

# RCA

## Regional Cooperative Agreement

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



RCA Regional Office  
[www.rcaro.org](http://www.rcaro.org)









## **Regional Cooperative Agreement**

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

A photograph of three children jumping joyfully in a grassy field. The child on the left is a girl with dark hair, wearing a striped shirt and jeans. The child in the middle is a boy with dark hair, wearing a yellow shirt and khaki pants. The child on the right is a girl with long brown hair, wearing a white shirt and jeans. They are all smiling and have their arms raised. The background shows green trees and a bright sky.

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A low-angle shot of three children jumping joyfully in a grassy park. The boy in the center wears a green polo shirt and blue jeans, with his arms raised high. To his right, a girl with curly hair in an orange shirt and white pants is also jumping with arms outstretched. A third child is partially visible on the left. The background is filled with lush green trees and bright sunlight filtering through the leaves. A semi-transparent white banner is overlaid across the middle of the image.

**Prosperity for the future**



# Introduction to RCA

## What is RCA?

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

The Agreement provides a framework for IAEA Member States in Asia and the Pacific region to cooperate with each other and the IAEA in order to promote and coordinate cooperative research, development, and training projects in nuclear science and technology through the appropriate nuclear institutions within the Member States.

The RCA Regional Office was established on 27 March 2002 in Daejeon, Korea for the purpose of providing enhanced visibility for the RCA and developing partnerships with other organizations. The government of the Republic of Korea has financed the operation since its inauguration.



## RCA Government Parties

The following 22 IAEA Member States in Asia and the Pacific region are the current signatories to the RCA: Australia (AUL), Bangladesh (BGD), Cambodia (KAM), the People's Republic of China (CPR), Fiji (FIJ), India (IND), Indonesia (INS), Japan (JPN), the Republic of Korea (ROK), Laos (LAO), Malaysia (MAL), Mongolia (MON), Myanmar (MYA), Nepal (NEP), New Zealand (NZE), Pakistan (PAK), the Republic of Palau (PLW), the Philippines (PHI), Singapore (SIN), Sri Lanka (SRL), Thailand (THA), and Vietnam (VIE).

Each RCA Government Party designates a National RCA Representative (NR) who is the principal point of contact for RCA activities in his/her GP. The NRs act on behalf of their Governments and are responsible to them for the operation of the RCA within the terms of the Agreement.

The NRs hold at least two meetings a year:

- The National Representative Meeting (NRM) is held, usually in March/April, at venues in the region, as agreed upon by the NRs;
- The General Conference Meeting (GCM) is held prior to the IAEA General Conference, usually in September at the IAEA Headquarters in Vienna, Austria.

At the meetings the National RCA Representatives:

- Approve the RCA Annual Report which includes the activities of the RCARO;
- Consider policy issues, overall management and planning, developing RCA projects.

- Consider the reports of the NRs of Lead Countries on the progress in each RCA project and make recommendations for improving the effectiveness and efficiency of the programmes;
- Decide on the future priorities of the RCA Programme;
- Consider the financial reports;
- Address any other matters relevant to the implementation of the RCA Programme.

### RCA Vision

The RCA shall be recognized as an effective partner in providing nuclear technologies that enhance socioeconomic wellbeing and contribute to sustainable development in the region.

### RCA Mission

- To identify and implement nuclear technologies that address regional needs;
- To encourage sustainability of nuclear technology capacities in RCA Government Parties and to ensure transfer of those technologies and associated technical know-how to end-users;
- To coordinate cooperative research in applications of nuclear science and technology;
- To promote the benefits of nuclear technologies and identify partners and funding mechanisms;
- To develop regional networks for exchange of technologies, training and equipment.









## Milestones of RCA

- 1972: First regional cooperative agreement under the aegis of IAEA
- 1973: First RCA Representatives Meeting at IAEA Headquarters in Vienna, Austria
- 1973: First RCA Project launched (on preservation of fish and fishery products)
- 1979: First Meeting of RCA Representatives held in Japan
- 1982: First UNDP/IAEA/RCA Industrial Project implemented
- 2002: The RCA Regional Office (RCARO) opened in Korea
- 2005: The RCARO's full operation started
- 2006: The RCA Medium Term Strategy for 2006~2011 established
- 2009: The RCA Medium Term Strategy for 2012~2017 established  
The 8<sup>th</sup> Extension of the RCA Agreement
- 2012: The 40<sup>th</sup> anniversary of RCA

## RCA Strengthens TCDC

The RCA is a vehicle for encouraging and stimulating Technical Cooperation among Developing Countries (TCDC) by enhanced networking and partnership among developing Member States. It also has flow-on effects to other organizations and regional partners.

## RCA Strategic Directions

- Ensuring effective management of the RCA;
- Achieving greater impact for RCA projects;
- Developing nuclear technology capacities in RCA Government Parties that are sustainable and address identified socioeconomic needs;
- Enhancing the uptake of nuclear technologies and increasing the visibility of the RCA;
- Ensuring that regional priorities guide the ongoing direction of the RCA.

The following are the focus areas in the RCA Strategic Priorities for 2012-2017.

- Agriculture
  - 1) Plant Mutation Breeding
  - 2) Animal Production and Health
  - 3) Food Irradiation
  - 4) Soils and Land-use
  - 5) Insect and Pest Control – Sterile Insect Technique (SIT)
- Human Health
  - 1) Intensity Modulated Radiation Therapy (IMRT)
  - 2) Hybrid Nuclear Medicine Imaging (PET/CT and SPECT/CT) in Cancer Management.
  - 3) Image Guided Brachytherapy for predominant cancers in the region.
  - 4) Management of common cancers in the RCA region by radiation therapy (RT)
  - 5) Nuclear Medicine in the Management of Cardio-vascular Diseases
- Environment
  - 1) Sustainable air particulate matter monitoring
  - 2) Sustainable water resources development
  - 3) Sustainable marine coastal resources development
- Industry
  - 1) Non-destructive testing
  - 2) Radiation processing technology
  - 3) Use of radiotracers for industrial troubleshooting and process optimisation





## What are IAEA/RCA Projects?

Over its lifetime, the RCA has received funding for its projects through extra-budgetary donations from many of its Member States as well as regional and international organizations, such as the United Nations Development Programme(UNDP), but the major source of funding has been from the IAEA's Technical Cooperation Fund(TCF).

Almost all the RCA projects have been and are being implemented through the IAEA's Technical Cooperation(TC) Programme irrespective of the source of funding. Where required or requested, the IAEA provides technical support and project management services including planning, formulation, implementation and evaluation.

RCA projects implemented through the IAEA TC Programme are referred to as IAEA/RCA projects.

The projects supported under the IAEA TC Programme should be aligned with the strategic goal of IAEA's TC, which is “to increasingly promote tangible socioeconomic impact by contributing directly in a cost-effective manner to the achievement of the major sustainable development priorities of each country”. The main objectives of the IAEA TC programme are:

- To produce sustainable benefits within the framework of national development plans;
- To gain recognition as a partner in resolving development problems through the cost-effective transfer of nuclear technologies;
- To increase the level of funding for technical cooperation activities, particularly from non-traditional sources, and to increase the number of opportunities for direct and “parallel funding” to help resolve development problems, and;
- To strengthen the capacity of institutions in Member States using nuclear technologies to become more technically and financially self-reliant.

The IAEA performs secretariat duties under the Agreement.

