

## Thematic Sectors

RCA Projects are designed fundamentally to meet the needs of the Member States and are in tune with the Agencies Technical Cooperation goals and UN Millenium Development Goals. The projects are prepared with an objective to increasingly promote tangible socio-economic impact by contributing directly in a cost effective manner to the major sustainable development priorities of each country within the framework of national development plans. The thrust areas are identified based on the regional needs and also on the deliverable direct socio-economic benefits likely to accrue from the implementation of projects under these areas employing nuclear techniques as one of the key elements. These thrust areas are referred as Thematic Sectors in RCA parlance and projects are classified under these Thematic Sectors. The RCA Thematic Sectors includes Agriculture, Human Health Care, Industry, Environment, Energy, Research Reactor and Radiation Protection. In addition, TCDC (Technical Cooperation among Developing Countries) comprises another sector since it is regarded as an important vehicle for RCA activities. At present, TCDC focuses on ENO (Electronic Networking and Outreach) project that mainly covers RCA information flow program and will further cover the e-learning endeavors. In order to formulate and implement the projects effectively Lead Countries for all Thematic Sectors have been selected among the RCA Member States.

**Each thematic sector will have a lead country from among the member states taking initiative for project formulation and planned implementation. The designated lead countries for the different thematic sectors are**

1	<b>Agriculture</b> ⇨	<b>China</b>
2	<b>Health</b> ⇨	<b>Japan</b>
3	<b>Industry</b> ⇨	<b>India</b>
4	<b>Environment</b> ⇨	<b>New Zeland</b>
5	<b>Energy</b> ⇨	<b>Republic of Korea</b>
6	<b>Research Reactor</b> ⇨	<b>Republic of Korea</b>
7	<b>Radiation Protection</b> ⇨	<b>Australia</b>

### **👉 Agriculture (Application of Nuclear Technology in Agriculture):**

With a total population of already over 2 billion people, security and safety of food and nutrient constitute a tremendous fundamental task to solve in the Asia-Pacific region, and indeed for the whole world! How to produce cheap and nutritious food for the mass of population constitutes a challenge that has to overcome. The range of activities for the development and application of science and technology here spans all the way from food production (plant based, animal based and artificially/chemically based), food processing and food preservation to food trade.

Food being one of the basic and essential requirements of every nation, increased food production as well as its safe preservation is of utmost important. IAEA and UN's FAO (Food and Agriculture Organisation) jointly set up a Division to improve food safety, crop and livestock productivity and overall quality by making use of nuclear technology. RIA technique has helped to understand the animal reproductive physiology.

**TSLCC**

**CHINA**



Mr. SunGuoqing

Department of International Cooperation  
Chinese Academy of Agricultural Sciences  
P.O.Box 5109 Beijing 100084

Tel:00 86 10 662815952

Fax: 00 86 10 62895356

[e-mail](mailto:sunguoqing@mail.caas.net.cn)

[sunguoqing@mail.caas.net.cn](mailto:sunguoqing@mail.caas.net.cn)

### **Projects for 2005-2006**

#### **Development of Sustainable Land Use and Management Strategies for Controlling Soil Erosion and Improving Soil and Water Quality (RAS/5/043)**

##### **Objectives**

The overall objective is to develop sustainable land and water management strategies using fallout radionuclides for reducing soil erosion and improving soil and water quality in East Asia and the Pacific region. Specific objectives are i) to measure soil erosion and depositing over several spatial and time scales by combined use of Cesium-137, Lead-210 and Beryllium-7; ii) to establish soil redistribution-soil quality relationship under different land management practices by using the above results ; iii) to develop guidelines to assess soil quality based on radionuclides, as by i) and ii); and to apply management practices developed as a result of the soil redistribution-soil quality relationship for effectively improving soil and water quality as well as increasing organic carbon storage in soil.

##### **Background**

The East Asia and the Pacific region experiences severe soil erosion and sedimentation problems due to improper land use and poor farming practices. Soil erosion reduces land productivity, challenges agricultural sustainability, and degrades soil and environmental functions. Effective soil conservation can substantially reduce these problems. In this context, novel techniques for solving soil and water quality problems caused by soil erosion are very important in designing effective soil conservation measures. These techniques need to be developed and tested. A wide variety of farming systems exists in East Asia and the Pacific landscapes. These landscapes are endangered by soil erosion, and – conservation farming and soil protection systems require evaluation under a variety of agri-environmental conditions, to assess their effectiveness and establish specific regional recommendations of integrated soil and water management practices.

RCA project RAS/5/039, 'Restoration of Soil Fertility and Sustenance of Agricultural Productivity' addressed measurement of soil erosion, sedimentation and associated pesticide contamination. A limited number of research groups in the region have established basic capacities to conduct such investigations by using the fallout Cesium-137 technique. Through the implementation of RAS/5/039,

the participating countries have realized the need and importance of this new project since it addresses the relationship between soil redistribution and soil and water quality, by the combined use of Cesium-137, Lead-210 and Beryllium-7. This project is also expected to promote collaboration of RCA Member States with other advanced research institutes.

### **National Commitment**

Participating countries will each nominate a National Coordinator, and contribute other personnel, facilities, the operating costs of the projects, and host some events. It is important that participating countries provide a multidisciplinary team that will combine expertise in radionuclide techniques and in soil quality and cropping systems management.

### **Outcomes**

1. Standardized methodologies and guidelines for the use of fallout radionuclides for the assessment of the soil quality-soil erosion relationship under different land use and management systems in the region made available.
2. Soil and water resource management practices developed using the data generated on soil erosion and soil quality and their implementation through field demonstration activities and training of farmers

### **Performance Indicators for Outcomes**

1. Standardized methodologies and guidelines prepared and distributed by the end of 2007
- 2a. New management practices made available for the use of agricultural extension services in the Member States before end of 2008.
- 2b. New management practices disseminated to farmers through demonstrations and field training within a period of 1 year after the completion of the project.

### **Expected Project Impact**

The project will result in tools to accelerate and improve the selection of effective land use and management measures to combat soil erosion and improve soil and water quality in the East Asia and the Pacific agricultural landscapes. This will be disseminated through national extension services, technical brochures, regional/local extension workshops, videotapes and other electronic means. Through these means, the transfer to farmers of new technologies for the appropriate management of different agricultural practices and sustainable production of crops will be achieved thus contributing to the national economy and socio-economic development in the region. It is expected that resource conservation policies in participating RCA countries will be established based on results obtained through the project.

## **Integrated Approach for Improving Livestock Production Utilizing Indigenous Resources and Conserving the Environment (RAS/5/044)**

### **Objectives**

To improve livestock productivity through better nutritional and reproduction strategies while conserving the environment. The specific objectives are to improve animal productivity and decrease discharges of selected greenhouse gases, (methane and carbon dioxide) and selected nutrients (nitrogen and phosphorus) into the environment; and to identify and adopt better breeding strategies that will improve animal productivity through the use of better selection criteria for offspring from

cross-breeding programmes, optimum utilization of appropriate indigenous cows, benchmarking for growth and reproduction, and improving procedures for management, nutrition and healthcare programmes in dairy farms.

### **Background**

Livestock farming is important to countries in the region for the provision of food products and as a source of income for poor farmers. However, the productivity of the livestock in most of the countries is below the potential due to number of reasons such as inadequate feeding, reproduction mismanagement, prevalence of diseases, and lack of effective support services, such as artificial insemination (AI). Technologies that can be used to overcome these problems have already been developed through regional and national projects. Under the project RAS/5/035, 'Improving Animal Productivity and Reproductive Efficiency' (1999-2004), urea molasses multinutrient block (UMMB) technology was widely disseminated and adopted by farmers in the participating countries. New, lesser-utilized and lesser-known plants capable of growing in poor and degraded soils were evaluated and used as animal feeds. The UMMB was used as a carrier for anthelmintic agents and for controlling parasitic load in the gastrointestinal tract to enhance livestock productivity. A computer database application (AIDA Asia) was developed and transferred to national AI services. Its application on a wider scale for decision support and farmer services needs further training and support. The project also supported the efforts to have routine production and regular supply of radioimmunoassay (RIA) reagents to other laboratories in the region. The project focused on consolidating the activities on AIDA and RIA in order to ensure future sustainability of these technologies.

### **Nutrition**

The biggest challenge facing the livestock sector is to enhance animal productivity without having any adverse effect on the environment. Productivity of animals is restricted by low nitrogen and high fibre content of the native grasses and crop residues in tropical environments and their seasonal shortage. . Low quality, highly fibrous forages when fed to ruminants in tropical environments have been found to result in higher methane emissions compared with better quality temperate forages. The excretion of methane from the rumen can represent a loss of 8%-10% of the digestible energy depending on the type of diet. The project is therefore focussed on identifying simple strategies that will i) decrease emission of methane and carbon dioxide from ruminant animals and channel the energy being lost through release of these pollutants for increasing milk and meat production as well as improving reproduction, ii) retain more nitrogen in the animal and lowering loss of nitrogen into the environment, and redirection of nitrogen excretion in a manner that higher proportion goes to faeces than into urine, iii) decrease loss of nitrogen and phosphorus into the environment from animal excreta through appropriate manure management strategies, and iv) create inventories for methane emission by ruminant animals. The project will also focus on enhancing awareness on increasing livestock productivity while conserving the environment.

The project will build on the work done on previous project activities, e.g., development of feed supplementation strategies and efficient use of locally available feed resources; and knowledge imparted on nuclear-based and other in vitro (gas method) and in vivo (estimation of microbial protein supply using urinary purine derivatives) feed evaluation methodologies including the assays for anti-nutritional factors and tannins.

### **Animal Reproduction**

A major limitation to increasing milk and meat production in many developing Member States in the region is the scarcity of high quality cattle, buffaloes and yaks. This is partly due to indigenous breeds often being neglected, with no efforts devoted to improving them by selection for desirable production traits. Crossbreeding has been executed often without definite goals, and in some situations the indigenous genetic resources are threatened with extinction. Where upgrading of local animals has been undertaken, through national cattle and buffalo breeding programmes, there is often a lack of knowledge and lack of procedures to ensure optimum use of the improved offspring arising from such programmes. Therefore, a two-pronged approach is necessary in the region: (i) to increase the number of high-productivity cows by optimizing the use of offspring from crossbreeding programmes; and (ii) to ensure the conservation of indigenous genetic resources through strategies to increase their contribution to productivity.

