RCA

Regional Cooperative Agreement
For Research, Development and Training Related to
Nuclear Science and Technology for Asia and the Pacific

Success Story in 2011

Improving the Quality of Radiotherapy in the Asia Pacific Region

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RCA Success Story in 2011

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RCA Success Story: Improving the Quality of Radiotherapy in the Asia Pacific Region

RCA Success Story : Improving the Quality of Radiotherapy in the Asia Pacific Region

I.1. Background to the Project

I.1.1. Introduction

Worldwide cancer is an emerging issue that is causing fear in the general community and concern at the Government level. The facts are quite clear. The impact of cancer in developing countries is much greater than in the developed countries. Health statistics show that the majority of the incidence of cancer and cancer deaths are seen in developing countries. The impact is not just a tragedy for the patients and their families but it is also a great loss for those economies and a burgeoning cost for their health care systems. While the increasing burdens of social, economic and heath care costs caused by increasing numbers of cancer cases are issues for all countries, they are far more so for developing countries as their resources to fight against the disease are still scarce. It is no wonder that cancer has become a major item in the health care agendas around the world.

Although the treatment of cancer is still being advanced with new procedures and technologies, there is a wide array of treatments presently available for cancer patients. Even though cancer may be a fatal disease, if left untreated, many early-stage cancer patients can stay both free of that cancer and well, if they receive prompt diagnosis and treatment. Today, even when cancer is found in an advanced and incurable stage, there are many treatments available for the patients to prolong healthy and productive lives. Such treatments alleviate the symptoms caused by the disease and, for terminally ill patients, they provide palliation.

Radiotherapy (or radiation therapy) is a major cancer therapy along with surgery and chemotherapy (anti-cancer drug therapy). Radiotherapy utilizes ionizing radiation such as X-ray, gamma-ray and electron beams to treat cancers. Radiotherapy is provided to cancer patients alone or in combination with surgery or chemotherapy as a curative therapy (to completely cure cancers), adjuvant therapy (to assist surgery), and palliative care (to relieve the symptoms or slow down the growth of very advanced cancer). The importance of radiotherapy in cancer treatment is readily demonstrated by the fact that, while the use of radiotherapy does vary depending on the types of cancer being treated, overall, more than 50% of all the cancer patients require radiotherapy sometime during the course of the treatment of their illnesses. Unfortunately this critical need cannot not be met in most of the developing countries, because of the lack of the radiotherapy facilities and of trained personnel. In many developing countries, including many countries in the Asia Pacific region, quality assurance of radiotherapy facilities and their practices is also an area that requires additional support and training, since good quality assurance will maximise the effectiveness and the outcomes of the radiotherapy.

Under the Regional Cooperative Agreement for Research, Development and Training related to Nuclear Science and Technology (RCA), 15 Member States of the International Atomic Energy Agency (IAEA) in the Asia and the Pacific region, have joined together to focus efforts on the issue of improving cancer treatment. The RCA project on "Improvement in Quality of Radiotherapy for Frequent Cancers in the Regions" (RAS/6/040) was successfully implemented between 2005 and 2008. The RCA Member States recognized the importance of the role and the contribution of radiotherapy to cancer treatment and care, and decided to produce this success story as a means to better inform for the wider public in the region. In particular they wished to highlight the achievements of the activities, the results, the outcomes and the future prospects that have resulted from this RCA project on radiotherapy.

The overall objective was to improve the quality of the radiotherapy in recipient RCA Member States through enhancing national capacities in brachytherapy, improving the quality assurance in radiotherapy through the use of mission by the Quality Assurance Team on Radiation Oncology (QUATRO missions) and the adoption of QUATRO audit methodology.

I.1.2. Problems of Cancer and the Shortage of Radiotherapy Capacity in the RCA Region

1) Growing Number of Cancer Cases in the World and in the RCA Region

The issue of cancer is becoming more significant both in the developed and developing countries. In 2008, according to International Agency for Research on Cancer, there were an estimated 12.7 million new cancer cases and 7.6 million cancer deaths globally. These numbers are projected to increase to 17 million of new cases and 10.2 million of deaths in 2020. The majority of the new cancer cases are predicted to be in developing countries.

The RCA region is not immune from these problems and has shown an increase of cancer cases as well. In the 17 RCA Member States, there were estimated to be 5.7 million new cancer cases and 3.8 million cancer deaths in 2008, and these numbers are predicted to increase to 7.8 million of new cases and 5.3 million of deaths in 2020. It is quite clear that the incidence of cancer is increasing worldwide and the RCA region will be significantly affected in the future.

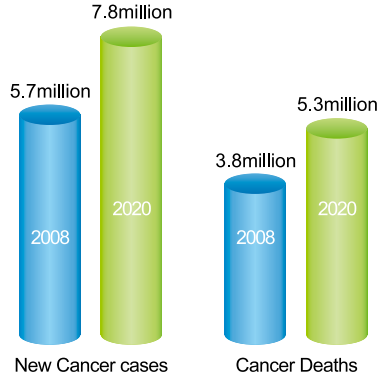

Figure 1. Cancer in RCA Menber States
Increasing number of new cancer cases and cancer deaths in the RCA Member States from 2008 to 2010 (Source data: GLOBOCAN 2008, Cancer Incidence and Mortality Worldwide: IARC Cancer Base No. 10 [Internet]. Lyon, France: International Agency for Research on Cancer; 2010.

2) Shortage of Radiotherapy Capacity in the RCA Region

Addressing the worldwide increasing burden of cancer is not just a matter of installing radiotherapy equipment. There have to be well-trained and experienced personnel to operate them efficiently and effectively and both aspects have been challenging issues for the RCA Member States. Among the issues related to the shortage of radiotherapy equipment and of personnel is also the lack of educational and

training opportunities and resources for those professionals involved in radiotherapy. There is also an issue of providing quality assurance in the delivery of radiotherapy treatment in the RCA Member States. According to a respected report on the status of radiotherapy equipment and personnel in the RCA Member States, in 2001 11 RCA Member States had less than adequate numbers of external beam radiotherapy machines, 7 Member States had less than adequate numbers of brachytherapy machines, 14 Member States had less than adequate numbers of radiation oncologists.*

I.1.3. Radiotherapy in Cancer Care

There are three major types of treatment for cancer: surgery, chemotherapy, and radiotherapy. Each of these modalities may be applied either alone or in combination, depending on the individual situation of the cancer patient. Overall, radiotherapy is applied in more than 50% of all the cancer patients. The use of radiotherapy is even higher when cancers are found at more advanced stages; most of the developing countries find themselves in such a situation. The most common types of radiotherapy treatments are external beam radiotherapy and brachytherapy.