## Critical Success Factors of RCA Projects

The success factors for suitability of a project for inclusion in the RCA are:

- Projects should be ‘needs driven’ and benefit from regional cooperation;
- Projects should be of sufficient size to achieve high impact and measurable outcomes;
- Project design should include evaluation as a key component;
- Increasing use of regional networks and resources, wherever possible;
- Designed to enhance sustainability of national nuclear technology capabilities;
- Built on adequate national resources and infrastructure, and be supported by national programmes;
- Choosing projects where a nuclear technique is a high value adding approach and technology transfer is a major focus;
- Taking into account the IAEA Technical Cooperation strategy and UN Millennium Development Goals, and;
- Avoiding duplication with other mechanisms(national projects, non-RCA projects, and other agreements).



IAEA/RCA Projects for the 2016-2017 Cycle are as follows

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AREA	Code	Project Title	Period
Capacity Building	RAS0074	Enhancing the Management of the Regional Agreement and its Programme (RCA)	2016-2017
Agriculture	RAS5070	Developing Bioenergy Crops to Optimize Marginal Land Productivity through Mutation Breeding and Related Techniques (RCA)	2015-2018
	RAS5071	Strengthening Adaptive Climate Change Strategies for Food Security through the use of Food Irradiation (RCA)	2015-2017
	RAS5077	Promoting the Application of Mutation Techniques and Related Biotechnologies for the Development of Green Crop Varieties (RCA)	2017-2020
Human Health	RAS6071	Strengthening Radionuclide Therapy for High Impact Cancer Treatment Strategy in Member States of the Regional Cooperative Agreement (RCA)	2015-2017
	RAS6072	Strengthening Intensity Modulated Radiation Therapy Capability in the Region (RCA)	2015-2017
	RAS6076	Improving Cancer Management Through Strengthening the Computed Tomography Cancer Staging Process (RCA)	2014-2016
	RAS6077	Strengthening the Effectiveness and Extent of Medical Physics Education and Training (RCA)	2014-2017
	RAS6083	Improving Patient Care and Enhancing Government Parties Capacity in Nuclear Medicine programmes in RCA Region (RCA)	2016-2018
	RAS6085	Enhancing Stereotactic Body Radiation Therapy for Frequent Cancers in the RCA Region (RCA)	2016-2019
Environment	RAS7028	Enhancing Regional Capabilities for Marine Radioactivity Monitoring and Assessment of the Potential Impact of Radioactive Releases from Nuclear Facilities in Asia-Pacific Marine Ecosystems (RCA)	2017-2020
	RAS7029	Assessing the Impact of Urban Air Particulate Matter on Air Quality (RCA)	2016-2018
	RAS7030	Assessing Deep Groundwater Resources for Sustainable Management Through the Utilization of Isotopic Techniques (RCA)	2016-2019
Industry	RAS1014	Supporting Radiation Processing for the Development of Advanced Grafted Materials for Industrial Applications and Environmental Preservation	2012-2015
	RAS1020	Building Capacity for Applications of Advanced Non-Destructive Evaluation Technologies for Enhancing Industrial Productivity (RCA)	2014-2017

## RCA in Pursuit of Partnerships

Strategic partnerships have been and are being sought through collaboration with regional and international funding organizations to help in regional development and develop joint projects and networks, with the aim of sharing benefits more widely.

This mechanism ensures that the RCA pursues regional collaborations with other organizations in a systematic manner, and that RCA partnerships, both in each country and regionally, are focused only on a few priority collaboration areas that can produce the greatest benefits. RCARO has been assigned with the mission to develop such partnership projects.

## Celebration of 40<sup>th</sup> Anniversary of RCA-Panel Discussion and Exhibition

In celebrating the 40<sup>th</sup> Anniversary of the RCA in 2012, RCA Exhibitions and Panel Discussions were organized in connection with the 34<sup>th</sup> National RCA Representative Meeting in Beijing, China, and at the 56<sup>th</sup> IAEA's General Conference in Vienna. The events were successful in enhancing awareness of the RCA programmes as well as publicizing the RCA successes and achievements in the four thematic areas: food and agriculture, human health, water and environment, and industrial applications.

### a) RCA Panel Discussion

The event was organized at the IAEA Headquarters in Vienna, on 18 September 2012. At the suggestion of the RCA Government Parties, the Panel Discussion focused on the successful cooperation and achievements of the RCA during the past 40 years, with the emphasis on the four thematic areas of RCA Programme. Experts from the region were invited to participate in the event as keynote speakers and panelists.



### b) RCA Exhibition

The exhibition was organized at the Rotunda area of the IAEA Headquarters in connection with the IAEA General Conference. The preparations and arrangements were coordinated by the RCARO in cooperation with the Government Parties, IAEA and RCA experts.

Exhibition materials, the promotional RCA video and sample products from the RCA projects showed the successful cooperation and achievements of the RCA during the past 40 years, with the focus on four thematic areas: The opening session took place on 18 September immediately after the RCA Panel Discussion. The visitors included the Director General of IAEA, National Representatives of the Government Parties, government delegates and many experts.

Another exhibition of the 40<sup>th</sup> Anniversary of the RCA was organized during the 34<sup>th</sup> RCA National Representative Meeting in Beijing, China. The exhibition gave a brief introduction to the RCA and showed the achievements of the RCA in the four thematic areas.

These celebratory events contributed to enhancing a wider understanding and visibility of the RCA and its programme.



## Best Practices Awards from the IAEA

Best Practice is a superior method, action or innovative practice that contributes to the improved performance of an organization. The IAEA Technical Cooperation (TC) Department initiated the Best Practices Awards to assist in improving performance through information sharing, networking and managing the knowledge and experience of stakeholders in the TC programme.

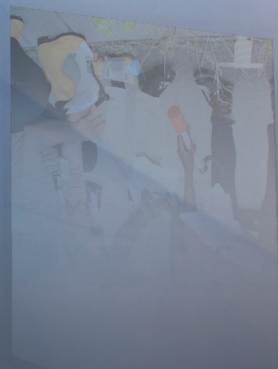
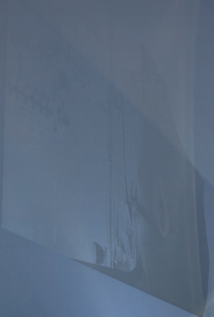
In 2012, the RCA was awarded TC Best Practices Awards in the following three areas:


- “Building the future on strong foundations: Evidence-based regional priorities for the RCA”, prepared by New Zealand
- “Building the future on effective and sustainable technology transfer: An active and monitored TCDC and partnership programme for the RCA”, prepared by Australia and the Philippines
- “Enhanced prosperity of RCA: RCA promotional and information programme engaging a wide range of stakeholder”, prepared by RCA Regional Office

This is a significant recognition of the effectiveness of the mechanisms and procedures developed and used by the RCA which have the potential to help strengthen and enhance technical and multilateral cooperation elsewhere.







A large photograph of a nuclear reactor facility, showing a long row of cooling towers and industrial buildings. In the foreground, two workers wearing yellow hard hats and safety gear are standing on a platform, looking at a clipboard. The image is presented as a large, slightly tilted photograph on a dark background.

# RCA Achievements in Nuclear Technology Applications to Address Regional Needs

There are numerous ways in which nuclear technologies are applied to solve everyday problems, including meeting human needs, advancing life sciences, and benefiting the physical sciences.

Some examples of major RCA achievements during the recent years as well as RCA outcomes expected from the on-going projects are given here.



A close-up photograph of several rice panicles. The panicles are green and yellow, showing the individual grains. They are set against a dark, blurred background. The lighting is bright, highlighting the texture of the rice grains.

# Meeting Basic Human Needs

Many developing countries in the region face enormous constraints in ensuring food security and safety. Efforts have been made to address those problems by enhancing Government Parties' capabilities and capacities to use nuclear technology in agriculture for improving management of land crop and livestock productivity, food safety, and overall quality.