Improved technologies to be applied will include appropriate nutritional, managerial and recording systems; rearing indigenous cows as foundation stock for crossbreeding; AI using sexed semen to produce offspring; development and application of novel selection criteria for young stock (including genetic screening where relevant); salvage of bull calves; and use of RIA for assessing the impact on reproductive efficiency. The costs and benefits of the improvements and interventions will be recorded and analyzed.

For the nutrition component, the nuclear techniques will involve the use of nitrogen-15 based methodologies for measuring microbial protein production and nitrogen leakage from manure into the environment; carbon-14 for in vitro methane production; molecular probes; iodine-125 based tannin assay; and phosphorous-32 based measurement of phosphorus leakage into the environment. As for the reproduction component; iodine-125 RIA kits for evaluation of selected nutritional and management strategies for their impact on reproductive efficiency; and phosphorous-32 based genetic screening and characterization using microsatellite methods will be used.

### **National Commitment**

Each Member State will appoint two Project Coordinators and a Project Management Committee, comprising representatives from national livestock support services and other stakeholders. This committee will work closely with farmers in the target areas to define specific project objectives and work plans in relation to the needs of the farming system at the location. Participating institutions and governments will undertake to provide cash contributions, facilities, equipment, personnel, and

hosting of meetings and training programmes. All participating countries have national development plans and projects to improve their livestock production system, particularly dairy production.

## **Outcomes**

### **Nutrition**

1. Livestock productivity enhanced.
2. Feed resources and strategies for decreasing methane emission identified and utilized.
3. Strategies for decreasing nitrogen and phosphorus release into animal excreta identified and utilized.
4. Appropriate manure management strategies in place to arrest leakage of nitrogen and phosphorus into the environment.

### **Breeding**

5. Increase in income of farmers through selling heifers of high potential.
6. National criteria developed for selecting superior cattle.
7. Better utilization of bull calves.
8. Regional capability built up to adopt techniques for speeding up the genetic gain (recording and evaluation of performance in cattle, semen sexing and genetic screening).

### **Performance Indicators for Outcomes**

#### **Nutrition**

1. Increase in livestock productivity by 20%-40%.
2. Reduction in methane emission by up to 40%.
3. Reduction in nitrogen and phosphorus release in excreta by 5%–10%.
4. Capturing of 60%-80% of nitrogen and phosphorus from manure and its diversion to crop production.

#### **Breeding**

5. Farmers participating in the project earn 10%–20% additional income.
6. National criteria and guidelines available for selecting superior cattle.
7. Wastage of bull calves in project areas reduced by 20%-30%.
8. Regional capability in 5-6 Member States developed to use techniques for accelerated genetic gain within two years after the completion of the project.

### **Expected Project Impact**

The development of an integrated approach for improvement of livestock productivity through better nutrition and reproduction strategies while conserving the environment will contribute to efficient use of locally available feed resources as well as leading to higher animal productivity and lowering environmental pollution. The adoption of the recommended farming technologies will enhance the regional capability for quantifying environmental pollutants and developing strategies to mitigate them; the capability to increase efficiency of resource management; improve cooperation and integration between scientists from RCA Member States; and increase income generation opportunities, thus contributing to the national economy and socio-economic development of the countries in the region.

## Approved New Projects for 2007-2008

- 1 Improvement of Crop Quality and Stress Tolerance for Sustainable Crop Production by Mutation Techniques and Biotechnology
- 2 Novel Applications of Food Irradiation Technology for Improving Socio-economic Development

## **Human Health (Medical and Health Care Applications of Nuclear Technology):**

Provision of good health care at affordable price for the mass of population, such as facilities for general health check-ups, specific diagnostic measures, therapeutic treatments, preventive services and general consultations would become another major challenge for the future, in particular considering the continuous rise in the living standard of the population. A healthy population is regarded as a national asset and good health care at an affordable price is of national priority. Preventive human health care offers early detection of hyperthyroidism, hepatitis etc., diagnosis and treatment of cancer using radioisotopes labeled chemicals having high organ affinity and specificity are some areas under study. The incidence of cancer in its all forms and virility is a daunting task to be surmounted by all the nations – developed, developing and under developed - and concerted and cohesive efforts are to be made to reduce the incidence of cancer/ cancer related ailments while developing better disease management programmes using advanced techniques.

**TSLCC**

**JAPAN**



Dr. Takashi Nakano  
Department of Radiology  
& Radiation Oncology  
Gunma University,  
School of Medicine

Tel: 0081 27 2208380

Fax: 0081 27 2208397

e-mail

[tnakano@med.gunma-u.ac.jp](mailto:tnakano@med.gunma-u.ac.jp)

3-39-22, Showa-machi, Maebashi-si, Gunma 371 8511

## Projects for 2005-2006

### **Distance-assisted Training for Nuclear Medicine Technicians (RAS/6/029)**

**Objectives:** To improve the quality of nuclear medicine services in Regional Co-operative Agreement (RCA) countries by raising the standard of basic training for technologists.

**Background:** Technicians working in nuclear medicine in developing countries, where good training facilities are not available, do not usually have the opportunity of overseas training since this has traditionally been available only for scientists and medical physicians. However, the largest group of nuclear medicine personnel are technicians responsible for the routine performance of clinical studies. The level of training for technicians varies considerably throughout the RCA countries, and, in some cases, there is insufficient demand to justify national training courses. This project aims to assist the development of skills-based training for this group using distance-education methods.

A pilot scheme phase I for the project conducted under the Australian funded regional project RAS/6/022 was concluded in 1998 which involved three countries: India (8 students), Malaysia (2) and Sri Lanka (3). Phase II was initiated in 1999 involving the phase I countries and was concluded in 2001 with 12 students. Several countries in the RCA region, namely Bangladesh, China, India, Korea, Pakistan, Philippines, Sri Lanka, and Thailand are now applying the distance assistance training (DAT) study material (developed by the Agency) to train nuclear medicine technologists in their own countries. Currently, about 290 students from 124 medical departments are undergoing this training with Agency support in the form of expert services and printed DAT material. A CD-ROM version of the 12 modules of the DAT material was prepared in 1998. Keeping in view the rapid growth and development taking place in the field of nuclear medicine, there is a need to update the DAT material as well as to create additional documents. Countries such as Indonesia and Viet Nam would like to start the training and would need supervision and support. The developed materials have formed the basis for sister projects in AFRA and ARCAL.

**National Commitment:** Support systems have been established in countries that participated in the pilot testing. Other participating countries have also established a similar network of key individuals to co-ordinate activities at a local level and provide essential feedback. Until now, the project has been implemented at the regional level by the West Mead Hospital, Sydney, Australia, through extrabudgetary funding from the Government of Australia. It is expected that the Diagnostic Physics Group at the West Mead Hospital, Sydney, will continue to play a leading role in the implementation of the extended project at the regional level. China has translated the materials into Chinese language and Korea is doing the same into Korean. The University of Sydney, Australia, has agreed to give certificates to successful DAT students after sitting and passing an exam by the university, and a faculty diploma to the student after completion of two years.

**Agency Input:** The Agency will continue to provide administrative, financial (for implementing specific technical contracts to update or create new DAT modules, group training activities, and expert services) and technical backstopping support.

**Performance Indicators:**

- Number of countries using the DAT material for training technologists in their own countries.
- System of assessment developed and in place in the participating countries.

**Expected Results:** At the end of the project, at least nine countries will have the capability to continue technologist training using the developed materials. Courses will be conducted in additional countries where training has not yet been conducted.

**Project Impact:** The quality of healthcare in the region will be enhanced by the upgraded and standardized educational qualifications and resultant higher motivation of nuclear medicine technicians. Several countries will be able to conduct their own training programme using the experience and resources already developed.

## **Distance Education in Radiation Oncology (RAS/6/033)**

**Objectives:** To prepare and pilot test distance learning materials in radiation oncology.

**Background:** The project was originally approved as footnote a/ project under the 1999-2000 programme. Following the development of the project work plan at the first Advisory Board Meeting in Kuala Lumpur in December 1999, negotiations took place during the year 2000 covering the first phase of the project, the development of English-language distance learning materials. The contractual negotiations delayed commencement of the work by approximately one year from the envisaged work plan. This project will also be jointly developed with AFRA and ARCAL Member States, as agreed during the tripartite meeting of the representatives of the Regional Agreements in September 1999, whereby RCA will develop the materials and ARCAL and AFRA will pilot test them in their respective regions. A CD-ROM version of the materials will be made available towards the end of 2002 and pilot testing will begin in early 2003.

**National Commitment:** Malaysia, Pakistan, and Philippines from RCA will participate in the testing of the modules and will designate a national supervisor, a testing centre, and identify students for the pilot testing. Each participating country has also designated a representative to the Advisory Board, who will be responsible for reviewing the modules and monitoring the progress of work. At the interregional level, the tripartite meeting of regional agreement will assess the progress of the joint development activities, including problems that may arise.

**Agency Input:** The Agency will continue to provide administrative and technical backstopping support.

### **Performance Indicators:**

- A distance learning mechanism for each participating country is in place.
- Participants from three RCA Member States have taken the pilot course.
- Report of Advisory Board Meeting (ABM) on the syllabus improvement.

**Expected Results:** Sixty-three modules on radiation oncology will be made available on CD-ROM, capable of being placed on the Internet. Three countries will be participating in the pilot testing. Recommendations for improving the teaching modules will be made by the Advisory Board members. Distance learning mechanisms for each selected countries, including networking of students, hospitals, and supervisors are in place. Additional countries interested in undertaking distance-learning initiatives in their own countries will be identified (at the interregional level, students from six other countries in ARCAL and AFRA will also have undertaken distance-learning studies).