1) External Beam Radiotherapy

External beam radiotherapy uses teletherapy machines that contain a radioisotope, such as Cobalt-60, or linear accelerators (Figure 2.). Gamma-rays or high energy X-rays are emitted from these devices and the radiation is applied to irradiate the patients' cancer cells from outside the body. The cancerous cells (tumours) are initially identified using examinations such as X-ray or ultrasonography tests or computerised tomography (CT) scans. With this information the radiation oncologists can then plan how to treat these tumours using external beam irradiation. External beam radiotherapy can be used for the treatment of a wide variety of cancers including: cancers in brain; head and neck; lung; oesophagus; pelvis; and, bones.

Figure 2. A picture of a linear accelerator used for external beam radiotherapy. The patients are positioned on the treatment table before the treatment begins.

Linear accelerator can also emit high energy electron beams, which can be used in the treatment of surface diseases in areas such as the skin and lymph nodes.

* In the report "Quantitative status of resources for radiation therapy in Asia and Pacific region." (Tatsuzaki, H and Levin, CV, Radiotherapy and Oncology, 2001), a standard number for external beam radiotherapy machine was considered to be 1 per 1000 cancer cases. A standard number of brachytherapy was considered as the capacity to treat 80% of cervical cancer patients, and an adequate number of radiation oncologists was considered to be 2 per 1000 cancer cases.

2) Brachytherapy

Brachytherapy is another type of radiotherapy, which utilizes gamma-rays from radioactive sources, such as Iridium-198, Cobalt-60 and Caesium-137, and it can be applied by itself or in combination with external beam radiotherapy to treat cancers. The radioactive sources are applied very close to the tumours, using specialized applicators that provide more concentrated irradiation compared to the external body radiotherapy. One of major applications of brachytherapy is in the treatment of uterine cervical cancers. In fact, brachytherapy is an essential part of standard treatment for most of uterine cervical cancer patients (Figure 3.). However, in some RCA Member States the availability of brachytherapy treatment and training in this speciality is limited. Brachytherapy can be used in the treatment of other cancers such as: head and neck cancer; oesophagus cancer; prostate cancer; and, breast cancer.

Figure 3. Brachytherapy therapy machine using radioactive iridium source

3) Professions Involved in Radiotherapy

The implementation of radiotherapy treatment involves many types of professions. Physicians (medical doctors) involved in radiotherapy are called Radiation Oncologists and they are responsible for the overall patient care, such as providing pre-treatment evaluation, radiotherapy treatment, general medical care, and patient follow-up. Medical Physicists are the specialists in quality management in physical aspects: they are responsible for the quality of the radiotherapy equipment and the treatment planning. Radiation Therapy Technologists are responsible for the daily implementation of radiotherapy. The roles of other professions such as radiation oncology nurses and hospital administrators are also essential in the complete operation of radiotherapy.

4) Quality Management of Radiotherapy

The practice of radiotherapy covers the complete cycle of medical care from the diagnosis, through the treatment and then to the post-therapy follow-up. Radiotherapy has many steps and involves the complex organization of radiotherapy facilities, equipment and personnel. It is important that each radiotherapy centre provides radiotherapy safely and at an adequate level of quality. For this purpose, the IAEA has long provided audits for its Member States and devised guidelines for peer-review external audits called Quality Assurance Team for Radiation Oncology (QUATRO) Programme. This programme assists in the evaluation of the quality status of the radiotherapy facilities and in the improvement of its quality management.

5) Challenges for the RCA Member States

In the face of increasing number of cancer cases worldwide, there is a shortage of the radiotherapy equipment and the trained personnel in the RCA Member States. The maintenance of adequate quality in radiotherapy is also a difficult issue for many RCA Member States. These matters are challenges that the RCA Member States are facing and this project has made a significant contribution to assist them in remedying some of these problems.

I.2. RCA Project

A project proposal "Improvement in Quality of Radiotherapy for Frequent Cancers in the Regions" was prepared and submitted for approval by the RCA National Representatives. The project was incorporated into the IAEA TC Programme and was approved in 2004 under the project code RAS/6/040 for implementation over the 4-year period from 2005 to 2008. Over the course of the project, the total implemented budget was over US$750,000.

The overall objective was to improve the quality of the radiotherapy in recipient RCA Member States through enhancing national capacity in brachytherapy, improving the quality assurance in radiotherapy by QUATRO missions and the adoption of QUATRO audit methodology.

Dr. Takashi NAKANO, Gunma University, School of Medicine, Maebashi, Japan, served as the Project Lead Country Coordinator. 15 countries participated through their respective national institutions, as shown in Table 1.

Table 1. Counterpart/partner Institutions, Staff in the Participating Ccountries

Countries(Abbreviation)	Counterpart and Partner Institutions	Counterpart Staff
Bangladesh (BGD)	National Institute of Cancer Research & Hospital	ALAM, A.M.M.Shariful
China (CPR)	Chinese Academy of Medical Sciences; Cancer Hospital	WU, Ling-Ying
India (IND)	Department of Atomic Energy (DAE) Tata Memorial Centre (TMC) Tata Memorial Hospital; Department of Radiation Oncology	SHRIVASTAVA, Shyam Kishore
Indonesia (INS)	University of Indonesia; Faculty of Medicine; Department of Radiology	SUSWORO, Raden
Japan (JPN)	Gunma University; School of Medicine; Department of Radiology and Radiation Oncology	NAKANO, Takashi - Project Lead Country Coordinator
Republic of Korea (ROK)	Korea Institute of Radiological and Medical Sciences; Korea Cancer Center Hospital; Department of Radiation Oncology; Division of Medical Services	CHO, Chul-Koo
Malaysia (MAL)	University of Malaya; Faculty of Medicine; University Malaya Medical Centre	BUSTAM, Anita Zarina
Mongolia (MON)	National Cancer Centre	NAVCHAA, Gombodorj; TUMURBAATAR, Luvsansambuu
Myanmar (MYA)	Yangon General Hospital; Radiotherapy Department Ministry of Health; Mandalay General Hospital	MAUNG, Soe Oo
Pakistan (PAK)	Pakistan Atomic Energy Commission (PAEC) Institute of Radiotherapy and Nuclear Medicine (IRNUM)	BEGUM, Naseem
Philippines (PHI)	St. Luke's Medical Center	CALAGUAS, Miriam Joy

Countries(Abbreviation)	Counterpart and Partner Institutions	Counterpart Staff
Singapore (SIN)	Singapore General Hospital; Department of Therapeutic Radiology	SETHI, Vijay Kumar
Sri Lanka (SRL)	National Cancer Institute	ARIYARATNE, Merenchi A. Yasantha
Thailand (THA)	Chulalongkorn University, Faculty of Medicine, Department of Radiology	ASAVAMETHA, Nopadol
	Mahidol University, Faculty of Medicine	DANGPRASERT, Somjai
Vietnam (VIE)	K Hospital; National Cancer Institute; Department of Breast Gyneacologic Radiotherapy	TO, Anh Dung

Figure 4. Participants of the Project Planning Meeting

I.3. Details of the Project Implementation

This project was implemented in three components:

1) Training on improvement of brachytherapy for frequent cancers in the region (6 Regional Training Courses and National Training activities by the participants);

2) Training of Radiation Therapy Technologists for improved patient care (1 Regional Training Course and National Training activities by the participants); and,

3) Implementation of QUATRO missions to obtain comprehensive information on the status of radiotherapy treatment in the participating RCA Member States (8 QUATRO missions).