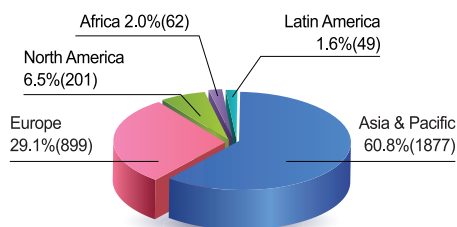


# Agriculture

## Mutation Breeding Techniques for Improving Crop Quality

Mutation breeding is an established technique that is able to induce genetic changes that improve the quality and productivity of crops. The RCA Project RAS/5/045 was implemented from 2007 to 2010 with the objective to develop and transfer methodologies and technologies to RCA Government Parties for the induction and identification of mutated genes contributing to important crop quality characters and stress tolerance. It has achieved the following:

- Establishment of new techniques and methods, such as screening methodologies for starch quality in rice (China), a mutation detection platform by capillary electrophoresis, advanced mutational analysis on important mutant genes(Australia), and papaya regeneration and early screening for Papaya Ring Spot Virus(Malaysia);
- Development of more than 30 procedures and manuals on mutagenesis and Marker Assisted Selection for routine application for desirable plant or crop characteristics and personnel training;
- Development of more than 470 stable mutants with significantly improved stress tolerance, quality and yield potential characteristics in cereals, grain legumes, fruits and vegetables in RCA Member States with 125 advanced crop mutant lines in regional trials, and use of 236 well-characterized mutants for genetic studies;



Worldwide Mutant Varieties

- 41 mutant varieties officially released and put into production in Australia, Bangladesh, China, India, Indonesia, Korea, and Vietnam, using a total of 118 million ha of dissemination areas for the released mutant varieties and leading to a financial increase of about US\$ 227 Million to farmers in the participating Member States;

- Establishment of the Asia and Oceania Association of Plant Mutagenesis(AOAPM) as an effective platform to support and sustain the networking of professionals and researchers in Plant Breeding.

## Improved Livestock Productivity

RCA Government Parties have been tackling the problems of improving livestock productivity while at the same time conserving the environment.

Two RCA projects were implemented between 2001 and 2009(RAS/5/041 in 2001~2004 and RAS/5/044 in 2005~2009) to transfer important key technologies to the region. They achieved the following results:

- Improvement of livestock with 25% increase in milk yields, 70% weight gain of cattle by improved nutrition, 70% reduced methane emissions;
- Development of 47 feeds, Urea Molasses Multinutrient Blocks(UMMB), which enables better nutrition and health of livestock while reducing greenhouse gas emission;
- Improved reproductive efficiency of cattle through radioimmunoassay diagnostic support for Artificial Insemination(AI).

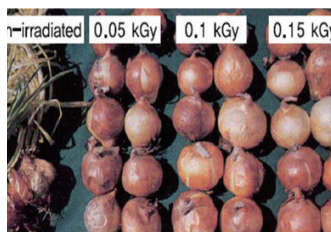


Urea Molasses Multi-nutrient Blocks(UMMB)

## Enhanced Food Safety and Security

Regional food safety and security is a priority for the RCA region. The RCA project RAS/5/050 was implemented from 2009 to 2012 with the objective of enhancing regional food safety and security and contributing to increasing the economic benefits through the use of irradiation technology. The following major achievements were made:

- Guidelines developed for the accreditation procedures and audit of food irradiation facilities and submitted to the Food & Agriculture Organisation (FAO) in Bangkok responsible for Phytosanitary Measures (RSPM) in the Asia-Pacific Region;
- Amendment of quarantine regulations in most RCA Government Parties based on the guidelines developed in the project with Australia, India, Vietnam, and Thailand having developed accreditation procedures, and;
- New trading partners for commercial exports of irradiated commodities successfully negotiated by five countries.



## Using Fallout Radio-nuclides and CSIA for Improving Soil Quality and Mitigating Land Degradation

Increasing land productivity and sustainable land use under a changing climate was identified as an important issue in the Asia-Pacific Region. To help address this, the RCA project RAS/5/055 was initiated in 2012 for a four year period.

The Fallout Radionuclide Technique (FRN) and Compound-Specific Isotope Analysis (CSIA) are the major tools being used in this project for the quantification of erosion and sediment management.

Soil redistribution patterns and rates from field scale to watershed scale are being established using FRNs with conventional techniques and spatial analysis. The following were achieved in the region:

- Enhanced and sustainable land productivity based on improved understanding of land degradation due to land use change, human intervention and climate change in a wide range of agro-ecosystems;
- Establishment of a regional database of isotopic signatures of crop and soil compounds (Isoscapes) and;
- Enhanced partnership with end-users and external institutions and partners.





The RCA Project RAS/5/043 was implemented from 2005 to 2010 and its major achievements are summarized as below:

- The results of conventional methods to assess soil redistribution correspond with the measured values based on  $^{137}\text{Cs}$ ;
- The use of  $^7\text{Be}$  has been proven to be an efficient tool to assess the efficiency of most soil conservation measures to reduce soil erosion in the short-term (rainfall events);
- The use of  $^{210}\text{Pb}$  offers the potential to estimate long-term erosion rates, where  $^{137}\text{Cs}$  cannot be properly detected;
- The excellent results of the proficiency tests show that the current analytical resources are sufficient to further successfully implement the FRN technology in the region;
- Participating countries have invested in the training of scientists and technicians in the use of FRN technology, showing their commitment in the development of human resources in the area;
- Participating countries have established and continued to develop partnerships with end-users for the dissemination of the FRN technology to assess soil redistribution;
- FRN capacities of a high technical level have been well established in China. Effective soil conservation measures identified by this regional project at Yan'an site in the Loess Plateau, China, have substantially reduced soil erosion.



# Advancing Life Sciences

The Human Health Sector has benefited from applications of nuclear technology in numerous ways. In most RCA Government Parties, emphasis is on the diagnosis and treatment of cancer, early detection and treatment of other common hereditary and non-hereditary diseases, and identification of nutritional deficiencies.

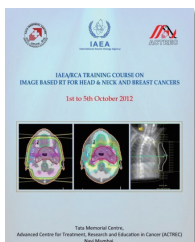


# Human Health

## Improving the Quality of Radiotherapy for Treatment of Cancer Patients

Radiation therapy practice for common cancers in the region is being improved by enhancing the application of evidence-based approaches and of quality standards with a focus on the 3D conformal radiotherapy. The RCA project RAS/6/053 was implemented from 2010 to 2014 and the following results are expected:

- Optimum and efficient use of image based radiotherapy and its Quality Assurance(QA) through utilization of technical documents and standardized teaching materials;
- Increased capability of the countries on image based radiotherapy and QA for sustainable development, and;
- Establishment of partnerships amongst related institutes such as formal relationships between the IAEA/RCA and national radiation oncology associations.



- Establishment of an expert network amongst the Applied Sciences of Oncology Course(ASOC) users as an important vehicle for further dissemination of the knowledge, and;
- Updated training materials, consisting of 80 specialist modules covering 8 subject areas, and converted a web-based content management system which provides for greater accessibility and utilisation of these materials and hence more access by radiation oncologists.