**Project Impact:** The availability of the distance-learning materials in radiation oncology will fill a long-recognized education gap among radiotherapists and radiographers, enhancing improvements in the management of cancer patients of the region. The potential for enrolling more students with Internet access will increase, thereby reducing the cost of training. Updating of teaching materials will be easy as they are electronically available. The use of a common syllabus for training will also lead towards harmonization of training of radiation oncologists among the three regions.

## **Strengthening Medical Physics through Education and Training (RAS/6/038)**

**Objectives:** The objectives of this project are to improve medical physics capability and capacity in the region through the establishment of regional approaches on education and training of medical physicists; and to improve and upgrade safe operating practices and technical standards in the region through the establishment of a common quality assurance/quality control (QA/QC) programme.

**Background:** Medical physicists collaborate with clinicians in practically all fields of medicine. In some countries, medical physicists cover extensive areas in non-ionizing medical applications (ultrasound, lasers, etc.). With medical physicists playing an increasingly important part in the scientific and technical aspects of prevention, diagnosis, and treatment of many diseases, high standards for medical physics must be developed and maintained.

In the Asia and Pacific region, medical physics support for the healthcare sector is limited by insufficient numbers of trained medical physicists. An RCA survey shows that additional physicists are required in radiation oncology for existing facilities.

In addition to the education requirements for qualification as a medical physicist, there is a growing need for medical physicists to be trained to certain minimum standards, and then to become a "qualified expert". National recognition for medical physicists in this category would be highly desirable as would be a general regional definition of "medical physicist" and their professional standards.

In some countries of the Asia and Pacific region, there are no formal requirements for QA in hospitals. In these countries, the development and implementation of QC protocols are done on a voluntary basis and depend only on the commitment of the radiation oncologists, radiologists, nuclear medicine specialist, or medical physicist. In this case, the situation may change dramatically with staff changes and is often subject to budgetary limitations.

Further expansion and development of quality health services and the introduction of modern technology throughout the region has necessitated a regional approach to solving common problems like training and education of medical physicists, recognition of the medical physics profession, and harmonization of methods used by these professionals in all fields of radiation medicine.

It is important that development of education and training programmes as well as professional standards are done in co-operation with the professional organizations representing medical physicists. Medical physicists in the region are represented by the Asia Federation of Medical Physics (AFOMP), a chapter of the International Organization of Medical Physics (IOMP).

**National Commitment:** The Member States will provide educators and trainers to support the trainees. Trainee assessment will also be undertaken locally. The country hosting meetings, workshops, and training courses will provide cost-free premises, facilities, administrative arrangements related to internal travel and accommodation, and local lecturers, if necessary. In addition, the project will be conducted in close co-operation with AFOMP.

Member States are committed to meet the International Basic Safety Standards on meeting Milestone 3 (medical exposure), and this project will contribute towards achieving that commitment. Several countries in the region, e.g., India, Malaysia, Pakistan, Philippines, and Thailand, have ongoing or planned advanced courses in medical physics and would benefit from having a common regional approach to training and education in this field.

**Agency Input:** The Agency will provide technical and administrative support including organizing regional events, recruitment of experts, and provision of supplies.

#### **Performance Indicators**

- Report on needs and resources required for training medical physicists.
- Report on a proposed education and training programme for medical physicists.
- Developed training materials.
- Harmonized technical standards in medical physics.
- Pilot programme established in three-to-four countries.

**Expected Results:** A recommended education and training programme for medical physicists will be produced. This includes a range of teaching resources, which will include self-study materials, materials to formalize in-service training and assessment, as well as general teaching aids. The programme will be tested in three-to-four selected places. A recommended QA/QC programme related to technical and physical aspects of radiation oncology, diagnostic radiology, and nuclear medicine. The project will assist in training medical physicists and a developing sustainable group of institutes in the region to provide education and training for medical physicists to the required standards using the recommended programme.

**Project Impact:** An improvement in the quality of education and training for medical physicists will not only improve the quality of service available but it will also enhance their professional status. This is important if healthcare providers are to attract and maintain a competent workforce. The project will provide teaching resources that can be used for development of further education and training programmes. The medical physicists trained within the project will have the potential to provide improved in-house capabilities to enhance services and provide valuable resources for future development.

### **Improvement of Quality Assurance for Brachytherapy of Frequent Cancers in the Region (RAS/6/040)**

#### **Objectives**

To improve the quality assurance (QA) and quality control (QC) of the radiotherapy programmes in recipient RCA Member States. Under this main objective, the project has three separate components: to improve brachytherapy treatment; to train radiotherapy technologists (RTTs); and to build the regional capability for radiotherapy equipment maintenance and repairs.

#### **Background**

The project will serve as an umbrella project for the three sub-programs, namely, i) improvement of QA for brachytherapy of frequent cancers in the region; ii) training of RTTs for improved patient care and iii) building the regional capability for equipment and repairs in the field of radiotherapy. The project activities will be implemented over a period of four years.

## **Improving QA**

The number of cancer patients is increasing among developed and developing Member States. This disease has become a burden to national development. Cancers of the cervix, head and neck, breast, prostate and oesophagus are common malignancies in most of the RCA Member States and radiotherapy, including brachytherapy, is an essential treatment modality, especially when organ conservation and function preservation is required.

However, even those who are in early or curable stages suffer from recurrences because they cannot be treated optimally due to inadequate quality assurance programmes, and lack of expertise and facilities for brachytherapy. All these factors result in poor treatment outcomes leading to high morbidity and mortality and there is a need to address these problems to improve the quality of management of cancer patients.

Under the previous projects related to brachytherapy, RAS/6/035 'LDR and HDR Brachytherapy in Treating Cervical Cancer (RCA)', and RAS/6/037, 'Quality Assurance for Treatment of Cervix Cancer by Radiotherapy', and partly under RAS/6/028, 'Nuclear Medicine Applications', the focus of the activities was on QA/QC of cervical cancer, specifically on the radiobiological, physical and clinical aspects of brachytherapy in the uterine cervical cancer, and on training medical physicists in proper treatment planning and the development/harmonization of treatment protocols. Here, the focus will be on the head, neck, breast and other types of cancer that require brachytherapy treatment.

## **Training Radiotherapy Technologists (RTTs)**

This sub-programme will improve the quality of RTTs through training. Radiation therapy is an essential modality to treat cancer. For conducting radiation therapy, three types of professionals are required, namely, radiation oncologists, medical physicists and RTTs. RTTs administer radiotherapy treatment, and it is therefore essential that they be well trained to deliver high quality radiotherapy treatment.

National training courses will be conducted under the project for continuing professional development of RTTs based on the document published by the regional cooperative agreements AFRA and RCA in 2002, titled 'A Syllabus for the Education and Training of Radiation Therapists (RTTs)'. The project will also "train the trainers" to help establishment of local capacity for training programmes in respective national languages, if necessary.

## **Equipment Repair**

There is a need in the region to build the capabilities for repair and maintenance of teletherapy and brachytherapy units, to ensure their proper operation and availability. Failures, which could be frequent, have to be rectified promptly and economically. Towards this end, the sub-programme is aimed at identifying equipment and instruments used in radiation oncology that require constant maintenance, estimating the cost of maintenance of these equipment, identifying existing sources of spare parts and minimizing the delay in repairing faulty equipment. This will also include identifying local resources available for production of spare parts and training of local human resources. The sub-

programme envisages developing a comprehensive database about various requirements in the maintenance for radiation oncology equipment in the RCA region.

### **National Commitment**

In the participating countries, there are an extensive number of ongoing national projects in relevant areas, including early cancer detection, improving treatment facilities, and training of personnel. Most of the participating countries have at least some brachytherapy equipment and are engaged in establishing QA/QC programmes.. Expert missions to the region to assess for QA needs for radiation oncology have been periodically supported through Japanese extrabudgetary contributions.

All participating counties have designated project counterparts and have agreed to provide facilities, human resources and local support for the implementation of national project activities. Some countries are also offering expert services as well as making their facilities available for training fellows or receiving visitors from the other Member States.

### **Outcomes**

1. Number of professionals trained in brachytherapy treatment for common types of cancers in the region increased.
2. Adequate quality assurance programmes for the clinical practice of brachytherapy established.
3. Harmonized protocols established for treating cancer.
4. An educational system meeting the criteria in the AFRA-RCA syllabus established for training RTTs in better management of patients.
5. Capabilities regarding radiation oncology equipment repairs and preventive maintenance in the RCA region assessed to identify the needs of the Member States.

### **Performance Indicators for Outcomes**

1. At least 50 professionals trained in brachytherapy treatment for common types of cancers in the region before the completion of the project.
2. Establishment of adequate QA/QC programmes in at least one cancer treatment centre in 8 participating countries before the completion of the project; verified through experts reports.
3. Publication of harmonized protocols on brachytherapy treatment before the completion of the project.
- 4a. Establishment of an educational system based on RCA–AFRA syllabus in at least five participating Member States before the completion of the project; verified through experts reports.
- 4b. Training of at least 50 RTTs on management of patients, before the end of the project, verified through the reports of training courses conducted.
5. Establishment of a database on needs and capabilities in the RCA region for repairs and preventive maintenance of radiation oncology equipment before the completion of the project.

### **Expected Project Impact**

The project is expected to result in improved healthcare and management of patients with cancer of the cervix, head and neck, breast and oesophagus; improved quality of radiation therapy among Member States; and improved capability of repair and maintenance of radiation oncology equipment.

## **Prevention of Osteoporosis and Promotion of Bone Mass in Asian Populations using a Food-based Approach (RAS/6/041)**

## Objectives

To evaluate the effectiveness of food-based dietary intervention programmes by using nuclear and isotopic techniques to promote bone mass and prevent bone loss especially in the postmenopausal women. The long-term goal is to identify the effective strategy in prevention of osteoporosis and promotion of bone mass in high-risk populations in Asia.

## Background

Osteoporosis is a skeletal disease characterized by low density and general deterioration of bone tissue. Bone fragility induces fractures that represent the major clinical aspect of the disease. Osteoporosis has become one of the major public health problems around the world attributable to the ageing populations.