I.4. Project Activities and Implementation

I.4.1. Enhancement of National Radiotherapy Professionals

Under the project, 6 Regional Training Courses have been conducted as shown in Table 2. These provided a total of 130 of radiotherapy professionals (mostly radiation oncologists), including local participants, with a better understanding of the current brachytherapy treatment techniques used to treat the common types of cancer, such as lung cancer, gastrointestinal cancers and uterine cervical cancers, as well as other subjects related to radiotherapy.

Figure 5. The lecturer and the participants working in the practical/hands-on session in the Regional Training Course on Improvements in Brachytherapy for the Most Common Cancers (held on August 4-8, 2008 at Tata Memorial Hospital in India).

Table 2. Regional Training Courses Implemented in the Project

No.	Topic of Regional Training Course	Participants	Venue	Dates
1	RTC on Brachytherapy in the Comprehensive Management of Lung Cancer	25 radiation oncologists and 4 local participants	Gunma University and National Institute of Radiological Sciences (Japan)	June 2005
2	RTC on Current Standards and Future Directions in Radiation Oncology (Jointly organized by Philippine Radiation Oncology Society, American Society for Therapeutic Radiology and Oncology, and IAEA)	21 radiation oncologists	St. Luke's Medical Centre (Philippines)	January 2006
3	RTC on Radiation Biology for Radiation Oncology	18 radiation biology professionals	National Institute of Radiological Sciences (Japan)	May 2006
4	RTC on Brachytherapy for Gastrointestinal Malignancies - Beyond Palliation	25 radiation oncologists	Gunma University and National Institute of Radiological Sciences (Japan)	October 2006
5	RTC on Optimal Management of Locally Advanced Cervical Cancer	19 radiation oncologists	National Institute of Radiological Sciences (Japan)	September 2007
6	RTC on Improvements in Brachytherapy for the Most Common Cancers	16 radiation oncologists and 2 local participants	Tata Memorial Hospital (India)	August 2008

I.4.2. Improvement of Patient Care

In 2005, the IAEA produced "A Syllabus for the Education and Training of RTTs (Radiation / Therapist / Therapy radiographers)", which provided educational guidelines. This material was used at a Regional Training Course for the professionals, who were involved in the training of radiotherapy technologists in the RCA Member States. The course was held at the Tata Memorial Hospital in India in August 2007 and 24 professionals, including local participants, participated. They reviewed the IAEA syllabus and its methodology with a view to the establishment of local training programmes for radiotherapy. In addition, all participants were given a copy of the Compact Disk containing the report of the "IAEA-AFRA-RCA task group for developing a syllabus for the education and training of Radiation Therapists (RTT)".

Figure 6. Brachytherapy applicators used for the treatment of cervical cancer.

I.4.3. Implementation of QUATRO Missions

QUATRO (Quality Assurance Team on Radiation Oncology) missions were conducted according to the IAEA guidelines as part of this project, with the aim of assessing and improving the quality status of radiotherapy facilities and services in the RCA region. The QUATRO Programme was developed by the IAEA to provide guidelines for peer-reviewed external quality audits of radiotherapy facilities. The purpose of the QUATRO missions was not limited to auditing the quality of the activities in the institutions. It also trained the institutions to build up a capacity to perform audits by forming in-house audit teams similar to QUATRO team. In addition, to make the programme sustainable, the missions advised on the implementation of national training programmes for auditors so that they could perform inter-hospital audits.

Table 3. QUATRO Missions Implemented in the Project

No.	Countries	Audited Institutions(City)	Dates
1	Mongolia	National Cancer Center (Ulaanbaatar)	September 2005
2	Sri Lanka	National Cancer Institute (Maharagama)	November 2005
3	Thailand	Siriraj Hospital (Bangkok)	November 2005
4	Malaysia	University Malaya Medical Centre (Kuala Lumpur)	March 2006
5	Indonesia	Dr. Cipto Mangunkusumo National General Hospital (Jakarta)	April 2006
6	Vietnam	National Cancer Institute, K Hospital (Hanoi)	May 2006
7	China	Chinese Academy of Medical Sciences, Cancer Hospital (Beijing)	June 2006
8	Philippines	St. Luke's Medical Center (Quezon City)	June 2007

QUATRO missions have been undertaken by teams from the RCA Member States, comprising a radiation oncologist, a medical physicist and a radiotherapy technologist, and they audited one institute in each of the following Member States as shown in Table 3.

Figure 7. Participants of the Regional Training Course on Quality Audits in Radiation Oncology held in Dr. Cipto Mangunkusumo National General Hospital in Indonesia in October, 2008. The participants were trained on the methodology of QUATRO audit programme.

In 2008, a Regional Training Course on Quality Audits in Radiation Oncology was implemented in Indonesia with 35 participants. The objective was to increase the capacity of RCA Member States to conduct their own quality assurance audits of the radiotherapy facilities. Teams of radiation oncologists, medical physicists and radiotherapy technologists were trained in the contents and methodology of the QUATRO Programme so that they could carry out their own audits in their own countries

I.4.4. Coordination Meetings

During the project implementation, there were two project coordination meetings, which reviewed and assessed the project progress as well as adjusting the project work plan and activities. The meetings also provided opportunities for all participating Member States to present and discuss the activities and progress they were achieving at the national level within the scope of the regional project. This ensured that all participants were well-informed about the activities being undertaken in other countries and assisted in establishing coordination and synergy for effective cooperation.

I.4.5. Other Activities

The project provided support for the professional development of seven professions from the RCA Member States, India, Malaysia, Singapore and Thailand to enable them to attend the International Conference on Advances in Radiation Oncology, which was held at the IAEA in Vienna, Austria. Additionally, in-kind contributions through the project made it possible to provide radiotherapy equipments such as: a ring applicator to improve training on high dose rate brachytherapy for cervical cancer; a dosimetry kit; and equipment for a QUATRO Asia kit.

Figure 8. Participants working in hands-on/practical sessions of Regional Training Course

I.5. Results and Impacts

I.5.1. Regional Project Achievement

Overall, the participating RCA Member States have reported that the project improved the quality of radiotherapy in the RCA region. Currently almost all the Member States have national quality assurance programmes, involving radiotherapy machines and patient safety. The Regional Training Courses were planned as "Train-the-Trainers" courses and intended to enable participants to make use of the knowledge and skills gained to conduct similar courses in their own countries. They all received copies of the training materials used for the Regional Training Courses.