## Oncology Distance Learning

To tackle the worldwide shortage of radiation oncologists and improve the overall management of cancer patients, the RCA project RAS/6/066 was implemented from 2012 to 2013 and has built on the achievements of the RCA project RAS/6/033 which established a distance education programme in radiation oncology and has achieved the following:

- Over 2,500 downloads of the training materials worldwide as of 2012;

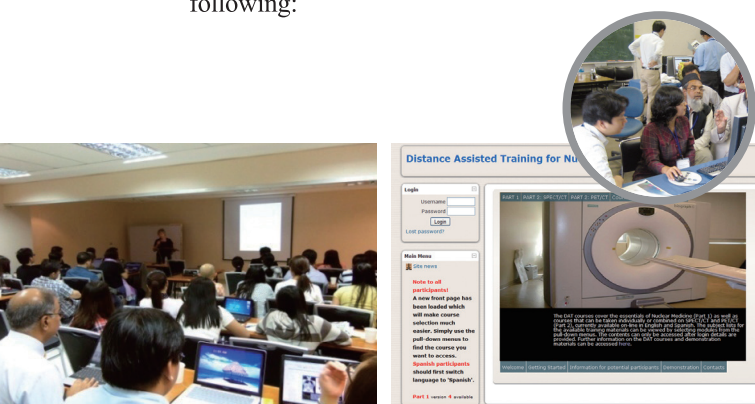




## Distance Assisted Training (DAT) for Nuclear Medicine Technicians

The RCA project RAS/6/064 was implemented from 2012 to 2013 to develop competency and capability in the safe and efficient practice of Nuclear Medicine with focus on Distance Assisted Training (DAT).

DAT Delivered On Line (DATOL) has been established to provide training courses for nuclear medicine technologists and access to networks, linkages, and technology transfer. The project has contributed to the following:

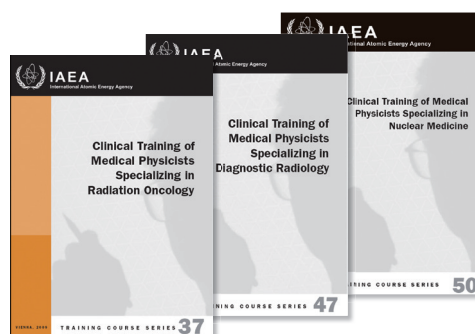


- Establishment of DATOL as a comprehensive training programme containing 40 subjects in 16 modules covering a wide range of nuclear medicine topics;
- Involvement of more than 225 participants from ten participating countries;
- Improved understanding and implementation of DATOL achieved through expert missions to participating countries;
- Sustainable capability developed through engagement with a larger number of national education institutions, and;
- Translation of the DAT programme into Spanish and French for implementation in ARCAL, AFRA\* and the European region.

## Publication of Guidelines for Medical Physicists

Improving the capability of personnel in medical physics has been recognized as an important component in the overall improvement of the quality of health care and patient treatment in radiation medicine. The RCA project RAS/6/038 was implemented between 2003 and 2012 with the objective of improving training in this area. It has achieved the following:

- Development of a set of comprehensive, structured clinical training guidelines for medical physicists in radiation oncology, medical imaging and nuclear medicine, which has contributed to upgrading the level and extent of patient safety;
- Implementation of more than ten programme trials were conducted in participating countries, and;
- Translation of the guidelines into Russian, French and Spanish for implementation in other regions such as ARCAL and ARASIA\* Member States.



Clinical Training Output

\* ARCAL: Regional Cooperative Agreement for the Promotion of Nuclear Science and Technology in Latin American and the Caribbean

\* AFRA: The African Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology

\* ARASIA: The Cooperative Agreement for Arab States in Asia for Research, Development and Training Related to Nuclear Science and Technology



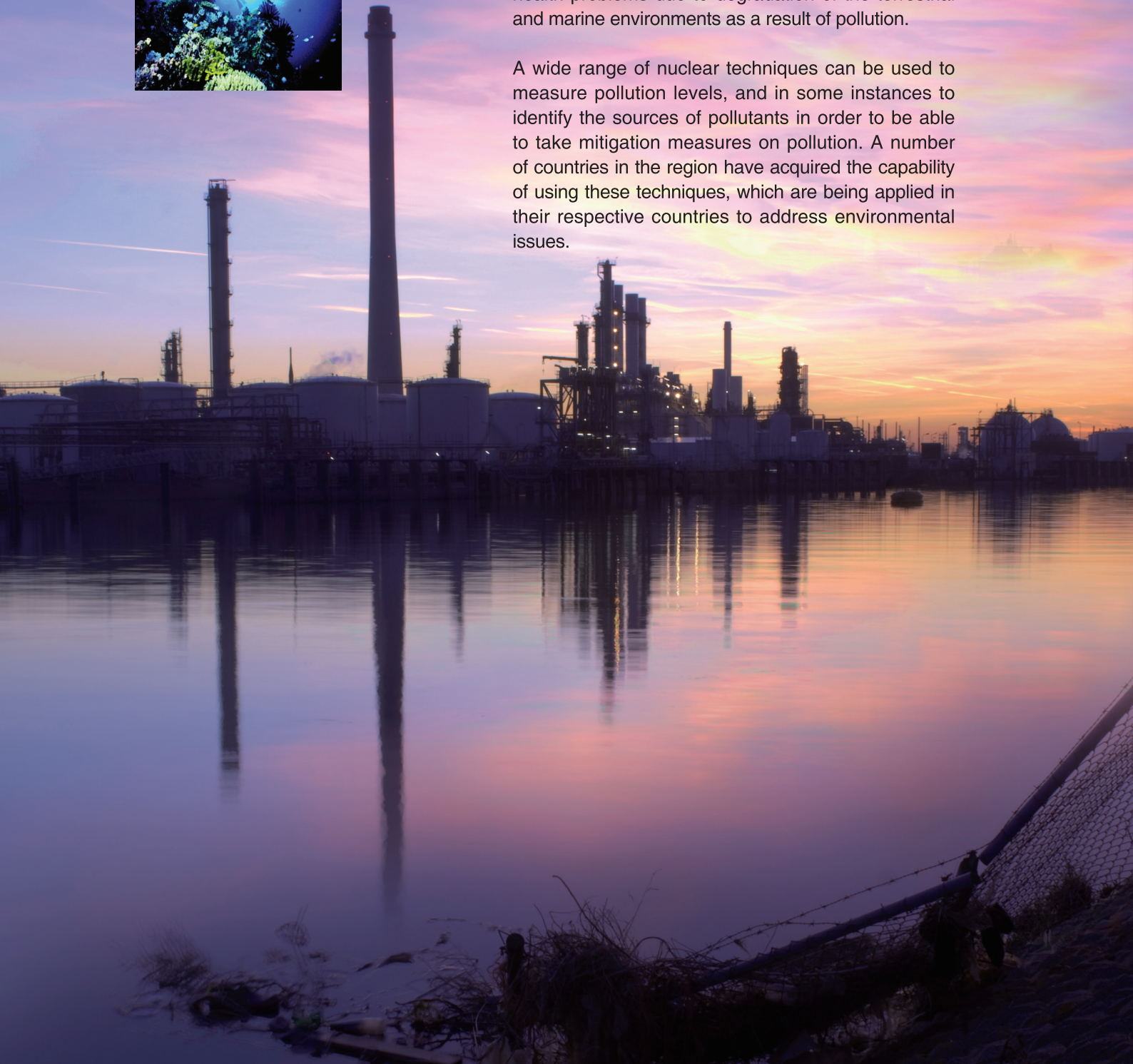


# Addressing Environmental Issues



Environmental issues need to be addressed, since many populations are facing serious economic and health problems due to degradation of the terrestrial and marine environments as a result of pollution.

A wide range of nuclear techniques can be used to measure pollution levels, and in some instances to identify the sources of pollutants in order to be able to take mitigation measures on pollution. A number of countries in the region have acquired the capability of using these techniques, which are being applied in their respective countries to address environmental issues.



# Environment

## Water Resource Management and Assessment of Water and Pollutant Flows on the Surface and Underground

Two RCA Projects(RAS/8/104 from 2007 to 2011 and RAS/8/108 from 2007 to 2011) were implemented to help the management of freshwater resources in the region through the application of isotopic and chemical techniques to assess water and pollutant flows on the surface and underground.

