

To cater for the need of people of the Federal Capital and Azad Kashmir, a Nuclear Medicine, Oncology and Radiotherapy Institute (NORI) was established in 1983 at Islamabad, adjacent to the Pakistan Institute of Medical Sciences (PIMS). NORI is equipped with sophisticated and state-of-the-art equipment for nuclear medicine and radiotherapy, which is supported by other services, namely a pathology laboratory, radioimmunoassay, diagnostic radiology, treatment planning system, medical and health physics. Over the years it has developed into an Institute of Excellence for diagnosis and treatment of malignant diseases. NORI is the first institute which has been recognized by College of Physicians Surgeons of Pakistan (CPSP) for training of Fellows of College of Physicians and Surgeons (FCPS) in Nuclear Medicine and radiotherapy. The Institute is also pursuing various research projects sponsored by the International Atomic Energy Agency (IAEA) and the World Health Organization (WHO), and has organized number of seminars and workshops. NORI is providing treatment facilities to about 40,000 patients from Islamabad, Hazara, Jhelum, Sargodha, Azad Kashmir, etc.

The two medical centres setup at Karachi and Lahore in the early 1960s could not cope with the requirements of these large cities. Therefore, PAEC decided to setup two fully fledged centres, one each at these cities. The Institute of Nuclear Medicine and Oncology (INMOL) was established at Lahore in 1984, which has both diagnostic and

radiotherapy facilities. An 80-bed indoor facility was also setup. The institute is also engaged in R&D studies and has developed a number of new procedures. It has pioneered the production of radioimmunoassay and cold kits, which are being used by other centres of the PAEC. Indigenous production of these kits has resulted in considerable saving of foreign exchange. Over the years, INMOL has developed into an Institute of Excellence, and has received both national and international recognition of its work. It is providing diagnostic and treatment facilities to about 40,000 patients per annum. The institute will be upgraded soon by the addition of new facilities, such as positron emission tomography (PET) and a small cyclotron.

The Karachi Institute of Radiotherapy and Nuclear Medicine (KIRAN) was established in year 2000 on 18 acres of land provided by the Government of Sindh at Safoora Goth, Karachi. A 100-bed ward has been attached to it for indoor patients. The institute has state-of-the-art diagnostic and radiotherapy facilities and well qualified and experienced staff. Additional buildings are being constructed to house operation theatre, computerized tomography (CT) and magnetic resonance imaging (MRI) machines. KIRAN is also engaged in R&D studies and providing diagnostic service and treatment to more than 40,000 patients per annum. It is considered as one of the best-equipped cancer hospitals in South Asia.

In addition to these medical centres, PAEC has also established such centres in other cities, namely Larkana, Faisalabad, Bahawalpur and Abbotabad. (Annexure I). Eight new centres will be established soon in other cities (Annexure II) to cope with the increasing number of patients.

The contribution of Pakistan Atomic Energy Commission through its integrated programme in diagnosis of various types of cancers and allied diseases and their treatment has received considerable acclaim both at national and international levels. At present 13 PAEC nuclear hospitals are working in major cities of the country, which have modern equipment such as single-head and double-head gamma cameras for imaging, bone densitometry, ultrasound, and mammography with biopsy facilities for breast screening. The laboratories are equipped with radioimmunoassay as well as Polymerase Chain Reaction (PCR) machine and immulite systems. For the treatment of cancer,  $^{60}\text{Co}$  sources of 7000-

10000 Ci and sophisticated linear accelerators (LINAC's) with simulators and treatment planning system (TPS) are used. During the last five years these hospitals have been equipped with twelve new gamma cameras, three new LINACs, four  $^{60}\text{Co}$  sources, two treatment planning systems (TIPS), two brachtherapy machines, 13 mammography and ultrasound machines. These tertiary care Nuclear Medicine Institutes of PAEC are working in close collaboration with the major teaching hospitals and striving to cater for the health needs of the public by providing diagnostic and treatment facilities to more than 350,000 patients per year. A majority of these patients are treated free of cost.

These medical institutes are also actively involved in research and development studies to evolve better understanding and strategies for the prevention, screening, diagnosis and treatment of malignant diseases. The international contacts, which the PAEC enjoys through the IAEA, the Union of International Cancer Control (UICC), as well as through bilateral relations with friendly countries, also facilitate the access of our doctors to international institutes and research organizations. At present PAEC institutes are pursuing two main IAEA technical cooperative projects: one on nuclear medicine support in Pakistan, and other on establishing radiotherapy quality control and quality assurance in Pakistan. IAEA has provided financial grant of US \$300,000 for these programmes. During the last 20 years PAEC medical centres have carried out about 60 R&D projects and organized a number of workshops sponsored by IAEA and other international organizations. These programmes provide medical doctors and other relevant persons frequent opportunities of training, scientific visits and participation in international conferences and seminars. PAEC hospitals also extend expert services to regional countries for the use of nuclear techniques in health care programmes and have trained a number of doctors and professionals from these countries, especially from the South Asian region, South Asian Association of Regional Cooperation (SARAC) and Organization of Islamic Countries (OIC).