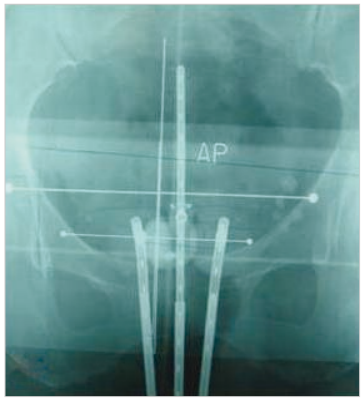

Figure 9. X-ray photograph of inserted applicators are used for the treatment planning of brachytherapy.

As a result of the QUATRO missions, participating RCA Member States initiated actions to improve the quality of their radiotherapy practice by implementing the recommendations of the QUATRO audits.

I.5.2. Enhanced Capacity of National Professionals

The Regional Training Courses have provided valuable contributions to improved brachytherapy in the participating countries, as demonstrated by the wide array of activities that were conducted by the Regional Training Course participants in their own countries.

India:

India hosted two Regional Training Courses in the project and this experience also strengthened the capacity the radiotherapy centre (Tata Memorial Hospital) as a national and regional training institution. Presentations of the contents of Regional Training Courses were made at the annual meetings of the Association of Radiation oncologists' of India, Association of Radiotherapy Technologists of India and Medical Physics conferences. There has been improvement in quality of radiotherapy delivery all over the country. By the end of 2010 three dimensional conformal radiotherapy (3D-CRT) was being practiced in 118 institutions. There were 157 Linear Accelerators (LA) in use, as some centres have more than one LA). In 2005 there were only 39 centres with this facility, showing the rapid growth that has occurred in this area. Intensity-modulated radiotherapy (IMRT) is available in 69 institutions. An indigenous Linear Accelerator has also been developed and is available at three institutions. There are over 20 indigenous telecobalt (Cobalt-60) machines installed in various institutions and Multileaf Collimators (MLC) are being developed for these

telecobalt machines to enable 3D-CRT to be delivered through these telecobalt machines. The RTC programme has been successful in stimulating interest nationally in these developments.

Indonesia:

In Indonesia, the Regional Training Course participants presented the course materials in meetings with the Indonesia Radiation Oncology Society (IROS) and their own institutions. They have also shared the knowledge gained from these Regional Training Courses with the professionals nationally. As a result, the National Committee for Radiotherapy was established as a further step to improve the national situation with regards to radiotherapy. The National Committee comprises members from IROS, the National Nuclear Energy Agency, the Nuclear Energy Control Board and the Ministry of Health.

Myanmar:

In spite of the lack of the radiotherapy equipment in Myanmar, the participants of the Regional Training Courses were able to treat head and neck cancers by adopting the innovative use of brachytherapy applications introduced in these training courses. This resulted in an increased number of cancer patients treated with brachytherapy.

Pakistan:

In Pakistan, the national project team, formed by radiation oncologists, medical physicists and radiotherapy technologists from the ten cancer treatment centres of Pakistan Atomic Energy Commission (PAEC), has made tremendous efforts to improve the quality of radiotherapy within the country. In collaboration with Radiological Society of Pakistan, the national project team conducted four national workshops and two national and international conferences on various radiotherapy topics. Efforts have also been made to raise awareness among policy makers about the importance of radiotherapy. This has resulted in an increased number of radiotherapy centres and the upgrading of two participating cancer centres in Pakistan. The establishment of the national training programme for radiotherapy technologists in Pakistan was approved by Pakistani authorities in December 2010. This effort will provide the first diploma course for radiotherapy technologists in the Pakistan public sector. In 2005 and 2008, in-house national surveys were conducted to assess the national radiotherapy status in Pakistan. The surveys showed improved quality assurance and quality control status in the participating centres in the country. The participants from the Regional Training Courses shared their knowledge with co-workers by hosting a training course that focussed on a range of issues including: current standards and future directions in radiation oncology; teaching postgraduate courses; adopting quality assurance programmes; and, initial efforts to establish radiotherapy treatment protocols in the country.

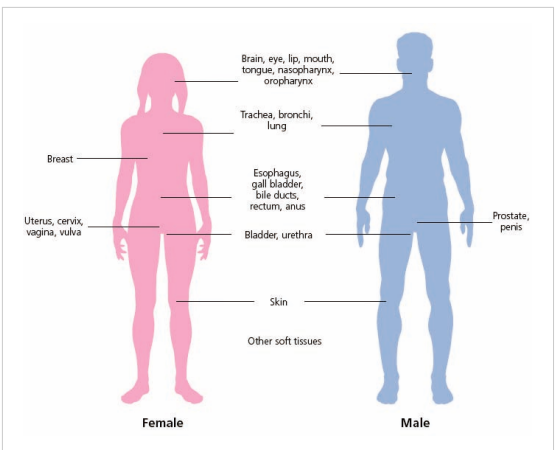

Figure 10. Body sites in which brachytherapy can be used to treat cancer.

Philippines:

In the Philippines, participants of the Regional Training Courses have conducted two post-graduate courses for radiation oncologists, medical physicists and radiotherapy technologists so as to transfer to others the knowledge they had gained. The topic of brachytherapy was incorporated into post graduate courses in the Philippines following the Regional Training Courses. Those who had participated in the Regional Training Courses gave lectures during the scientific meetings of the Philippine Radiation Oncology Society (PROS) and other local oncology societies such as the Philippine Society of Oncology (PSO) and the Society of Gynecologic Oncology (SGOP). In this way, the Regional Training Course participants shared the new knowledge and skills they had gained to the other oncology professionals in the country.

Sri Lanka:

In Sri Lanka, participants of the Regional Training Courses conducted several workshops in hospitals and in the College of Oncologists to disseminate the knowledge they had acquired. Project participants also involved themselves in the education of radiation oncologists, medical physicists, and the radiotherapy technologists both at pre- and post-graduate levels.

Thailand:

In Thailand, the participants of the Regional Training Courses passed on their newly acquired knowledge and skills through presentations and workshops to the Royal College of Radiologist of Thailand and to the Thai Society of Therapeutic Radiology and Oncology. Some of the materials that were distributed through the workshops were integrated into daily clinical practices. In addition, a national training course on 3D planning was held in conjunction with the IAEA.

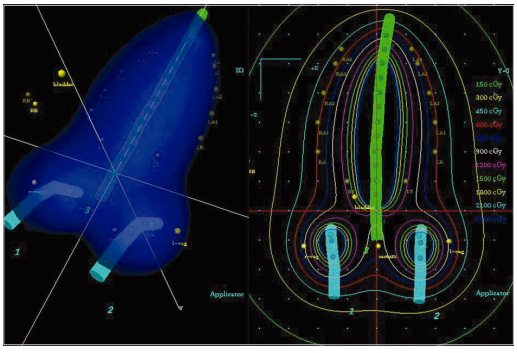

Figure 11. An example of brachytherapy treatment plan for cervical cancers, with the calculated dose distribution. Brachytherapy is an essential part of standard treatment for uterine cervical cancer.