Although osteoporosis cannot be cured, its progression can be slowed, and actions should be taken to help and prevent the disease. Dual-energy X-ray absorptiometry (DEXA), a nuclear-related method, is a bone mineral density (BMD) test and it is a safe, accurate, quick, painless, and non-invasive way to diagnose osteoporosis, to detect low bone density, to monitor the effectiveness of treatments, to predict the risk for future fractures and to suggest the preventive course of action. Neutron activation analysis (NAA) and isotope techniques can also be used to assess calcium content and bioavailability from the indigenous diet, and the effect of calcium-rich products on BMD.

The implementation plan entails evaluation of calcium bioavailability from indigenous foods and enriched food products by using in vivo stable isotopic technique and a 2-year dietary intervention programme to improve bone health in the elderly women including postmenopausal women.

This project will build on the completed 5-year coordinated research project (CRP) on comparative international studies of osteoporosis using isotope techniques. The Agency has developed harmonized protocols and applications of nuclear techniques for evaluation of BMD. The project would transfer the technology to harmonize the approach of BMD measurements. Additionally, alliances have been formed in Asian countries to look into the prevention and care of osteoporosis, namely, The Asian Pacific Osteoporosis Foundation, and The Asian Osteoporosis Study (a multi-center study for osteoporosis research with countries such as China, Malaysia, the Philippines, Singapore and Thailand).

As a result of this activity, regional infrastructure will be developed for addressing bone health of the elderly, counterpart collaborators will be trained in harmonized protocols for evaluating bioavailability of calcium from local foods and enriched food products, and for assessing BMD status. All these will be useful to identify appropriate food-based supplementation strategies to promote bone health in the region as a whole.

The counterparts of this regional project are the Chinese University of Hong-Kong (China); Indraprastha Apollo Hospital (India); Universtiy Kebangsaan (Malaysia); Food and Nutrition Research

Institute (Philippines); Singapore General Hospital (Singapore); and Faculty of Medicine, Mahidol University (Thailand).

### **National Commitment**

The participating countries will designate Project Coordinators and assign local resources and facilities to carry out the activities in the project.

### **Outcomes**

1. Trained staff in harmonized protocols for evaluating bioavailability of calcium from local foods and enriched food products, including protocols for measuring BMD.
2. Indigenous foods and enriched food products high in calcium identified

### **Performance Indicators for Outcomes**

1a. Adoption of harmonized protocols for the evaluation of bioavailability of calcium from local foods and enriched food products as well as protocols for measuring BMD by participating RCA countries before the end of the project

1b. At least one person from each participating Member State trained in application of the protocols before the end of the project.

2a. Development of menus high in calcium based on indigenous calcium-rich foods and calcium-enriched products within two years after the completion of the project.

2b. At least one marketable calcium rich food products developed in five of the participating Member States within three years after the completion of the project.

### **Expected Project Impact**

The expected social and economic impact will be realized when the project results and recommendations at the end of the proposed study are incorporated into the National Health Care Policy and Food and Nutrition Policy for the reduction of osteoporosis-related diseases among elderly in the Member States. This will help reduce healthcare expenditures; promote health and well being of elderly as a result of improved bone health in the populations; and encourage the use of calcium rich indigenous foods and fortified foods products as vehicles to provide adequate calcium and vitamin D to the vulnerable populations.

## **Tumour Imaging using Radioisotopes (RAS/6/042)**

### **Objectives**

To improve the management of cancer patients by transferring radionuclide imaging techniques of single photon emission computed tomography (SPECT) and positron emission computed tomography (PET) for cancer detection and monitoring the efficacies of therapies, including validating and developing protocol for sentinel lymphnode detection technique in RCA countries.

### **Background**

Incidents of cancer is rapidly increasing in Asian countries, and the diagnosis of distant metastasis as well as primary tumors has become an urgent need to determine the mode of therapy for achieving the better prognosis. To find distant metastasis that may critically affect the prognosis, whole body and SPECT scanings with tumour seeking agents such as technetium-99m (Tc-99m)-DMSA (V), Tc-

<sup>99m</sup>Tc-MIBI, gallium-67 (<sup>67</sup>Ga)-citrate, thallium-201 (<sup>201</sup>Tl)-chloride, and fluorine-18 (<sup>18</sup>F)-FDG have been employed. They play important roles in visualizing unexpected metastasis and expansion to adjacent tissue or organ.

PET is changing the way in which cancer is managed and is forcing a reassessment of conventional staging with CT and MRI in certain cancer groups. It can be used to plan the delivery of, and assess the response to, therapy, allowing the treatment regimens to be modified without delay if the response is inadequate. The largest influence of PET has been in the management of lung tumours, colorectal tumours and lymphomas.

<sup>18</sup>F-FDG is one of the most effective tumour-seeking agents, and it proved cost-effective in the assessment of solitary pulmonary nodules (SPN) and in staging non-small cell lung cancer.

<sup>99m</sup>Tc-DMSA (V) is a tumor imaging agent which is able to visualize some malignant tumors such as soft tissue tumor and thyroid medullary carcinoma. The labeling of commercially available DMSA (III) kit with <sup>99m</sup>Tc is a quite unique technique but simple. The clinical application may be useful for visualizing tumor distribution.

<sup>99m</sup>Tc-MIBI is a radiopharmaceutical for cardiac perfusion imaging but also for tumor imaging. The retention of this radiopharmaceutical in tumor cells can be validated as a predictor of response to chemotherapy in a wide variety of human cancers. The clinical application with a gamma camera may be useful for management of patients that should undergo chemotherapies.

<sup>67</sup>Ga-citrate is one of cyclotron-produced radiopharmaceuticals and the clinical use has been limited even in RCA Member States. However, the radiopharmaceutical is very useful for the diagnosis and staging of malignant lymphoma, sarcoma and melanoma. The clinical application with SPECT would be very useful for RCA Member States.

<sup>201</sup>Tl-chloride is also a cyclotron-produced radiopharmaceutical that is shown to have affinity for brain tumors. It has high sensitivity for detection of new, recurrent, or residual viable tumor, which are difficult to differentiate from post-radiation necrosis and edema on CT or MRI.

Lymphoscintigraphy with a gamma probe has recently acquired an expanding role in clinical medicine for oncology and plays an important role in the detection of sentinel lymph nodes in several types of tumors, primarily breast cancer and melanoma.

The project will make it possible for the Member States that do not have access to SPECT, PET and sentinel lymph node detection technologies to apply them in the management of cancer patients.

### **National Commitment**

Participating countries with the suitable infrastructure, such as an advanced gamma camera system and PET system, will provide their facilities for training.

### **Outcomes**

1. Transfer of technology for nuclear medicine imaging and sentinel lymph node imaging to participating RCA Member States.
2. Improvement of the clinical management of cancer patients with nuclear medicine techniques.

### **Performance Indicators for Outcomes**

1. At least 100 persons from the Member States will be trained on new nuclear imaging techniques through Regional Training Courses and Expert Missions before the end of the project.
2. At least ten percent (10%) of the nuclear medical centres in the region will apply new nuclear imaging techniques introduced through the project in management of cancer patients within one year after completion of the project.

### **Expected Project Impact**

A greater awareness among medical professionals on the effectiveness of nuclear medicine imaging techniques and sentinel lymphnode detection technique to improve the management of cancer patients will be achieved. This will eventually lead to better clinical management of cancer patients resulting in the possible reduction in mortality and morbidity rates and cost-effectiveness by avoiding unnecessary treatment procedures.

### **Approved New Projects for 2007-2008**

- 1 Upgrading Nuclear Medicine Technologist Training
- 2 Strengthening Medical Physics through Education and Training
- 3 Upgrading Sustainability of PET Technology

### **Industry (Industrial Applications of Nuclear Technology):**

Industrial development in its broadest sense, namely the development of small, medium and large scale business enterprises to produce market competitive (preferably high) added value products, would give positive impacts to the economy and provide employment for the people. Included in this category are agro-based industries which can play a major role in many of the Asia-Pacific countries.

To improve economy & generate employment opportunities, Industrial upgradation and increased productivity are the prime requirement of overall national progress. Radiation processing of materials, nucleonic gauges, NDT tools, process optimisation using radionuclides, mineral analysis and sealed sources applications are areas of interest.

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**INDIA**



Dr. Gursharan Singh Tel: 00 91 21 5593735

Head, Isotope Applications Division Fax: 0091 21 550 5345

Bhabha Atomic Research Centre e-mail

Trombay, Mumbai 400085 [gsingh@apsara.barc.ernet.in](mailto:gsingh@apsara.barc.ernet.in)

### **Projects 2005-2006**

### **Improving Regional Capacity for Assessment, Planning, and Response to Aquatic Environmental Emergencies (RAS/8/095)**

**Objectives:** To improve the regional capacity for the management of aquatic environmental risks and to develop capacity in the RCA countries to assess, plan, and respond to pollution in coastal aquatic environments.

**Background:** Pollutant materials in the aquatic environment may be derived from natural or anthropogenic sources and may be of radionuclide, organic or inorganic origin. These pollutants in large bodies of water can be dispersed by active forces such as wind, tides and currents. The health and livelihoods of populations living in coastal marine environments may be placed at risk as a result. The growth of the mining and other industry-related activities in the East Asia and Pacific region has increased the level of contamination in receiving waters, leading to reduced populations of the flora and fauna through direct toxic effects, as well as increasing the concentrations of non-radioactive pollutants in staple aquatic foods. For example, arsenic deposits have been found in the Mekong Delta region in association with mining activities in Thailand. The accumulation of contaminants in the water, flora, and fauna can impact local communities' sources of food supply as well as their sources of livelihood.

The project will demonstrate and transfer technologies for the assessment of the impact of contaminants on aquatic organisms. It will also address the problems of water-dispersed pollutants by developing and verifying hydrodynamic models of polluted aquatic environments.

The hydrodynamic models can then be used to accurately predict the dispersion of pollutants in the aquatic environment. They provide powerful tools for planners who can then predict if pollutants will reach and affect specific marine resources. They can also use such models to predict the impact of changing the hydrodynamics of an area through the construction of manmade structures.