The information from these assessments has been used in collaboration with relevant national authorities in the region to improve the management of water resources. The following achievements have been made:

- Establishment of a regional database on water quality parameters with information on pollution control measures;
- Establishment of protection zones for aquifers in The Philippines and Thailand;
- Establishment of a safe groundwater exploitation zone in Indonesia;
- Enactment of controls in Malaysia on the effects of mining activity on groundwater dynamics.



## Assessment of Radiological Impacts of Nuclear Power Activities on the Marine Environment

There has been a focus on improving national and regional capabilities to assess the radiological impacts of nuclear power activities on the marine environment in the Asia-Pacific Region. The RCA project (RAS/7/016) was successfully implemented from 2007 to 2011. The following achievements were made:

- Improved capability of science-based assessment of impacts of radiological and other contaminants on valued marine resources;
- Contributed to the protection of human and ecosystem health through the identification of harmful radiological and other contaminants in biota, and refined risk/dose assessment by applying region-specific transfer factors;
- Improved radiological emergency preparedness and response through the use of region-specific transfer factors in dose assessment, enabling timely interventions;
- Established Quality Management System(ISO 9000 compatible) for marine radioactivity monitoring programmes and data management;
- Provided 1,443 inputs of new data into ASPAMARD (Asia-Pacific Marine Radioactivity Database) for seawater, sediments and marine biota endemic to the region.









## Assessment of the Environmental Impacts of the Releases of Radioactivity from the Fukushima Daicchi NPP

The RAS 7/021 Project entitled “Marine Benchmark Study on the Possible Impact of the Fukushima Radioactive Releases in the Asia Pacific Region” was successfully implemented from 2011 to 2015 with the following objectives: to evaluate the extent and possible impact of the Fukushima releases into the marine environment of the Asia-Pacific region and make scientific assessments of the data to help in the development of national countermeasures and environmental response. Extra budgetary contributions for the project came from Australia, Japan, New Zealand, Korea and USA.

The project achieved success in capacity building and development, establishment and upgrade of marine radioactivity monitoring programmes including marine sampling, radiochemical skills, updated regional database (ASPAMARD), radioecology laboratories, QMS, increased bilateral cooperation and international partnership and ecological risk analyses in participating RCA Government Parties (Australia, Bangladesh, China, Fiji, India, Indonesia, Japan, Cambodia, Malaysia, Myanmar, Nepal, New Zealand, Pakistan, Palau, Philippines, Korea, Singapore, Sri Lanka, Thailand and Vietnam) and 4 non-RCA GPs (Cook Islands, Kiribati Islands, Marshall Islands and Solomon Islands) belonging to the Pacific Small Islands Developing States (PSIDS).

- The project concluded that: 1) Fukushima NPP accident in 2011 has no radiological impact detectable in the marine ecosystems of the Asia-Pacific Region (excluding Japan) ; 2) no spatial or temporal trends observed in territorial water of the Government Parties.



## Improving Air Quality

Advanced nuclear analytical techniques are key tools in air particulate matter pollution assessment, providing valuable information and insight on the type, level, and main sources of pollution. Improving air quality in the Asia Pacific region is a priority for the RCA Member States and these advanced technologies have been employed in the RCA Project RAS/7/015, which was implemented from 2007 to 2011. It achieved the following significant outcomes:

- Establishment of a regional database on the levels of key pollutants in the main urban and industrial areas in the region using the data from this project;
- Strengthened close links with the national authorities responsible for controlling air-pollution;
- Facilitated regulation of the sources of pollution in some countries such as measures taken to ban vehicles with two-stroke engines in Bangladesh, and;
- Shared the information from the project with the Clean Air Initiative which enhanced the database for the region and will assist in better management of air quality in the region.





# Benefiting from the Physical Sciences

Industrial applications is another important area benefiting from the use of nuclear techniques. Some prominent examples include: radiation processing for manufacturing new materials; non-destructive testing for quality control; nucleonic control systems for quality control and mineral analysis; and tracer and sealed source technology for problem analysis and process optimization.

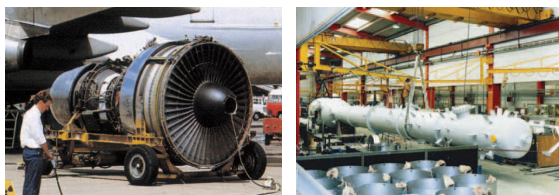


# Industry

## Improvement of the Capability in Process Visualization Radiotracers and Sealed Sources in Industry

A RCA project(RAS/8/111) was implemented from 2009 to 2011 to improve the performance of the region's industries by promoting and transferring technologies on process gamma tomography and radiotracer studies, which also incorporated computer modeling and simulation technologies. It has achieved the following:

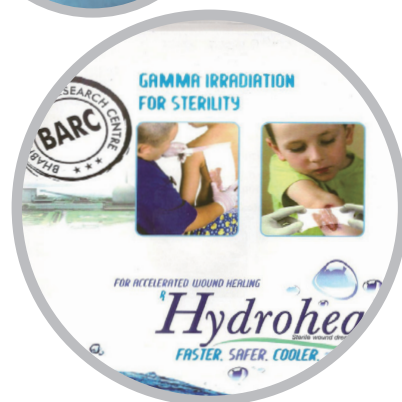
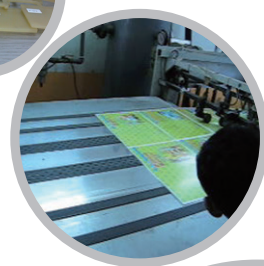
- Increased utilization of gamma CT technologies and radiotracers in China by an increasing range of industries, such as petroleum, petrochemical, chemical and sewage treatment plants;
- Establishment of procedures and protocols in the region for relevant techniques involving use of radio-tracers and sealed source applications in industry;
- Development of technologies(process gamma-ray tomography, radiotracer and RTD+CFD) and enhancement of capabilities(human capacity and laboratory facilities) in most of the participating countries.



## Application of Radiation Processing to Natural Polymers

A RCA Project (RAS/8/106) was implemented between 2007 and 2010 that applied radiation processing to natural polymers for application in the health and environment sectors. It achieved the following:

- Modification of different natural polymers available in the region to synthesize new products such as:
  - hydrogel wound dressing;
  - materials for tissue engineering applications, including bone substitutes;
  - hydrogel for pain relief, drug delivery systems, and;
  - nano-particles.
- A total of 24 new products trialed for development, of which three new products have been transferred to end-users and a few others are in the process of further development;
- Increased demand for radiation-processed materials has led to an extension of investment in radiation facilities(gamma or e-beam).

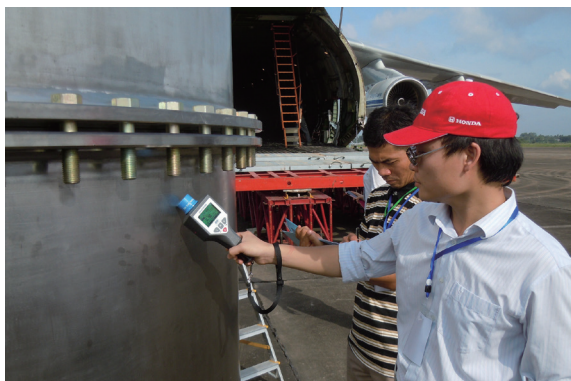




## Strengthening Skills in NDT for Use in Industry

A RCA project(RAS/8/110) was implemented from 2009 to 2011 to demonstrate, promote and transfer the applications of advanced digital radiography and planar and volume imaging techniques for non-destructive testing and examination of industrial specimens. Participating countries were assisted through:

- An increased awareness of the applications and benefits of Digital Radiography(DR) and Computed Tomography(CT) applications for NDT among practicing industries/organizations in the region;
- An increased number of qualified RT-3 personnel;
- Provision of DR and CT services for industry;
- Transfer of DR and CT technologies.