Vietnam:

In Vietnam, the participants of the Regional Training Courses have shared their knowledge within their own institutions; yearly from 2006 to 2008 at the annual Ho Chi Minh City Conference on cancer control as well as the National Conference on Cancer Control held in September 2008.

I.5.3. Improved Quality Assurance in Radiotherapy Practices

QUATRO missions conducted under this project have provided comprehensive audits of radiotherapy services for the institutions in participating countries. Multidisciplinary teams comprising a radiation oncologist, a medical physicist and a radiotherapy technologist have been recruited from within the RCA region to undertake the audit of institutions, equipment, infrastructure and operational clinical practice. These missions have provided the institutions with in-depth reports on their audit findings, which also contain recommendations for improvement. These audits have increased the awareness of quality

assurance in the practice of radiotherapy in the RCA region. Member States have continued the implementation of QUATRO audits to improve the quality of radiotherapy practice through their national activities as well as another IAEA project that followed after this one.

The reports of the QUATRO audits are confidential between the IAEA and the audited institutions and therefore the results cannot be described in specific detail. However, some successful outcomes from these QUATRO missions are important to mention here. For example, an institution, which was audited in this project, has recently received a follow-up QUATRO audit by the same team of professionals four years later. This follow-up audit has found that there has been a radical improvement in radiotherapy practices and equipment. In addition they recognised the amount of renovation activity that had been achieved by the institution. It was clear that most of the recommendations made in the initial audit had been incorporated by the institute to the best of its abilities. The procurement of the new treatment machines and other related facilities helped the institute to open up new avenues for implementing radiotherapy at a more sophisticated level and a significant improvement in the managerial and the technical aspects of patient care had also been achieved. This example clearly demonstrates that the QUATRO audits provide benefits not only from the assessment of the status of radiotherapy facilities in the RCA region but they also contribute to the increased awareness of the importance of quality assurance in radiotherapy and to an improvement in the daily clinical practices for cancer patients.

Following the QUATRO missions, Member States have reported that post-audit changes have been made at the audited institutions as shown in Table 4.

Table 4. Results of QUATRO Missions in the Member States

Country	Results of post-audit change by QUATRO missions in the Member state
India	Experts from India have participated in the QUATRO missions, and they have reported that they gained the knowledge of quality assessment audit in the process, which was beneficial in the quality management of their own centres. The experts have presented their experiences in various forums in India and sensitized several institutions to improve quality of radiotherapy delivery in the country.
Indonesia	The audited institution has sent the QUATRO Programme documents to all the radiotherapy centres in the country and suggested conducting internal audit following the QUATRO programme. Indonesia has established the National Committee of Radiotherapy, which formed the National Auditor Team for the nation.
Malaysia	After the QUATRO audit, staff numbers, especially radiation oncologists, has been increased. More multi-discipline team meetings have been established, and the QUATRO document is being used as additional reference for the radiation oncology department.
Mongolia	In the National Cancer Centre, the recommendations provided by the QUATRO audit team have been implemented following the audit in Mongolia.
Philippines	Following the experience of the QUATRO audit and the RTC on the QUATRO programme, the recommendations, especially those on documentation, have been implemented. The Philippines is capable of conducting self-audits at a national level and it has been suggested that ,in the future, self-audits be conducted and the reports sent to the IAEA. While St. Luke's Medical Centre, the audited centre, has successfully undertaken its own QUATRO audits, other radiotherapy facilities in the country are using the QUATRO audit checklist to assess the quality of their radiotherapy. This application of the QUATRO Programme has resulted in heightened awareness and improvement of the quality of radiotherapy services in the nation.

Country	Results of post-audit change by QUATRO missions in the Member state
Sri Lanka	The QUATRO audit revealed the need for more medical physicists as well as the lack of functioning brachytherapy treatment. A plan to install new machines with Cobalt-60 sources is under way, and the audited centre is making efforts to implement the recommended improvements.
Thailand	In the Siriraj Hospital, the mold room processes and the portal imaging in the radiotherapy have been improved. A training course on quality assurance and a workshop on radiotherapy beam data acquisition have been conducted. The QUATRO document has been discussed by the radiotherapy society with a view for adoption of the recommendations of the QUATRO audit.

I.5.4. Enhanced Cooperation for Improvement of Radiotherapy

The activities and successes achieved by this project have encouraged the participating Member States to initiate a development to further strengthen regional cooperation for the improvement of radiotherapy in the region.

Figure 12. Members of inaugural meeting for South East Asian Radiation Oncology Group (SEAROG). In order to maintain the sustainability of the project, the SEAROG has made efforts to improve the opportunities for education for radiotherapy professionals and implement QUATRO audit program in the participating nations.

The project has directly contributed to the organization of the South East Asia Radiation Oncology Group (SEAROG) by radiation oncologists from Indonesia, Malaysia, the Philippines, Singapore and Thailand. SEAROG was inaugurated in May 2007 and formed from the National Radiation Oncology Societies in the following Member States: the Indonesian Radiation Oncology Society (IROS); the Malaysian Oncological Society (MOS); the Philippine Radiation Oncology Society (PROS); the Singapore Radiological Society (SRS); and, the Thai Society for Therapeutic Radiology and Oncology (THASTRO). They share a common geographical location, disease patterns and problems, and resources. By working together they will to find solutions to these problems.

This RCA project has played a major role in the formation and organization of SEAROG. Most of the founding member/officers of SEAROG have participated in the RCA/IAEA meetings and have seen the need for a regional radiation oncology group that would provide sustainability in this area long after the project has been completed. Many formal and informal SEAROG meetings were undertaken during the RCA project meetings. As a part of its programme of activities, SEAROG is making efforts to continue to provide educational opportunities for the radiotherapy professionals and also to implement the QUATRO audit programme at the national level in its member countries.

I.6. Project Outcomes and Future Prospects

I.6.1. Project Outcomes

The main project outcome has been the overall improvement in the quality of radiotherapy in the RCA region, which has been achieved through investments in building up of human capacity and the strong commitment to regional cooperation.

The eight Regional Training Courses implemented under this project has enabled a total of 189 professionals to be trained in the areas of brachytherapy, radiotherapy technologist training and the QUATRO audit programme. The knowledge and the teaching materials from these Regional Training Courses have not only been shared by the participants with others in their home countries but they have been the key to providing knowledge and experience in the running of follow up national training courses. In some Member States, such as Pakistan, the National Project Teams have made tremendous efforts to improve the status of the radiotherapy practice.

The main achievement of the project has been the formation of a basic structure for training in radiotherapy within each of the participating Member States as well as among the other Member States. While the formal training provided through this RCA project with the Regional Training Courses, the National Counterparts in the Member States have made considerable efforts to disseminate the knowledge acquired through various mechanisms ranging from in-house workshops to national training courses. These activities have not only improved the quality of radiotherapy but also have contributed to the build up of both the national and the regional capacity to train radiotherapy professionals.