**National Commitment:** RCA Member States have endorsed this project at their National Representatives Meeting in Seoul, 2002. The project design includes the Philippines and Thailand as partners in the implementation of project activities. RCA Member States will nominate suitably qualified participants for the major activities and will identify suitable demonstration sites for the project. Demonstrations will involve national commitments of infrastructural and other support. The Australian footnote a/ contribution consists of an amount of \$400,000 over three years (2003-2005).

**Agency Input:** The Agency will provide administrative and technical backstopping, as well as support for activities including training events, fellowship placements, and expert services.

**Performance Indicators:**

- Number of regional activities implemented and number of trained persons/participants in computer modelling of dispersion of pollutants in the aquatic environment.
- Number of expert missions implemented and number of persons/participants trained in ecological risk assessments.
- Number of RCA Member States benefiting from ecological risk assessments and response technologies.

**Expected Results:** The expertise and knowledge transferred to the RCA Member States on the use of computer codes for quantitative assessment of ecological risk, associated with the release of contaminants into riverine, estuarine, and coastal environments will improve the management and increase the effectiveness of national and regional responses to ecological emergencies. Improved sampling and analytical techniques for analysis of contaminants in the aquatic environment will be transferred to RCA Member States.

**Project Impact:** The project will enhance the regional and national ability to assess, plan, and respond to aquatic environmental emergencies and therefore reduce the risks to the economic well-being and health of communities in the region. The trans-boundary nature of the problems being addressed underlines the need for a regional response.

### **Isotope Techniques for Groundwater Contamination Studies in Urbanized and Industrial Areas (RAS/8/097)**

**Objectives:** To assess, manage, and prevent further degradation of groundwater quality in selected urbanized and industrial areas, and to promote the use of isotope hydrology techniques in addition to conventional techniques (hydrogeological, chemical, and biological) for study of pollutant behaviour and contaminant transport in groundwater systems.

**Background:** The quality of groundwater resources used for potable supply has been adversely affected in many urban and industrialized areas of the region through various causes including: disposal of urban wastes, leachates from sanitary landfills, low-lying waste disposal sites, domestic and municipal sewage; disposal of industrial wastes with special emphasis on toxic metals, and organic contaminants/polyaromatic hydrocarbons (PAHs); agricultural practices, with special reference to nitrate and pesticides; and seawater intrusion in coastal regions.

This project complements the ongoing project RAS/8/084 "Isotope Use in Managing and Protecting Drinking Water," which is being implemented under the joint United Nations Development Programme (UNDP)/RCA/IAEA project "Better Management of the Environment, Natural Resources and Industrial Growth through Isotopes and Radiation Technology" (RAS 97/030). Under RAS/8/084, the Member States have received training on use of modelling tools, participated in the inter-laboratory comparison of samples, and applied the skills in investigations of selected water reservoir sites. The present project will extend and develop the further use of isotope techniques to applications in assessing, characterizing, and ameliorating the impact of groundwater contaminants in selected urban and industrial areas.

**National Commitment:** The Member States will make available their facilities and other resources for hosting regional events, will use isotope hydrology techniques in conjunction with other conventional methods for studying the problem, and will select sites in urban and industrialized areas for studies. Bangladesh is implementing a 4-year project on arsenic mitigation in its water supply with support from the Government and the International Development Agency (IDA) Credit Union in the amount of \$44.4 million; China is concerned about groundwater contamination (e.g., organic mass and heavy metals) and ground subsidence in the Suzhou-Wuxi-Changzhou region due to high population and urbanization; in the Philippines, the Japanese International Co-operation Agency (JICA) is funding a project worth \$260,000/year for monitoring mine emissions into surface water in an industrial mining area; in Thailand, the Department of Mineral Resources will carry out a groundwater resources assessment in Songkla Lake Basin South Thailand and Lower Central Plain with \$620,000 in 2003; and in Viet Nam, the groundwater supply in Ho Chi Min City is contaminated with phenol affecting an estimated area of 100 square kilometres.

**Agency Input:** The Agency will support fellowships, recruit experts, supply minor pieces of equipment, and organize group activities. It will also provide technical support to the project activities.

**Performance Indicators:**

- New information to characterize urban and industrial area pollution problems and developed approaches to their solution.
- Investigations conducted at the selected sites.
- Water resources management decisions arise and are implemented at as an outcome of the investigations undertaken at national sites.

**Expected Results:** Each participating country will (i) develop a comprehensive understanding of the scale and geometry of pollutant migration (ii) characterize pollution issues and develop approaches to their solution at the selected sites. Qualitative mapping of aquifers at selected sites will be conducted, and quantitative tools will be developed.

**Project Impact:** Understanding of the pollution sources and vulnerability of the aquifer in the selected sites will enable decision makers to develop and manage water pollution control policies and strategies.

**Radiation Technology for Development of Advanced Materials and for Protection of Health and the Environment (RAS/8/098)**

**Objectives**

To enhance RCA Member State capabilities in applying radiation technology for advanced materials development, natural polymer processing, and assurance of health safety and protection of environment.

**Background**

Radiation technology using gamma or X-ray sources and electron accelerators is one of the cleanest and most reliable processes for material modification applied in many countries. There are over 160 gamma industrial irradiators and 1200 electron industrial accelerators in operation worldwide. These facilities are being widely used for sterilization and polymer/rubber processing. More than 40 pilot and industrial scale cobalt-60 gamma irradiators, as well as several electron accelerators have been

established in developing Member States with the cooperation of the Agency. There are developments in the field of radiation source engineering for more compact gamma irradiators, high-power electron accelerators (medium energy range) and direct electron to X-ray conversion systems. Industrial plants for wastewater treatment are under development, plants for flue gas treatment and a pilot plant for sewage sludge irradiation have been in operation. There is a continuing interest in RCA Member States in using radiation technology for various applications. Radiation and nuclear centres in the RCA Member States are requesting cooperation and guidance of the Agency to use ionizing radiation for advanced material development, including natural polymers, environment and health protection as well as to enhance safe, efficient and reliable operation of irradiation facilities.

### **National Commitment**

RCA Member States will nominate National Project Coordinators and appoint Project Teams for implementation of the project. Member States will also host meetings and training events and will provide in-kind contributions in the form of lectures, facilities, and premises

### **Outcomes**

1. New processes, technologies, and advanced materials based on application of gamma, X-ray and accelerator radiation sources developed and utilized.

### **Performance Indicators for Outcomes**

- 1a. The Number of standardized procedures for the development of new products from radiation-processed natural polymers and radiation control of biological hazardous contaminants established by end of 2006.
- 1b. The Number of processes, technologies, and advanced materials commercialized within three years after the completion of the project.

### **Expected Project Impact**

Economic benefits from development of new marketable materials and reduction of the health effects resulting from release of untreated hazardous biological contaminants to the environment.

## **Radioisotope Technology for Natural Resource Exploration & Exploitation (RAS/8/099)**

### **Objectives**

To use radioisotope technology for natural resource exploration and exploitation and for improving industrial process efficiency and product quality.

### **Background**

Radioisotope-based technologies play an important role in trouble-shooting, analyzing, and optimizing industrial processes. Interest in RCA Member States for applying radioisotope technology for natural resource exploration and exploitation through technical cooperation projects is continuing. The end-user awareness on the benefits of radioisotope technology is increasing and a working partnership with industry has been established in many RCA Member States. The oil reservoir evaluation, petrochemical, chemical industries, mining, metallurgy, cement, and mineral processing and wastewater treatment sectors are the main targets where the radioisotope technology is shown as competitive and beneficial. New radioisotope methods are developed for online inspection, visualization and modelling analysis. Data acquisition and processing techniques in these sectors are

improving with this technique. Quality control and accreditation of radioisotope techniques is in process to enhance end-users acceptance of the technology. There is a need to upgrade the capability of radioisotope groups in developing countries, to promote routine services of mature techniques and to transfer novel developments and emerging new applications.

### **National Commitment**

RCA Member States will nominate National Project Coordinators and appoint Project Teams for implementation of the project. Member States will also host meetings and training events and will provide in-kind contributions in the form of lectures, facilities, and premises.

### **Outcomes**

1. Enhanced radioisotope services to assist industries in RCA Member States in improving management of natural resources, conserving raw materials and energy, and preserving the environment.

### **Performance Indicators for Outcomes**

- 1a. The number of new radioisotope services provided to industries in RCA Member States leading to improved management of natural resources by the end of 2006.
- 1b. The number of new radioisotope techniques implemented.
- 1c. The number of technology transfer documents prepared and distributed, verified through copies made available to the Agency.

### **Expected Project Impact**

Better management and utilization of natural resources for industrial development through applications of radioisotope techniques will lead to economic and technical gains.

## **Advanced Industrial Radiography (RAS/8/100)**

### **Objectives**

To establish and sustain non-destructive testing (NDT) technology for industrial quality assurance and to assimilate new developments in the field.

### **Background**

NDT is essential for quality assurance of manufactured products. Through past technical cooperation projects on NDT, many RCA Member States have established infrastructure for providing NDT services and for conducting training programmes. Training requirements need preparation of updated training manuals and support for advanced training and regional harmonization of certification. Apart from well-established NDT protocols for inspection of industrial components, machinery, and oil pipelines, new techniques and applications, such as digital radiography, online inspection of concrete structures and pipe corrosion, are being developed. Accreditation of NDT training centres to ISO standards is in progress. Many national nuclear centres in RCA Member States have strong ongoing NDT programmes and will benefit from this project in improving NDT infrastructure as well as training and certification of personnel.

### **National Commitment**

RCA Member States will nominate National Project Coordinators and appoint Project Teams for implementation of the project. Member States will also host meetings and training events and will provide in-kind contributions in the form of lectures, facilities, and premises.

### Agency Input

This will include expert services, financial and administrative support to organize regional events.

### Outcomes

1. Increased regional capabilities for NDT applications in industry and availability of trained and certified NDT personnel.

### Performance Indicators for outcomes

- 1a. The number of standardized protocols adopted by participating member States for NDT inspection as per ISO 17025 by end of 2006.
- 1b. The number of NDT personnel certified as per ISO 9712 and ISO 17024.
- 1c. The number of new Societies formed to promote & coordinate NDT activities, by the end of 2006.