## Improving Agricultural Production and Mitigating Environmental Pollution

A RCA project(RAS/8/109), which was implemented from 2009 to 2011, had objectives to enhance agricultural production through the use of radiation-processed products such as super-water absorbents, toxic-metal absorbents and plant-growth promoters, and to mitigate environmental pollution using radiation technology for recycling industrial polymeric waste. It has achieved the following:

- Development of super water absorbents, toxic metal absorbents and plant growth promoters for agriculture applications, and the establishment of a procedure for their effective utilization;
- Pilot scale production of super water absorbents and plant growth promoters;
- Collaboration with industry on recycling of industrial polymeric waste using radiation technology;
- Sustainable transfer of technology related to radiation processed products.







# Other RCA Endeavors

Areas on sustainable energy development, research reactors, and radiation protection have also been successfully addressed through the RCA Programmes.





## Building Self-Sustainability and Self-Reliance into Radiation Protection Infrastructure

Since the Chernobyl accident in 1987, the RCA has implemented eight projects to help protect the region against human tragedies and significant economic damage caused by ionizing radiation released by a nuclear accident. The most recent project was RAS/9/042, which was implemented between 2007 and 2010, and had the objective to establish self-sustainable and self-reliant regional networks in four crucial areas: the Asian Network of Cardiologists; the Asia Region ALARA Network(ARAN); the Regional Emergency Responders' Network; and the Regional Regulators' Network. The following were the major achievements of the project:



- Establishment of the Asian Network of Cardiologists in radiation protection to achieve regional sustainability in medical exposure control for patients and staff. A cadre of cardiologists was created to train other cardiologists in radiation protection;
- Establishment of an action plan to establish the Asia Region ALARA(keeping radiation “As Low as Reasonably Achievable”) Network(ARAN), which was developed to apply the ALARA concept. This is a basic radiation protection concept, with the primary focus to control occupational exposures in the industrial sector;
- Establishment of the Regional Emergency Responders' Network to enhance emergency preparedness and response capabilities of the region. A website hosted by Bangladesh is being used as a platform for information exchange;

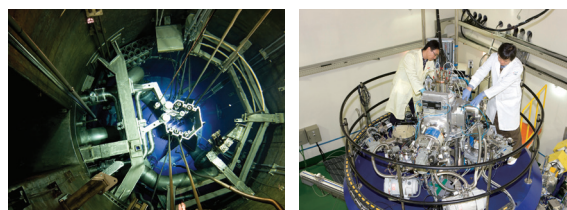
- Formation of the Regional Regulators' Network to facilitate electronic communication among regulators. An action plan for developing a website was also set up for operational use of the network, utilizing the IAEA website RaSaReN(Radiation Safety Regulator Network).

## Elaboration of Sustainable Energy Development Strategies

Two RCA projects(RAS/0/041 from 2005 to 2009 and RAS/0/045 from 2007 to 2009) were implemented under which national studies were conducted on the establishment of sustainable energy development strategies that took into account the role of nuclear power and other energy options.

They also provided recommendations for appropriate sustainable development actions consistent with national objectives. The following were the key achievements:

- Conduct of national studies by national teams using the IAEA's analytical tool MESSAGE(Model for Energy Supply Strategy Alternatives and their General Environment Impacts) and development of long-term scenarios;
- These technically sound national studies directly supported Policymakers in the region and aided decision-making processes related to national long-term electricity planning;
- A long-term strategy paper formulated for Nuclear Power Development in India;
- A study on an energy security initiative conducted in Pakistan, which became the official goal of the Nuclear Power Development Programme in the country.











# RCA Regional Office



# Introduction to RCA Regional Office

## Mission

The RCA Regional Office was established to contribute to the development of the RCA programme by increasing RCA awareness and promoting partnerships.

- To increase RCA awareness: visibility
- To promote partnerships for RCA Program: viability

## Milestones of RCARO

- In 1978, the need to have an RCA Office in the region was first raised at the RCA Representatives Meeting in Vienna.
- In 2000, at the 22<sup>nd</sup> Meeting of National RCA Representatives(NRM) in India, the Republic of Korea offered to host the RCA Regional Office (RCARO) in Korea. the RCA Government Parties supported this proposal.
- In September 2001, at the 30<sup>th</sup> RCA General Conference Meeting(GCM) in Vienna, the RCA Government Parties agreed on the establishment of the RCARO in Korea.
- On 27 March 2002, the RCARO was officially opened for a three-year interim operation in Daejeon, Korea.
- In September 2003, the 32<sup>nd</sup> RCA GCM adopted the RCA Resolution on the Establishment of the RCARO.
- In April 2005, the 27<sup>th</sup> NRM in Malaysia decided on full operation of the RCARO and also appointed the Director of RCARO.
- In September 2007, the 36<sup>th</sup> RCA GCM adopted the Resolution on the Roles and Status of the RCARO.
- In March 2012, the 10<sup>th</sup> anniversary of RCARO was celebrated.

## Roles and Functions of the Director of the RCA Regional Office

- Pro-actively seek out opportunities for the RCA to participate in projects being funded by major regional and international donors, including international agencies;
- Negotiate and secure funding for RCA projects;
- Promote the peaceful uses of nuclear technology to assist in addressing regional and national needs;
- Provide enhanced visibility for the RCA at regional and national forums;
- Implement the directives of the RCA Government Parties as agreed upon at the NRMs and GCMs; and
- Provide RCA Government Parties with reference to the RCA archived records on the projects, meeting proceedings, guidelines and procedures for undertaking the RCA activities as a repository of knowledge on the RCA Programme

## RCARO Standing Advisory Committee

The RCARO Standing Advisory Committee(SAC) was constituted in April 2005 with the full operation of RCARO. Members consist of one representative from each Government Party occupying the position of past, current, and future RCA Chair, the representative of Korea(host state of the RCARO), and the RCA Focal Person.





# Programmes Initiated by the RCARO

The RCA Regional Office implements cooperative RCA projects with UNDP in an effort to enlarge the RCA's partnerships and exploring programs to support the RCA Government Parties in nuclear capability building as well as nuclear knowledge preservation.

## RCA/UNDP Partnership Projects

### Post-Tsunami Environmental Impact Assessment (2006~2009)

In partnership with the United Nations Development (UNDP) Programme, RCARO successfully completed the RCA/UNDP Project on "Post-Tsunami Environmental Impact Assessment"

This project was implemented between July 2006 and December 2009 with the participation of 14 RCA Member States and had a total budget of US\$ 350,000 (UNDP: \$50,000, RCARO: \$300,000)



The project demonstrated that nuclear and isotopic techniques are effective tools to understand the impact of tsunamis on the coastal marine environment. These techniques are applicable not only for the tsunamis but also for other natural disasters facing coastal areas such as storm surges, typhoons, sea warming, and sea level rise.

The Project's Final Report was published and distributed to stakeholders and end-users. The following conclusions were made for each of the following key objectives:

- **Sediment studies:** In general the coastal marine sediments did not show any significant increase in toxic metal concentrations resulting from the tsunami backwash, but revealed a redistribution of particle size in the coastal sediments as a result of the tsunami event;
- **Water/soil contamination:** The results from isotopic hydrology studies indicated that the recovery rate from salinity contamination in groundwater and soil was significantly variable depending on local geology of the coastal areas;
- **Coral reefs:** Experimental studies using some tracer metals on coral samples indicated the toxicity levels caused by sediment resuspension exceeded the water quality guidelines, and were thus capable of acutely impacting coastal biota.