Figure 13. Source application are placed in the body for accurate positioning

Comprehensive audits by the QUATRO teams have been conducted in eight RCA Member States (China, Indonesia, Malaysia, Mongolia, Philippines, Sri Lanka, Thailand and Vietnam). These participating Member States have reported that they have initiated actions to implement the recommendations made by the QUATRO audits and that the QUATRO missions have contributed to the improvement of quality assurance in the audited radiotherapy centres. Experience gained from the implementation of the QUATRO mission in this project and the Regional Training Course on the contents and the methodology of the IAEA QUATRO audits has enabled the Member States to conduct audits domestically. Thus, the QUATRO audits have provided not only an assessment of the status of radiotherapy practices but they have also contributed to both increasing the awareness of quality assurance in radiotherapy and improving daily clinical practice in the RCA Member States.

Finally, a special benefit from this RCA project in radiotherapy has been in the area of regional cooperation among the RCA Member States. At present, there are no regional academic or professional societies in radiation oncology that cover the entire Asia Pacific region. The RCA is possibly the only but certainly one of the few opportunities for such a wide membership of the Asia Pacific region to be able to readily exchange information and/or build up cooperation to improve the status of radiotherapy in the region as a whole. One of the most visible outcomes of this regional cooperation has been the formation of South East Asian Radiation Oncology Group (SEAROG) by the radiation oncologists from Indonesia, Malaysia, the Philippines, Singapore, and Thailand. The goal of the SEAROG is to improve the radiation oncology in the Southeast Asia through cooperation among the neighbouring countries. SEAROG is making an effort to provide educational opportunities for the radiotherapy professionals and implement QUATRO audits within the region.

I.6.2. Future Prospects

Although this RCA project on radiotherapy has achieved a great deal, the issue of cancer still poses great challenges for the RCA region. RCA Member States consider the ongoing improvement of radiotherapy treatment as one of its regional cooperation priorities and it is included in the RCA Strategic Priorities for 2012 to 2017. Member States are aware that they need to continue to make efforts to build up their national capacities in radiotherapy. The imbalance between the current number of radiotherapy facilities and trained personnel and the increasing number of cancer patients remains a challenge for the Member States. National authorities will need to continue their effort to increase the number of radiotherapy facilities and trained personnel. Member States also need to continue building up their own national capacities to train the necessary numbers of personnel for radiotherapy. Follow-up QUATRO missions are an important requirement to sustain the momentum achieved through the initial QUATRO audits and are a key for assessing the progress and the future needs for improved quality in radiotherapy practice in the RCA region.

RCA Success Story in 2011

Part. II

Background to the Publication

II Background to the Publication

II.1. Objectives of Publication of RCA Success Stories

One of the major roles of the RCA Regional Office (RCARO) is to promote and publicize the achievements of the RCA programme. A key element in this task is the preparation and maintenance of a portfolio of achievements set out in the form of success stories. These success stories also contribute to the achievement of the RCA Vision of earning recognition in the region as a resource capable of contributing to the provision of high impact solutions to significant technological problems in the region using nuclear science and technology.

Past success stories have been in a short one page leaflet format. The publication in this booklet format is responding to requests to provide more detailed information that highlights the successful achievements together with the socio-economic impacts in the region as well as some basic information on the project.

What is the RCA?

The RCA is an intergovernmental agreement among the International Atomic Energy Agency (IAEA) Member States of South Asia, South East Asia and the Pacific, and the Far East that entered into force in 1972 under the aegis of IAEA. It is an abbreviation for "Regional Cooperative Agreement for Research, Development and Training related to Nuclear Science and Technology for Asia and the Pacific".

The following 17 IAEA Member States in the Asia and the Pacific region are the current signatories to the RCA: Australia (AUL), Bangladesh (BGD), The Peoples' Republic of China (CPR), India (IND), Indonesia (INS), Japan (JPN), The Republic of Korea (ROK), Malaysia (MAL), Mongolia (MON), Myanmar (MYA), New Zealand (NZE), Pakistan (PAK), The Philippines (PHI), Singapore (SIN), Sri

II.2. History of Publication of RCA Success Stories

The development of good RCA success stories has been a regular discussion point at past RCA meetings and, following the establishment of the RCARO, this task has been assigned to the RCARO. A brief review of the milestones in chronological order is set out below.

Initial Formulation

* **Opening of the RCA Regional Office, March 2002, Daejeon, Republic of Korea**
  This was a landmark event in the history of the RCA. The publication task was assigned to the RCARO as a part of its mission. In 2002 the RCARO printed the "RCA 2001 Annual Report" which included RCA success stories from the RCA Member States. The report was presented at the 31st National RCA Representatives General Conference Meeting (GCM) in September 2002 and the Meeting requested the RCARO to send it to all RCA Member States and also to international development organizations.

  The Success Stories in the 'RCA 2001 Annual Report' gave summary on the Thematic Sectors at the time: Agriculture, Health, Environment, Industry, Radiation Protection and Energy / Research Reactor / Radioactive Waste Management.

  The Meeting made recommendations concerning the highlighting of those RCA projects that: contributed to the socio-economic development of the region; demonstrated the distinctive advantages of nuclear science and technology to solve or to contribute to the solution of significant regional problems; showed potential sustainable benefits; and, displayed the potential for collaboration with others.

* **25th National RCA Representatives Regional Meeting (NRM), May 2003, Colombo, Sri Lanka**
  It was agreed that the RCARO should prepare the RCA Success Stories in the form of a brochure.

Development of Success Story Guidelines

* **5th RCARO Advisory Committee (AC) Meeting, April 2004, Islamabad, Pakistan**
  The Meeting recognized that there was a need to provide guidelines to help the Lead Country Coordinators to produce the Success Stories. Representatives from Australia (John Easey), the Philippines (Alumanda dela Rosa), Malaysia (Nahrul Alang Md Rashid) and Japan (Hideo Tatsuzaki) drafted guidelines and recommendations.

Publication of the 1st and 2nd Batch of Success Stories

The drafts for the 1st batch of five RCA Success Stories in leaflet form were submitted to the 2nd Standing Advisory Committee Meeting (SAC), which was held in conjunction with the 28th RCA NRM in March 2006. These drafts were further refined and edited by the stakeholders including the relevant Project Lead Country Coordinators, IAEA/RCA Focal Person, a professional editor and the RCARO.
The 1st batch of five RCA Success Stories in leaflet form was published in May 2007. A similar process was used for the 2nd batch of four Success Stories published in 2008. Each batch of leaflets was distributed to Member States and other target readers. The leaflets were also handed out at appropriate meetings and conferences held in the region.