### Expected Project Impact

The project will contribute towards improving industrial productivity and safety through application of advanced NDT technologies as well as ensuring the sustainability of NDT applications, and harmonizing the accreditation of NDT laboratories throughout the region.

### Approved New Projects for 2007-2008

- 1 New Applications of Nucleonic Analysis Systems (NAS) in Minerals and Resources Industries  
**Intensification of Industrial Productivity and Improving Environment Using Radiotracer and Sealed Source Technologies**  
(These 2 projects are expected to be combines with revised objectives).
- 2 **Development and Applications of Advanced Industrial Radiography and Tomography Techniques**
- 3 Radiation Processing applications for Health and Environment

### **Energy (Assessment of the Role of Nuclear Power and other Energy options):**

Energy is the fuel of the economy! With increasing size and standard of living of the population and the growth of industries, the demand for energy in the Asia-Pacific region is expected to grow at a tremendous rate in the future. With the rapid depletion of the finite and limited hydrocarbon resources, their potentials to be utilized for the production of higher added value products, and the environmentally detrimental effects of their burning, humanity would be forced to seek or develop other sources of energy. In this context, it would be of basic importance for the Asia-Pacific nations to think strategically on the role and impacts of nuclear power plants. of which the number is expected to increase, in the region.

As a consequence, alongside the economics and technology of nuclear power generation, the questions related to safeguards and to the safety of nuclear power plants and radiation protection become quite relevant to the whole region.

Per capita power consumption is regarded as one of the yardsticks for the assessment of national development and hence availability of uninterrupted power supply is an intrinsic essentiality for every nation. Development of non-conventional sources for sustainable power generation as against the depleting conventional sources is important. Nuclear power is an attractive alternative available for power generation.

**TSLCC**

**Republic  
of Korea**



Mr. Lee, Man Ki

KAERI (Korea Atomic Energy  
Research Institute)

150 Dukjin-dong, Yuseong-gu,  
Daejeon 305-353

Tel: 0082 42 868 2145

Fax: 0082 42 861 5261

[e-mail: mklee@kaeri.re.kr](mailto:mklee@kaeri.re.kr)

### **Projects 2005-2006**

#### **Tracing Future Sustainable Paths Through Nuclear & Other Energy Options (RAS/0/041)**

##### **Objectives**

To enhance the capabilities of RCA Member States to undertake sustainable energy strategies. The specific objectives are to help Member States establish national indicators for sustainable energy development (ISED), conduct a national study to assess the role of nuclear power in achieving a balance in the development of the energy sector, and provide recommendations to national authorities on response actions consistent with sustainable energy development.

##### **Background**

Energy is an essential input for social development and economic growth, providing basic needs and services and a critical production factor in virtually all sectors of the economy. At the same time, the production and utilization of energy cause environmental degradation and concomitant costs, at the local, regional and global levels. Thus, there is a need to provide adequate energy services at affordable costs, in a secure and environmentally benign manner, and in conformity with a country's social and economic developmental needs.

Previous RCA regional projects, RAS/0/028, 'Comparative Assessment of Electricity Generation Options', RAS/0/033, 'Role of Nuclear Power and Other Energy Options in Mitigating Greenhouse Gas Emissions', and RAS/0/038, 'Role of Nuclear Power and Other Energy Options in Competitive Electricity Markets', addressed important issues such as optimization of energy systems taking into consideration of economic and social costs of supply, impacts on the greenhouse gases emission levels, and competitiveness of different energy sources in a deregulated electricity markets. The results of these

projects will be used in elaborating energy development strategies that conform to sustainable development objectives.

The above-mentioned issues are interrelated and the Member States see the need to address these issues in a more integrated fashion, thus helping them to conduct energy planning in a more balanced way and developing energy strategies in a sustainable manner.

The new project will focus on helping RCA Member States capitalize on the results of previous projects to establish national ISEDs. The project will focus on elaborating response actions based on these national sets of ISED. The regional project would foster regional cooperation and facilitate analysis of regional environmental issues.

### **National Commitment**

All participating countries have given a high priority to energy planning in their Country Programme Frameworks (CPFs). Some Member States (China, India, Japan, Republic of Korea and Pakistan) have operating nuclear power plants, and funds have been allocated for national institutes to conduct studies on nuclear energy development planning. Several Member States have participated in Asia Least Costs Greenhouse Gas Abatement (ALGAS) during 1997-1998, a project funded by the Asia Development Bank. Others without nuclear power have demonstrated interest in improving their energy planning capability. Participating countries will form national teams, conduct national studies related to the activities of this project and conduct national seminars to share ISED concepts and/or methodology. They will provide human resource support, equipment and facilities necessary to conduct system analysis.

### **Outcomes**

1. National ISEDs for participating RCA countries established.
2. Reports of the national studies conducted on the assessment of nuclear power in achieving balance in the development of energy sector submitted to respective authorities for adoption and implementation.

### **Performance Indicators for Outcomes**

1a. Establishment of ISEDs in at least five Member States before the end of the project, verified through progress reports.

2a. Submission of national studies conducted on the assessment of nuclear power in achieving balance in the development of energy sector by at least five Member States within one year after completion of project.

### **Expected Project Impact**

The social and economic impact would not be felt immediately as a result of the project, but results of the project can lead to national decisions that will help Member States develop an energy development programme in an optimal and sustainable manner, including the assessment of the role of nuclear power and other energy resources in such a programme.

### **Approved New Projects for 2007-2008**

- 1 Formulation of Sustainable Energy Development Strategies under Framework of Climate Changes

## **Environment (Environmental Application of Nuclear Technology):**

Care for the environment is an important objective, but it is something which should not be considered in isolation. Indeed, it must be seen in the overall context of national development, as nobody would destroy or pollute the living environment unnecessarily. Considering the growing awareness of the importance of the environmental care and protection, in particular realizing the local and transboundary effects of environmental pollution and degradation, individual as well as common efforts should be intensified to seek and implement the most effective and efficient policy, strategy and programs with appropriate technologies to ensure environmental integrity.

Nuclear technologies can play a significant role as a competitive, and in some cases unique, tool to solve these problems. Planners should be well informed on the potential benefits of these technologies, and incorporate them into the overall national and regional development planning activities. As a source of regional expertise in nuclear science and technology, the RCA is placed at a strategic position to provide significant contributions towards solving problems in all of the above mentioned priority areas. Eco friendly Technology ensuring environmental integrity is preferred for their compatibility with nature. Mitigation of environmental pollution through the application of nuclear techniques include use of electron accelerators for cleaning flue gases released from fossil fuelled plants, isotope tracer for various pollutants etc.

**TSLCC**

**New Zealand**



Mr. Andreas Markwitz  
Institute of Geological and  
Nuclear Sciences  
Team Leader of the NZ  
Ion Beam Analysis Group

Tel:00 64 4 570 4785

Fax: 0064 4 570 4657

[e-mail:](#)

[a.markwitz@gns.cri.nz](mailto:a.markwitz@gns.cri.nz)

Rafter Laboratory PO Box 31- 312 Lower Hutt, Wellington

### **Projects 2005-2006**

#### **Improved Information about Urban Air Quality Management (RAS/7/013)**

**Objectives:** To obtain a sufficiently large set of high-quality regional data characterizing airborne particulate matter (APM) in the fine and coarse breathable modes such that (i) a regional database can be developed that contains selected data characterizing the aerosols in the region; (ii) advanced receptor models can be employed to provide more detailed and accurate descriptions of the types and locations of pollution sources; and (iii) the effectiveness of actions taken by participating countries to reduce the concentrations and impact of particulate pollution can be assessed.

**Background:** Many large cities in Asia are highly polluted with fine atmospheric particulate matter (APM) (particles with a diameter less than 2.5 micron), which has an adverse effect on human health in the region. High air pollution episodes, in particular regional haze episodes, may cause economic problems (reduction in agriculture production and loss of revenue from tourism) and increased occurrence of respiratory diseases. Moreover, the fine particles can easily be transported across national boundaries for long distances creating problems for neighbouring countries in the region (transboundary pollution). The proposed project will permit further augmentation of the regional database on the composition of APM. This will provide the basis for the use of advanced receptor models to identify and quantify the sources of air pollution. These models will provide greater source resolution, better quantification of the source contributions, and estimates of the influence of distant, transboundary sources on the airborne-particle concentrations at the receptor site. Another area includes initial accountability assessments of the effectiveness of air quality management programmes that are being initiated in a number of the Member States. Nuclear analytical techniques (including neutron activation analysis (NAA), x-ray fluorescence (XRF), ion beam techniques such as proton-induced x-ray emission (PIXE), Rutherford backscattering spectrometry (RBS), and proton-induced gamma emission (PIGE) are exceptionally suitable for both qualitative and quantitative analysis of fine airborne particles. They are very fast, inexpensive (they do not require major investment in the region), and accurate. Based on the results of the analysis, one can assess the level of pollutants, identify the sources of the particles, and apportion the pollutants to the different sources.

Since the throughput of the nuclear analytical techniques is very high, the methods are extremely suitable to analyze a large amount of samples, which is of special importance in assessing air quality trends and transboundary movement in the region.

**National Commitment:** A number of participating countries have begun to adopt air quality management legislation, regulations, or policies. As an example, the Philippines adopted a Clean Air Act in 1999 and have promulgated the first set of enabling legislation. The Beijing region of China and Indonesia have initiated "blue sky" programmes to improve air quality. Bangladesh and Singapore have removed lead from gasoline, and Pakistan and Sri Lanka are starting the process to switch to unleaded fuel. Malaysia supports this project and is collaborating with Australia on a Malaysian haze study. In June 2002, the Members of the Association of SouthEast Asian Countries (ASEAN) signed a memorandum of agreement to tackle the problem of haze in the region. In May 2002, the Asian Development Bank (ADB) and World Bank (WB) together with other Asian countries initiated a clean air initiative (CAI-Asia) to address air quality in the region.

The countries involved, government authorities, and other project participants are ready to provide the necessary scientific and technical staff, analytical laboratory facilities, sampling equipment, and operating costs. Regional Resource Units (RRUs) are ready to receive scientific visitors and fellows, and to assist in multi-element analysis of APM, statistical evaluation and interpretation of the analytical results. The interest and involvement of the end-user institutions responsible for the implementation of air quality management practices in the participating countries strengthens a commitment to sustain the activities.