# Programmes Initiated by the RCARO

## RCA/UNDP Partnership Projects(Cont'd)

### Promoting Nuclear SPECT/PET Imaging Technologies (2010~2013)

RCA/UNDP project on “Promoting and Accelerating Nuclear SPECT/PET Imaging Technologies in the Region” was implemented in 2010~2013 with the participation of 13 RCA Member States(Australia, Bangladesh, Indonesia, Malaysia, Mongolia, Myanmar, Nepal, Pakistan, the Philippines, Korea, Singapore, Thailand, and Vietnam) with a total budget of US\$ 500,000(UNDP: \$300,000, RCARO: \$200,000)

**The objective** of the project was to raise the level of knowledge, technology and capability of human resources in nuclear medicine to reduce the death rate from major diseases such as cancer, heart disease and dementia by applying nuclear imaging technologies which enable early detection and diagnosis, thereby improving the quality of life of the people in the Asia-Pacific Region.

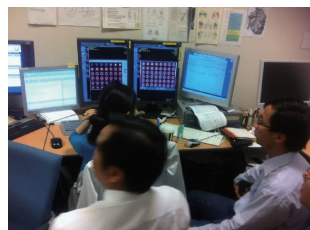
**Outcomes** of the Project were improvement of diagnosis and treatment of patients with oncologic and neurologic disorders, enhanced level of SPECT/PECT imaging technology and capability of human resources, and expanded expert network in the region.

### Electron Beam Applications for Food and Industrial Products and Environmental Pollutants (2013~2015)

In partnership with the UNDP, RCARO implemented the project “Electron Beam Applications for Value Addition to Food and Industrial Products and Degradation of Environmental Pollutants in the Asia Pacific region” in 2013~2015. with a total budget of US\$450,000 (UNDP: \$300,000, RCARO: \$150,000) 16 countries participated in the project: Australia, Cambodia, China, India, Indonesia, Korea, Malaysia, Mongolia, Myanmar, New Zealand, Pakistan, the Philippines, Singapore, Sri Lanka, Thailand and Vietnam.

**The objective** of the project was to improve the quality of food and industrial products and ameliorate the effects of environmental pollutants in the Asia Pacific region through facilitating and maximizing the application of the innovative technology of electron beam.

**Outcomes** of the project were enhanced level of knowledge and capability of human resources in electron beam technology and expended application of the technology in the region.





### RCARO/KAIST Master's Degree Programme on Nuclear Energy and Quantum Engineering Course

To train young scientists and engineers in nuclear energy and quantum engineering fields in the region, RCARO, in cooperation with the Korea Advanced Institute of Science and Technology (KAIST), has implemented this programme since 2002, inviting 29 students from the region. During the programme, RCARO provides students with financial assistance, including tuition, monthly stipends, medical insurance, airfare, etc.

### RCARO/KAERI Regional Training Programme on Nuclear Science and Technology

In partnership with the Korea Atomic Energy Research Institute (KAERI), RCARO has implemented the RCARO/KAERI Regional Training Programme to assist RCA Government Parties in enhancing technical and practical knowledge regarding nuclear science and technology. Since its first implementation in 2008, 116 trainees were trained from 15 RCA Government Parties.



### RCARO/ARCCNM Joint Training Course

Since 2008, RCARO has provided financial assistance for training courses in the area of nuclear medicine organized by the Asian Regional Cooperative Council for Nuclear Medicine (ARCCNM). Each course has been held in cooperation with the Asian School of Nuclear Medicine and about 212 trainees participated up to 2015.

### RCARO Temporary Staff Fellowship Programme

RCARO invites three staff from RCA Government Parties each year for two to three months respectively, to support the RCA and the RCARO activities. Since 2004, a total of 34 fellows participated in the programme and completed assignments.





# Enhancing Awareness of RCA

Another important mission of RCARO is to enhance the awareness of RCA. Below are some of the major activities accomplished by RCARO.

## Enhanced RCA Web Service for Information and Communication

RCARO has been operating the RCA website to enhance information flow on the RCA Programme and to promote communication among stakeholders, end-users, and the general public. The website has been upgraded with the aim of making it a hub of information flow within the RCA community and redesigned in a more user-friendly and interactive manner to maximize usage of RCA data.



## Production of Promotional RCA Video

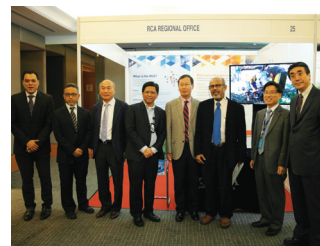
In 2011, RCARO, with the cooperation of RCA Government Parties and the IAEA, produced the RCA promotional video to promote the RCA activities more effectively. Since its production, it has been used at the regional/international events and also in Government Parties for their promotional uses at national level. The RCA promotional video can be found in RCA website.



## Promotion of RCA Activities at Regional/ International Events

RCARO has made efforts to promote RCA and its activities to target audiences through presentations, exhibitions, and publications at international conferences and seminars. Some examples of such occasions participated by RCARO are as follows:

- Pacific Basin Nuclear Conference, 18-23 Mar. 2012, Busan, Korea
- UNDP Global South-South Expo, 19~23, Nov. 2012, Vienna, Austria
- International Conference on the Sources, Effects and Risks of Ionizing Radiation on 10-11 Oct. 2013, Bali, Indonesia
- 8<sup>th</sup> International Conference on Isotopes (ICI), 24-28 Aug. 2014, Chicago, USA
- International NDT Conference and Exhibition, 23-25 Nov. 2015, Kuala Lumpur, Malaysia



## Exhibition of the 40<sup>th</sup> Anniversary of RCA

Celebrating the 40<sup>th</sup> Anniversary of RCA, RCARO organized an exhibition during the 56<sup>th</sup> IAEA General Conference (GC) in cooperation with RCA Government Parties, IAEA and RCA experts.

Posters describing the general information of RCA, partnerships and four thematic areas, sample products from the RCA projects and the promotional RCA video were displayed and attracted many visitors attending the IAEA GC. The visitors included the Director General of the IAEA, National Representatives of the Member States, government delegates and many experts.





# Publication of RCA Success Stories

Since 2007, RCARO has been publishing the RCA Success Stories as a part of its activities for promotion of the RCA. The Success Stories are describing how the RCA projects have contributed in solving the problems and bring socio-economic benefits in the region through the application of nuclear technology.

Up to 2016, a total of 21 RCA Success Stories have been published in 6 batches: 3 leaflets for agriculture, 5 leaflets and 2 booklets for environment, 3 leaflets and 1 booklet for health, 4 leaflets for industry, 2 leaflets for energy and 1 leaflet for radiation protection. Following is the list of Success Stories, the whole stories of which are available on RCA Website.