Monitoring of Impact

* **30th NRM, April 2008, Hochiminh City, Vietnam**
  At this Meeting it was recommended that the RCARO conduct a survey on the impact of the two batches of the RCA Success Stories that had been published and distributed, before continuing with publication of the 3rd batch. A survey questionnaire was designed by the RCARO and circulated to Member States for comment.

* **31st NRM, April 2009, Tokyo, Japan**
  The survey results were reviewed. Based on the positive survey results, the Meeting decided to proceed with the publication of the 3rd batch of Success Stories.

Test Publication in Booklet Form

* **38th RCA GCM, September 2009, Vienna, Austria**
  In addition to the four stories that made up the 3rd batch of the RCA Success Stories, the Meeting decided that there should be a trial publication of a Success Story in booklet form and the topic selected was, "Combating Soil Erosion-Caused Land Degradation in the Asia and the Pacific Region".

Publication of the 3rd Batch of Success Stories

* **32nd RCA NRM, April 2010, Manila, the Philippines**
  The drafts for the 3rd of RCA Success Stories; four stories in leaflet form and one story out of the four in booklet form, were submitted to the 10th Standing Advisory Committee (SAC) held in conjunction with the 32nd RCA NRM in April 2010. As decided at the Meeting, the 3rd batch was successfully published and distributed after editorial refinements and inputs from Member States.

The NRM also requested the RCARO to proceed with the 4th batch of RCA Success Stories; one story in leaflet form on the RCA/UNDP Tsunami Project, and the other one in booklet form focusing on the area of radiotherapy. This decision by the Member States recognized the leaflet and booklet forms as very effective and useful means for highlighting the RCA's contributions in the region. The Meeting, which was attended by IAEA staff, including the Deputy Director General, Department of Technical Cooperation, noted that the 1st booklet had been a good example for providing information about the RCA's contribution to regional cooperation and recorded appreciation of the RCARO's highly valued endeavors in producing these success stories.

II.3. Summary of RCA Projects

The RCA projects have assisted Member States to gain additional knowledge and experience in the field of nuclear science and technology. This has enabled them to increase their contribution to their national programmes with these enhanced technical capabilities and capacities. Table 5 provides a detailed breakdown of the current and past projects with regards to the numbers in each of the nine thematic areas/sectors and 23 technical areas. Member States have responded about the significant benefits they have received from these projects and have provided many examples of the strong outputs and outcomes that have been generated as a consequence of their participation.

Since its establishment in 1972, the RCA Programme has delivered significant benefits to the participating Member States through 119 projects. As of January 2010, the following inputs of training and assistance have been delivered to the Member States:

- 502 Regional Training Courses for 8,245 participants;
- 191 Regional Workshops or Regional Technical Meetings for 2,236 participants;
- 173 Project Management Meetings for 2,773 participants;
- 124 Fellowships;
- 64 Scientific Visits; and,
- 1,033 Expert missions.

The total expenditure on the programme has been almost US$60 million.

Table 5. Number of RCA Projects versus Areas

Sector	Technical Area		No. of Projects	
			Completed	Active in 2010
Agriculture	Animal health and production		3	0
	Food irradiation		4	2
	Plant breeding		3	1
	Soils and land use		2	0
	Sub-total		12	3
Human Health	Cancer		8	1
	Joint and bone disorders		3	0
	Medical physics		0	1
	Nuclear medicine imaging		5	1
	Radioimmunoassay		4	0
	Tissue grafts		2	0
	Sub-total		22	3
Industry	Industrial applications (sponsored by UNDP)		13	0
	Nuclear analytical systems (NAS) and nucleonic control system(NCS)		2	0
	Non-destructive testing (NDT) and tomography		3	1
	Radiation processing		5	1
	Tracers and sealed sources		5	1
	Sub-total		28	3
Environment	Air pollution		2	1
	Fresh water resources		6	1
	Marine and coastal environment		4	2
	Sub-total		12	4
Others	Energy	Sub-total	9	0
	Radioactive waste management	Sub-total	1	0
	Radiation Protection	Sub-total	7	1
	Research reactor utilization	Sub-total	8	0
	Technical Cooperation between Developing Countries	Sub-total	5	1
TOTAL			104	15

II.4. Criteria for the Selection of the RCA Success Stories

A success story should be able to clearly describe how regional cooperation and the applications of nuclear technology have contributed to the solution of significant problems which would have then resulted in socio-economic benefits at the national level.

Examples could be:

- The introduction of new agronomic practices through RCA projects has resulted in an increase in agricultural productivity and this in turn has led to local farmers increasing their productivity and income;
- Improvements in the quality of health-care from the RCA projects are resulting in better quality of life as well as less lost time for workers, which is resulting in greater productivity, higher incomes and providing a boost to local economies;
- Improving productivity and safety of industrial processes through the RCA projects is boosting the output of local industries, increasing employment, decreasing accidents and benefiting the local economy; and,
- Monitoring environmental pollution using technologies transferred through the RCA projects has resulted in the local agencies introducing better control of plant emissions, which has lowered locally the incidence of health-related problems, decreased medical costs, and increased local school attendance and level of achievement at school.

Mere completion of activities of a project such as training of personnel should not be considered as a success story. A success story is not a progress report. However the establishment of a new capability and capacity that has the potential to benefit the local community might be something that should be publicized.

A success story may either highlight the impact from "human interest" or "technical interest" point of view and preferably both aspects can be represented. "Human interest" stories would probably come most readily from projects covering Agriculture, Environment and Human Health Sectors, while "technical interest" stories would be mostly from Energy, Industry, Research Reactor and Radiation Protection Thematic Sectors.

Since most success stories would be the result of a combination of contributions from other inputs as well as those from the RCA projects, it would be necessary to highlight the contribution of the RCA Programme. For example, the reduction in cancer deaths in a country could be due to many other factors in addition to improvement of radiotherapy facilities. Claiming credit for the total reduction could affect credibility.

II.5. Published RCA Success Stories

The following 14 RCA Success Stories have been published: in 13 leaflet form and 1 in booklet form, which are available on the RCARO website at www.rcaro.org.

Table 6. List of 14 Published Success Stories

BATCH	AREA	TITLE
First Batch	Air Pollution	Nuclear analysis of airborne particles provides a key to alleviating air pollution
	Drinking Water	Isotope hydrology helps find water fit to drink
	Polymer Processing	New materials from natural polymers: using nuclear technology to improve nature's gifts.
	Tissue Grafting	Restoring health and saving lives: global benefits from RCA's trail blazing
	DAT on Nuclear Medicine	'Distance assisted training' strengthens regional skills in nuclear medicine.
Second Batch	Plant Breeding	Cultivating better crops for sustainable agriculture
	Marine Environment	Turning the tide against marine pollution
	NDT Applications	Strengthening skills in NDT for regional industry
	Geothermal Investigation	Harnessing energy from the heart of the earth
Third Batch	Livestock Productivity	Improving livestock productivity while conserving the environment
	Soil Erosion	Combating soil erosion-caused land degradation in the Asia and the Pacific Region(1 leaflet + I booklet)
	Energy Planning	Enhanced energy analysis and planning capabilities
	Radiotracers Technology	RCA innovation supporting regional chemical, petrochemical and petroleum industries

Published Stories in Brief

* **Improving Air Quality**
  Through the application of the nuclear techniques transferred through the RCA projects, local agencies now are able to better monitor and understand air pollution. These new technologies provide them with the means of obtaining important information to assist in national efforts on the introduction of better control of emissions from industries and other sources. The projects have contributed to the development of a significant regional database to provide information about air pollution in the region, including source, distance, and trans-boundary aspects.