Since the availability of trained manpower is an important requirement for the smooth and effective operation of these cancer hospitals, PAEC has given high priority to human resource development. Initially many physicians were trained in Europe and America, but later on trainings facilities were developed within the

country. Pakistan Institute of Engineering and Applied Sciences (PIEAS), Islamabad, has been organizing a two-year M.Sc. Nuclear medicine course since 1988 for the training of physicians. Up to the present time, more than 90 physicians have been so trained, who are working in PAEC cancer hospitals or in private hospitals. PIEAS also runs M.Sc. courses in Medical Physics and Health Physics. Besides this an M.Sc. course in radiotherapy is under consideration; PIEAS is thus able to provide these highly qualified and trained personnel to the various Nuclear Medical Institutes.

PAEC has also started cancer awareness and screening programme and has submitted a

National Cancer Control Plan (NCCP) to the government. As a first step in this direction, PAEC has established 13 breast cancer clinics in its institutes through the country, which give screening facilities to more than 20,000 patients annually. In the second phase of this programme PAEC is establishing 14 mobile breast cancer clinics attach to its cancer hospitals, which will provide services through district headquarters-level hospitals in the surrounding areas over at least 100 km from each centre. In a recent initiative, PAEC has started informing the public regarding these facilities through electronic and print media.

Annexure –I

PAEC Nuclear Medicine and Radiotherapy Institutes

No	Institutes	Bed Capacity	Established in
1.	Atomic Energy Medical Centre (AEMC), Karachi	-	1960
2.	Centre for Nuclear Medicine (GENUM), Lahore	-	1963
3.	Atomic Energy Medical Centre (AEMC), Jamshoro	50	1965
4.	Multan Institute of Nuclear Medicine & Radiotherapy (MINAR), Multan	50	1968
5.	Institute of Radiotherapy & Nuclear Medicine (IRNUM), Peshawar	75	1975
6.	Larkana Institute of Nuclear Medicine & Radiotherapy(LINAR), Larkana	75	1978
7.	Nuclear Medicine, Oncology & Radiotherapy Institute (NORI), Islamabad	75	1983
8.	Institute of Nuclear Medicine & Oncology (INMOL), Lahore	85	1984
9.	Centre of Nuclear Medicine & Radiotherapy (CENAR), Quetta	50	1987
10.	Punjab Institute of Nuclear Medicine (PINUM), Faisalabad	-	1996
11.	Bahawalpur Institute of Nuclear Medicine and Oncology (BINO), Bahawalpur	50	1999
12.	Karachi Institute of Radiotherapy & Nuclear Medicine (KIRAN), Karachi	100	2001
13.	Institute of Nuclear Medicine, Oncology & Radiotherapy (INOR), Abbottabad	50	2004

Annexure-II

New PAEC Cancer Hospitals in Building Stage

No	Name of Institute	Project cost in Rs. and construction time	Land in Kanals	Development Stage (in 2005)	Bed Capacity
1.	Gilgit Institute of Nuclear Medicine Oncology and Radiotherapy (GINOR), Gilgit	545 million (2005-09)	100	Construction of boundary wall & infrastructure in process	50
2.	Phase-I Gujranwala Institute of Nuclear Medicine (GINUM)	186 million (2005-2007)	92	Construction of main building in process	50
3.	Bannu Institute of Nuclear Medicine Oncology & Radiotherapy (BINOR), Bannu	456 million (2006-09)	54	Possession of land in process	50
4.	Nawabshah Institute of Nuclear Medicine and Radiotherapy (NIAMAT), Nawabshah	495 million (2006-09)	80	-do-	50
5.	Swat Institute of Nuclear Medicine, Oncology and Radiotherapy, Swat	455 million (2006-09)	45	-do-	25
6.	D.I. Khan Institute of Nuclear Medicine, D.I. Khan	318 million (2006-09)	25	-do-	-
7.	Nuclear Medical Institute, Rahim Yar Khan	Land offered	-		-
8.	Nuclear Medical Institute, Muzaffarabad, AJK	Land offered	-		-

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