**Agency Input:** The Agency will provide the necessary co-ordination and funding. Agency support will focus on training courses/workshops and individual fellowship programmes; provision of small instruments, spare parts and supplies. Expert services will be made available to support national seminars, and statistical evaluation and interpretation of the analytical results.

**Performance Indicators:**

- Availability of national database for each Member State and regional database for the region.
- Existence of multi-year, multi-element data characterizing particles at a single urban site for each participating Member State.
- Number of policy decisions taken at country level associated with the project outputs.

**Expected Results:**

Major outcomes of the project include:

- Ability in Member States to analyze data for trends, and to use advanced models to estimate air mass movement in transboundary episodic events.
- Reports on national actions taken by participating Member States to reduce concentrations and negative impact of particulate pollution.
- Collaboration with other organizations continued and/or initiated.

**Project Impact:** The project will allow Member States to continue to carry out trend analysis on the accumulated multi-element data. The expanded database to be developed will be used to examine a number of additional aspects of the air pollution problem in the region, including likely sources of transboundary transport and better estimates of the influence of distant transboundary sources of the airborne particles at the receptor site. Moreover, the results of the project will be used for an initial accountability assessment of the effectiveness of air quality management programmes that are being initiated in a number of the Member States.

**Approved New Projects for 2007-2008**

- 1 Characterization and source identification of Air Particulate Pollution in the Asian Region and its trans-boundary, visibility, climate change, and health impacts and consequences
- 2 Establishing a benchmark for assessing the radiological impact of nuclear power activities on the marine environment in the Asia-Pacific region
- 3 Assessment of trends in freshwater quality using environmental isotopes and chemical techniques for improved resource management

## **Research Reactor (Improvement of Research Reactor Operation and Utilisation):**

Research reactors form the backbone of all activities making use of nuclear techniques and hence a well-established research reactor infrastructure is a mandatory requirement for the safe and efficient exploration of the peaceful applications of atomic energy. The **Research Reactor** not only produces various isotopes for application in the different thematic areas but is also a facility for training the required manpower for the nuclear power programme and doing a lot of R&D for the power programmes, most of which is done in the high pressure & high temperature loops installed in the core of Research Reactor. These loop simulates power reactor conditions, and can be used for development of nuclear fuels and structural materials, fuel chemistry, radiochemistry, activity transportation studies etc. The research reactors are also used for radiation protection and emergency preparedness.

**TSLCC**

**Republic  
of Korea**



Mr. Jun, Byung Jin  
Korea Atomic Energy  
Research Institute (KAERI)  
150 Dukjin-dong,  
Yuseong-gu, Daejeon 305-353

Tel: 0082 42 868 8493

Fax: 0082 42 861 0209

e-mail: [bjjun@kaeri.re.kr](mailto:bjjun@kaeri.re.kr)

### **Projects 2005-2006**

#### **Radioisotope Production and Neutron Beam Applications (RAS/4/024)**

##### **Objectives**

To achieve sustainability in research reactor utilization for isotope production and beam line applications, while ensuring safety in operation. The outcome will have an impact in the fields of medicine, agriculture and industry.

##### **Background**

In East Asia and the Pacific region, about 40 research reactors are in operation in 12 Member States (MS) and five new research reactor projects are in the a proposal stage. Almost all of the research reactor projects are government initiatives to sustain application of nuclear technology for national socio-economic development. Radioisotope production and neutron beam application are activities of interest for most of the participating Member States, and respective governments desire an improvement or an expansion of these activities. Furthermore, some Member States need improvement in technology and facilities for research reactor utilization. Research reactors are fundamental to the development of a national research and development capability and are therefore essential to the application of nuclear techniques in medicine, food, agriculture, industry and the environment.

The project aims at disseminating information on the state-of-the-art techniques in irradiation for radioisotope production, design and use of neutron beam line instruments, research reactor quality assurance, and neutronic analysis.

RAS/4/011, RAS/4/019 and RAS/4/020 were designed to improve the capability of RCA Member States in i) establishing and nurturing a safety culture; ii) timely decisions on temporary and extended shutdown, refurbishment- and decommissioning; iii) ensuring appropriate quality assurance and ageing management programmes; and iv) performing periodic review of safety management systems. However, under utilization of research reactors is still an issue of concern for many Member States in the region. Nevertheless, improvement in research reactor operation and utilization is a continuous process and the proposed project is expected to further enhance the capability of participating RCA Member States with state-of-the-art technology. Participation in the previous activities of the above-mentioned projects has provided avenues for exchange of experience with other key research reactor personnel of other Member States. It is expected that this project will provide an opportunity for exchange of experience, particularly to enhance isotope production and neutron beam applications, which have relevance in the field of health, food, agriculture, industry and the environment, while maintaining the established safety culture.

### **National Commitment**

Countries in the region with operating research reactors have indicated their interest to participate in the project. Their national infrastructure is adequate to ensure the successful performance of the project activities. The participating countries will host training courses and workshops, including cost-free premises, facilities, local lecturers, and arrangements for internal travel and accommodation.

### **Outcomes**

1. Improved design of irradiation facilities and targets for radioisotope production.
2. Skills and competence of key personnel, including reactor managers, personnel responsible for radioisotope production, neutron beams and neutronic calculation.

### **Performance Indicators for Outcomes**

1. Increased production of radioisotopes with better quality at a lower cost as a result of improved irradiation facilities in at least 5 participating Member States within one year after completion of the project.
2. At least 25 persons trained on isotope production, neutron beam applications, and neutronics before the end of the project, for improving research reactor utilization.

### **Expected Project Impact**

The project is expected to enhance and improve RCA participating Member States' capability in radioisotope production and neutron beam application in a safe and effective manner. This will lead to generation of routine income for the counterpart institutions and contribute to continuous development of human resources and self-reliance of national nuclear centres.

personnel responsible for radioisotope production, neutron beams and neutronic calculation.

### **Approved New Projects for 2007-2008**

1 Increase of Material Value by Neutron Irradiation

### **Radiation Protection:**

Safe handling of radiation and radioactive materials and their disposal forms an integral part of any nuclear technology programme and creating awareness, training, manpower development and new techniques for radiation protection is an important aspect.

**TSLCC**

**Australia**



Mr. David A Woods  
Head, Radiation Protection Services  
ANSTO (Australian Nuclear Science  
& Technology Organisation)  
PMB 1 Menai N.S.W. 2234

Tel: 00 61 2 97173578

Fax: 00 61 2 9717 9266

e-mail: [daw@ansto.gov.au](mailto:daw@ansto.gov.au)

### **Projects 2005-2006**

#### **Harmonization of Radiation Protection, Phase IV (RAS/9/029)**

**Objectives:** The overall objective is to achieve a strengthened radiation protection environment in RCA Member States. This is being realized through a balance of measures addressing a wide range of enhancements from improvements in legislation and regulatory control regimes, consistent with the requirements of the Basic Safety Standards (BSS); to upgrade the knowledge and experience of medical and industrial personnel working with ionizing radiation as well as to further improve the control and safe use of radiation sources, including emergencies from accidents or from terrorist threats. There is also a need for phase IV to address additional factors introduced through the progressive introduction of new equipment and new technology.

**Background:** The project RAS/9/018 was first approved in 1997 as an extension of RAS/9/006. The next phase of the programme was formulated at the Expert Advisory Group Meeting held in Christchurch, New Zealand, in March 2001. The RCA Member States will participate in an integrated management arrangement to ensure that the activities being undertaken under this project are being efficiently and effectively harmonized with those being undertaken as part of the ongoing projects RAS/9/026 and RAS/9/027. All three projects will collectively contribute to the attainment of the milestones set for establishing: regulatory framework; occupational, medical, and public exposure control; and the development of capabilities for preparedness and response to radiological emergencies. Each of these milestones has been categorized with individual objectives, outputs, outcomes, and performance indicators to assist in ongoing management, assessment, and evaluation. All 17 RCA Member States are participating in this project and in-kind and extrabudgetary support will supplement the Agency funding. Footnote a/ support is anticipated for the components on improving regional capacity to respond to radiological emergencies including those from terrorist threats and assessing radiological risk.

**National commitment:** Each participating country will designate a National Focal Person on Radiation Protection who will co-ordinate all radiation protection projects at the national level and will be supported by any National Project Co-ordinators appointed for individual regional projects. They will be tasked with targeting the attainment of the milestones identified in the project document and securing in-kind and extrabudgetary contributions to support the project. Most of the RCA Member States are also participating in the radiation protection projects RAS/9/026 and RAS/9/027.

A co-ordination group involving selected National Focal Persons in Radiation Protection will provide advice to the RCA and Regional Managers on the national activities in radiation protection.

Extrabudgetary contributions have been provided by Australia and Japan to implement project activities in previous phases of the project. The possibility for further support has been indicated, particularly to support activities to enhance the regional capacity to respond to radiological emergencies including those from terrorist threats and in the assessment of radiological risk from accidental radiological release scenarios. These elements will provide an opportunity to consolidate existing training packages, and to develop additional training material.

**Agency input:** The Agency will provide administrative and technical backstopping as provided for under the regional agreement as well as support for activities including training events, fellowship placements, and expert services. The Technical Officer and the Regional Manager, in consultation with the Co-ordination Committee, will ensure that there is no duplication of effort or overlap of the project activities with RAS/9/026 and RAS/9/027.

**Performance Indicators:**

- Number of regional events implemented and number of trained persons/participants.
- Training material (on CD-ROM) provided to Member States.
- Co-ordination or project activities at the national level in the Member States harmonized.

**Expected Results:** The regional harmonization of radiation protection practices and procedures will be achieved with a high degree of regional ownership that will enhance the sustainability of the project achievements. Regulatory systems for the control of radiation sources consistent with the BSS will be regionally harmonized; common systems of implementation of the principles, practices, and measurement techniques will provide a strong platform for the development of technical co-operation among developing countries (TCDC). The project will enhance the region's capability to assess, plan, and respond to radiological emergencies, including those from terrorist threats, and therefore reduce the risks to the economic well-being and health of communities in the region. The transboundary nature of the problems being addressed underlines the need for a regional response.