* **Contributing to the Search for Fresh Water**
  Applications of isotope hydrology techniques in RCA Member States have resulted in more accurate assessment of groundwater behavior, providing better information on the search for and management of clean drinking water resources. Use of these techniques has also contributed to informed decision-making on water policy and control in the region.

* **Enhancing Materials Properties**
  The transfer of radiation processing technology to the RCA Member States has helped them develop the capabilities to produce new and innovative products and deliver them to markets. An example is a radiation processed polymer (Chitin), which is being developed for medical uses.

* **Enhancing the Use of Tissue Graft Materials**
  This project has greatly assisted national agencies build up their capabilities as well as their training and physical infrastructure in the production, use and promotion of tissue graft materials prepared using radiation sterilization. This has resulted in tissue grafts become much more affordable, more widely available and more widely used in RCA Member States. This success has served as a role model for other regions.

* **Assisting Nuclear Medicine with Training at a Distance**
  The demand for qualified nuclear medical technologists is high in the region as the number of nuclear medicine departments grows at a rapid rate. There are competing demands for technologists to be trained while at the same time these technologists are urgently required to be working in the departments. The RCA projects have established a distance assisted training programme, which has been able to address both demands. Hundreds of students from many Member States have taken part in the programme and other regions are now taking up the use of these training materials.

* **Improving Crops**
  The RCA Member States are acquiring nuclear technology to assist them to breed new varieties of crops which will have higher yield rates, greater resistance to drought, salinity, disease and pests as well as

improved quality for consumers. Several high performance varieties of soybean, groundnut, mungbean, wheat, and sesame have already been released to the market, and a number of other new crop varieties are being field-tested prior to commercial release.

* **Tackling Marine Pollution**
  RCA Member States have improved their regional capacity to deal with aquatic pollution in coastal areas. Hydrologists have been trained in the use of nuclear and conventional techniques and tools to sample and analyze the composition water-borne pollutants and then use this information, together with relevant hydrodynamic models, to carry out risk assessments using advanced computer simulation tools.

* **Strengthening Skills in Non-Destructive Testing (NDT)**
  NDT techniques use penetrating radiation (i.e., gamma- or x-rays) to examine the internal state of materials (such as identification of defects) and are widely applied in industry. A total of 300 personnel from 14 RCA Member States were trained initially through the RCA projects. In turn, these individuals have then provided training, disseminating the NDT knowledge and technology at the national level. The current aim is the harmonization of the region's NDT qualification and certification process by 2012.

* **Helping the Search for Geothermal Power**
  In the search for sustainable energy sources, some RCA Member States have been developing geothermal power, which has now reached a collective capacity of about 3,500MWe. The RCA project has been providing assistance in the search for suitable new geothermal sources through the provision of regional training in the utilization of isotopic techniques, including natural isotopes and artificial radiotracers. These techniques have provided valuable information on reservoir characteristics especially when the reservoirs are subject to changes in pressure, temperature, and fluid flow. Member States have carried out investigations on 33 new geothermal prospects (about 130 geothermal springs) and have contributed to the development of several geothermal power plants in Member States such as the India, Indonesia, and the Philippines.

* **Improving Livestock Productivity while Conserving Environment**
  The improved productivity of the livestock has enabled RCA Member States to: increase the weight gain and milk production of farm animals; achieve genetic improvement in the livestock; reduce methane emissions through improved nutrition by developing new feeds and Urea Molasses Multi-nutrient Blocks (UMMB); and, the development of reproduction strategies using nuclear and nuclear related techniques. Artificial Insemination (AI) with diagnostic support, in the form of radioimmunoassay (RIA) technology, has also been used to improve reproductive efficiency through a better understanding of the reproductive status of livestock. China, India, Malaysia, Mongolia, Myanmar, Pakistan, Sri Lanka, Thailand and Vietnam consolidated their ability to sustain the use of RIA by making the standards and quality control samples in their national laboratories.

* **Preventing Soil Erosion caused Land Degradation**
  The use of a nuclear based technique known as "Fallout Radionuclides" (FRNs) in the RCA's regional projects has significantly contributed to prevent soil erosion caused land degradation and at the same

time protect land and water resources and environmental sustainability in the region. It has been widely accepted as a technique and is even being used by the Ministry of Soil and Water Resources, China to establish water quality maps. Effective implementation of this FRN technology has involved RCA Member States forming teams with multidisciplinary skills and expertise. They have also had to invest in essential infrastructure and equipment so that they could perform the required field and laboratory work.

* **Enhancing Energy Analysis and Planning Capabilities**

RCA Member States have responded to the drastic increase in energy demands causing by the fast economic and population growth in the region. National teams have been assisted by an RCA project to conduct national studies on the design of long term energy strategies and evaluate the impact of environmental regulations on energy system development using the advanced computer modeling package, "Model for Energy Supply Strategy Alternatives and their General Environmental Impacts" (MESSAGE). Their studies have directly supported or influenced the decision-making process for national or local long-term electricity planning and have provided policymakers with technically sound information. This project also has fostered regional cooperation and facilitated integrated analysis of regional energy and environmental issues. Most RCA Member States have seriously considering adopting the model for energy planning and policy.

* **Radiotracers for Innovation Supporting Chemical, Petrochemical and Petroleum Industries**

Radiotracers and sealed source technologies are well known as effective tools for online control and measurement as well as being indispensible agents for troubleshooting in the operation of chemical, petrochemical and petroleum plants. However opportunites for RCA Member States to gain the benefits from the use of these technologies are limited due to the highly commercial nature of the production advantages that can be achieved. In spite of these difficulties RCA projects have been responding to the needs of regional industries by transferring knowledge and enhancing capabilities and capacities. Two examples of technologies that have been transferred for use in areas of significant importance to the industries of the Member States are: Interwell Tracer Technology (IWTT), which is used in oil fields; and, Gamma Scanning, which is used to investigate operational problems in distillation columns in chemical and petrochemical and petroleum plants.

RCA Success Story in 2011

Improving the Quality of Radiotherapy in the Asia Pacific Region


MON
CPR
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VIE
PAK
IND
MYA
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Published by RCA Regional Office
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