**Project Impact:** The project will contribute to the establishment of an improved radiological safety environment in the region through the establishment of enhanced regulatory systems and practices as well as an enhanced response and preparedness capability for any radiological emergencies. These improvements and upgrades in capability and capacity will contribute to enhancing public confidence about the application and use of nuclear techniques.

**Assessment of Radiological Risks (RAS/9/031)**

## **Objectives**

To develop the capacity in Member States to assess the consequences of accidental radiological releases in order to take counter measures to minimize the radiation doses to the population.

## **Background**

This approved project is being continued from 2004.

The models presently available for assessing the consequences of radiological releases are based on data pertaining to temperate and cold climates and therefore cannot be considered valid for tropical or sub-tropical climates. Assessment of the consequences of radiological accident scenarios would be necessary to take counter measures to reduce the radiation doses to the affected populations, often farmers and peasant populations. The models used for this purpose should be based on accurate climatic and transport parameters for tropical climates and appropriate shielding factors.

The Australian Nuclear Science and Technology Organization (ANSTO) has developed a model for assessing radiological consequences (RADCON) which allows consequence analysis for various groups of people including women and children, taking into account local environmental and social parameters.

Under this project, ANSTO will initially train experts from Indonesian Nuclear Energy Agency (BATAN) on radiological consequence modelling and on collecting, storing and verifying data needed for the model. Local environmental and social parameters will be collected including meteorological data, transfer parameters, and lifestyle and shielding factors. After the demonstration model is completed, a workshop will be held in Indonesia to transfer the technology to the other participating Member States.

## **Other Stakeholders Input**

Australia has made extrabudgetary contribution of \$185 000 over a period of three years (2005–2007).

## **Agency Input**

The Agency will provide administrative and technical backstopping, as well as support for activities including training events and expert services.

## **Outcomes**

1. Capability developed among participating Member States to assess the consequences of accidental radiological releases taking local environmental and social conditions into consideration. This shall include the capability of collecting and validating data.

### **Performance indicators for Outcomes**

- 1a. Development and validation of the computer model by Indonesia using local environmental and social parameters of Indonesia before end of 2005.
- 1b. Number of Member States that acquire the knowledge of consequence modelling and collection and validation of data needed for the model, which assesses the risk associated with possible accident scenarios based on local environmental and social conditions and incorporate them to national emergency response plans before the end of 2007.

## **Expected Project Impact**

The project will enable the Member States to assess the consequences of different radiological accident scenarios in order to develop counter measures to reduce the radiation doses to the population in the event of a radiological accident.

## **Radiological Emergency Response (RAS/9/032)**

### **Objectives**

To enhance the capacity in Member States to respond to radiological emergencies.

### **Background**

This approved project is being continued from 2004 with an extrabudgetary contribution from Australia.

Radiation emergencies can arise through accidental releases from nuclear facilities, through radiological accidents involving lost or uncontrolled radiation sources or through acts of sabotage or terrorism on radioactive material. Significant numbers of accidents have occurred in both developed and developing countries because of failure of regulatory controls. These accidents have produced severe radiation injury to exposed individuals or contaminated communities with high levels of radioactivity. For developing countries, in addition to protecting the health of individuals, the need to divert resources from basic development projects can be reduced, if such accidents are effectively dealt with at the initial stages.

The Australian Nuclear Science and Technology Organization (ANSTO) has participated in Agency workshops writing basic material on which international recommendations for emergency response are based. ANSTO also has run and provided experts for a number of emergency response training courses and workshops held in the Asia and the Pacific Region. The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) has used the Agency's generic guidance to produce procedural manuals and training material for a number of radiation response teams.

Personnel from national emergency response organizations in the region have received training and materials for responding to radiological and nuclear accidents and radiological terrorism events at a training programme held previously under a related project. Under the current project, the expertise gained by the regional emergency response organizations and the effectiveness of their emergency response plans will be assessed at a workshop to be held with the participation of specialists from ANSTO and ARPANSA. The workshop will include feedback from participants on the application of their earlier training.

Field trials will also be conducted in the Republic of Korea with the assistance of Korean Institute for Nuclear Safety (KINS) to further improve the capacity of the Member States to respond to radiological emergencies. The participants will use their own emergency response equipment in dealing with a number of simulated radiological accidents/incidents.

### **Outcomes**

1. Capability developed among participating Member States to effectively deal with radiological emergencies.

### **Performance Indicators for Outcomes**

1a. Twelve participants from Member States taking part in a workshop and the field trials to improve their capabilities of responding to radiological emergencies and to disseminate the knowledge gained among members of the emergency response groups by end of 2006.

1b. At least five Member States have developed the capability of effectively responding to identified radiological emergency scenarios in order to mitigate the effects by end 2006.

#### **Expected Project Impact**

The project will enable the Member States to reduce the health effects due to radiological accidents and to minimize the diversion of resources to mitigate the consequence of such accidents.

#### **Approved New Projects for 2007-2008**

1 Sustainability of Regional Radiation Protection Infrastructure

#### **☞ Technical Co-operation between Developing Countries (TCDC)**

One of the objectives of TCDC is "to strengthen the capacity of developing countries to identify and analyze together the main issues of their development and to formulate the requisite strategies..." Consequently, all Regional Co-operative Agreements sought new ways to expand regional "ownership" by assuming greater responsibility for the formulation and implementation of regional programmes financed by the Agency and other donors.

#### **ENO (Electronic networking & outreach for RCA information flow & distant learning):**

Electronic Networking and Internet has become an essential tool for the rapid socio-economic advancements and realising it as a newly introduced concept for quick dissemination and bi-directional information flow between the member countries making use of sophisticated communication means that will further enhance the output, exchange of views and better project management was incorporated. The first phase has been successfully implemented and the RCA web scheme with regional home page, 14 national home pages, Vienna RCA office home page and linkage to various related sites, has established the role of ENO as a coordinating link and communication vehicle of RCA.

#### **Management of Technical Co-operation among Developing Countries (RAS/0/035)**

**OBJECTIVES:** To manage technical co-operation among developing countries (TCDC) in the nuclear field within RCA Member States and with other regions/regional agreements; to increase the capability of electronic networking among the Member States to include databases, internet-based distance-learning materials developed previously and to be developed under the RCA programme; to provide support to the management of RCA; and to identify and promote partnership and collaboration with other regional organizations and agreements.

**BACKGROUND:** TCDC has been carried out among the RCA Member States for several years under various RCA projects through provision of facilities, experts, services, and lecturers in various regional events and national activities. Recruitment of national consultants has been carried out to undertake special studies and activities related to the RCA programme, and this activity is expected to be continued. Additionally, personnel from Member States are provided opportunities to undergo experiential training. The ownership of the RCA programme is manifested through the twin concepts of lead country and regional resource units. A better understanding of the role of lead countries among Member States is still needed to enable the Member States to implement and monitor project activities with minimal constraints.

The electronic network established among RCA Member States under the joint United Nations Development Programme (UNDP)/RCA/IAEA project RAS /97/030 resulted in the creation of regional RCA and national RCA web pages in Member States. The web page, after having been used for promotion of nuclear science and technology and dissemination of information among Member States, is proposed to be expanded to include other applications including storage of databases and a platform for distance-learning materials developed in other RCA projects.

At the 24th RCA Meeting of National Representatives in Korea in March 2002, Member States inaugurated an RCA Regional Office in Korea. This office, made possible through Korean financial contribution, will operate initially on a two-year interim basis during which time pending issues surrounding its establishment will be resolved. This office is intended to provide high visibility to the RCA as provider of nuclear technology to solve high-priority developmental needs of the region and also to obtain additional funding for the RCA programme. Support and guidance to this office in addressing legal and administrative issues still needs to be provided in this interim period.

A consultative meeting was held by RCA in March 2001, in Bangladesh involving other regional and international organizations, e.g., International Maritime Organization/Global Environmental Facility (IMO/GEF), United Nations Children's Fund ( UNICEF), and United Nations Economic and Social Commission in Asia Pacific (UN ESCAP) to exchange information and identify differentiated commonalities in addressing issues in environment and natural resources; this meeting resulted in identifying areas for future collaboration in selected areas, such as air pollution, water, and marine pollution. Collaboration with RCA and Forum for Nuclear Cooperation in Asia (FNCA) through exchange of information and joint undertaking will be continued and pursued.

A tripartite forum held among the three regional agreements, ARCAL, AFRA, and RCA, provided opportunities for technology transfer among the Member States of the agreements, and continuous exchange of information among these was found to be important and needs to continue.

**NATIONAL COMMITMENT:** Member States will continue to maintain their national web pages; Malaysia and/or the regional office will continue to maintain the RCA regional web page; Member States will participate in development and/or trials of internet-based distance-learning initiatives. Countries will provide national consultants to various activities in the RCA, such as development of training materials, evaluation of selected RCA projects and project activities; organizing meetings; provide administrative support to RCA National Representatives; and prepare and submit reports and success stories. Korea will continue to support the regional office.

**AGENCY INPUT:** The Agency will provide administrative and technical support to the project activities through provision of experts, organization of regional events, liaising with other regional organizations

**PERFORMANCE INDICATORS:**

- Increased use of regional experts.
- Inventory of regional database established and operational.
- Platform of "e-learning" initiative for at least one distance-learning subject established.
- Project collaboration with other regional organizations.
- Promotional materials on RCA produced.
- Regular forum for exchange of information with other agreements and partners maintained.

**EXPECTED RESULTS:** More RCA regional experts will be recruited for assignments within RCA in the spirit of TCDC; additional internet-based distance-learning materials will be made available and ready for trial; the inventory of RCA technologies and database will be used in promoting regional activities; collaborative work with other regional organizations and regional agreements are identified and mechanisms for implementation will be in place.

**PROJECT IMPACT:** This project will enhance the technical co-operation among developing countries in the region. More outreach to people who need training in various nuclear technologies will be achieved through e-learning activities. Further regional co-operation will be achieved.