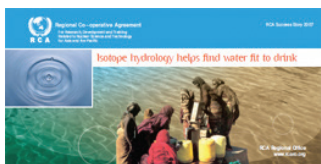
List of Published Success Stories

Publishing Year	Area	Title
1 <sup>st</sup> Batch (2007)	Air Pollution	Nuclear analysis of airborne particles provides a key to alleviating air pollution
	Drinking Water	Isotope hydrology helps find water fit to drink
	Polymer Processing	New materials from natural polymers: using nuclear technology to improve nature's gifts.
	Tissue Grafting	Restoring health and saving lives: global benefits from RCA's trail blazing
	DAT on Nuclear Medicine	'Distance assisted training' strengthens regional skills in nuclear medicine
2 <sup>nd</sup> Batch (2009)	Plant Breeding	Cultivating better crops for sustainable agriculture
	Marine Environment	Turning the tide against marine pollution
	NDT Applications	Strengthening skills in NDT for regional industry
	Geothermal Investigation	Harnessing energy from the heart of the earth
3 <sup>rd</sup> Batch (2010)	Livestock Productivity	Improving livestock productivity while conserving the environment
	Soil Erosion	Combating soil erosion-caused land degradation in the Asia and the Pacific Region( 1 leaflet + 1 booklet)
	Energy Planning	Enhanced energy analysis and planning capabilities
	Radiotracers Technology	RCA innovation supporting regional chemical, petrochemical and petroleum industries
4 <sup>th</sup> Batch (2011)	Post-tsunami Environmental Assessment	Mitigating Coastal Impacts of a Tsunami: the Role of Nuclear Technology
	Radiotherapy	Improving the Quality of Radiotherapy in the Asia and Pacific Region( 1 booklet)
5 <sup>th</sup> Batch (2012)	Marine Environment	Preparing for the Nuclear Renaissance in the Asia Pacific Region-Establishing a Benchmark for Assessing the Future Radiological Impact of Nuclear Power Activities on the Marine Environment( 1booklet)
	Food Irradiation	Feeding the Region in the Future: Food Safety and Security in Asia and Pacific enhanced by Novel Nuclear Applications
	Radiation Protection	Building Self-sustainability and Self-reliance into Radiation Protection Infrastructures in the Asia Pacific Region
6 <sup>th</sup> Batch (2016)	DAT on Nuclear Medicine and ASOC on Oncology	Improving Nuclear Medicine and Radiation Oncology Services in the Region through E-education
	Radiotracers and Sealed Sources Applications	Enhancing the Regional Capability in using Innovative Radiotracer and Sealed Source Techniques for Investigation of Complex Industrial Systems



### Improving Air Quality

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



### Contributing to the Search for Fresh Water

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



### Enhancing Materials Properties

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



### Enhancing the Use of Tissue Graft Materials

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



### Assisting Nuclear Medicine with Training at a Distance

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



### Improving Crop Productivity

The RCA Member States are acquiring nuclear technology to assist them to breed new varieties of crops which will have higher yield rates, greater resistance to drought, salinity, disease and pests as well as improved quality for consumers. Several high performance varieties of soybean, groundnut, mungbean, wheat, and sesame have already been released to the market, and a number of other new crop varieties are being field-tested prior to commercial release.



## Tackling Marine Pollution

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



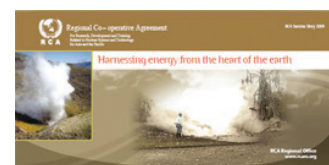
## Strengthening Skills in Non-Destructive Testing (NDT)

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



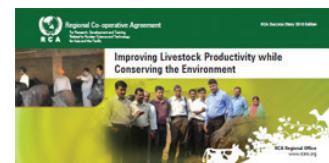
## Helping the Search for Geothermal Power

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



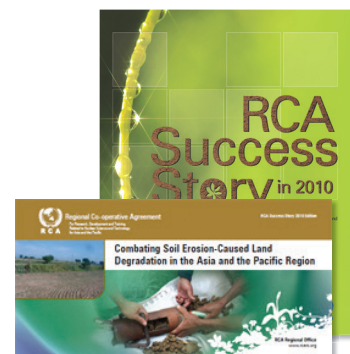
## Improving Livestock Productivity while Conserving the Environment

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

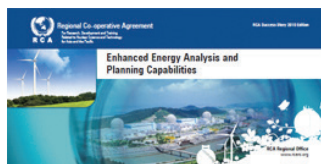


## Preventing Soil Erosion causing Land Degradation

The use of a nuclear based technique known as "Fallout Radionuclides" (FRN) in the RCA's regional projects has significantly contributed to prevent soil erosion and at the same time protect land and water resources and maintain environmental sustainability in the region.



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



### Enhancing Energy Analysis and Planning Capabilities

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



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

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



### Mitigating Coastal Impacts of a Tsunami

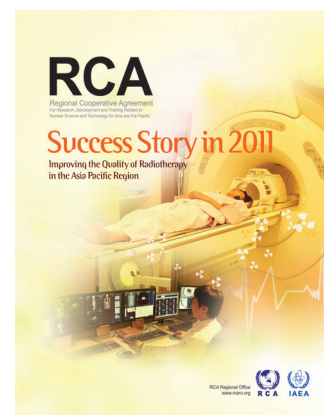
A large-scale ocean tsunami is one of the catastrophic natural disasters that can periodically afflict the RCA region and threaten Member States’ socioeconomic integrity, as well as individuals’ livelihoods and their health and welfare. Through a science-based risk assessment process introduced to the region by this project, Member States can now assist in combating and decreasing the vulnerability of affected populations to the environmental contamination problems they face as a consequence of tsunamis and other natural disasters. The project has also provided increased awareness of advantages of nuclear analytical techniques through well-structured interactions with national and regional organizations. Scientists and technicians in the RCA Member States who were engaged in the activities surrounding the post-tsunami environmental assessment activities now have an enhanced capacity the application of Nuclear Analytical Techniques(NATs).



## Improving the Quality of Radiotherapy

In both the developed and developing Member States in the region the number of cancer patients is increasing and has become a burden to national development. Radiotherapy has been recognized as an essential treatment for cancers frequently experienced in the Asia Pacific region. This project contributed to the training of radiotherapy technologists in recipient RCA Member States in improved patient care and improved the quality of radiotherapy through enhancing national capacities in brachytherapy.

Since Member States may not have adequate quality assurance programmes, the project has included Quality Assurance Team on Radiation Oncology (QUATRO) missions so as to obtain comprehensive information on the individual status of radiotherapy treatment in those participating Member States. This measure has greatly contributed to improving the quality assurance in radiotherapy.



## Improving Capabilities to Assess Radiological Impacts of Nuclear Power Activities in the Marine Environment

With the increasing demands of nuclear power generation, and potential risks from planned and/or unplanned releases of radionuclides into the marine environment, monitoring programmes to ensure that there are no significant impacts from radionuclides on the marine environment have to be developed or strengthened to meet issues that will emerge with increased use of nuclear power. For these monitoring programmes to be useful, effective and reliable, nuclear research institutes need to have analytical and management protocols.

The project contributed 1,443 inputs of new data into the ASPAMARD database for seawater, sediments and marine biota endemic to the region and an agreed Quality Management System (ISO 9000 compatible) was established for marine radioactivity monitoring programme and data management.



## Enhancing the Food Safety and Security in the Region by Using Food Irradiation Technologies

Interest in food irradiation is increasing worldwide because of persistent high food losses from infestation, contamination, spoilage and mounting concerns over food-borne diseases. Especially for this technology's commercial uses and international trade, the developing countries in the region needed to establish guidelines and regulations to satisfy the strict standards of quality and quarantine in the importing countries.

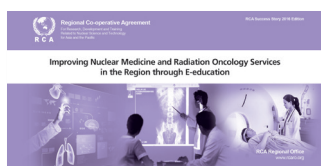
As the regulatory situation for approval, sale, import and export of irradiated foods varied among the participating Member States, the project contributed to establishing harmonized national regulations, protocols and procedures on the application of irradiation by providing adequate levels of competencies.





### Building Self-sustainability and Self-reliance into Radiation Protection Infrastructures

Since 1987, RCA Member States have carried out projects on radiation protection infrastructures. These project aimed to establishing self-sustainable and self-reliant regional networks in four crucial areas: the Asian Network of Cardiologists; the Asia Region ALARA(keeping radiation “As Low As Reasonably Achievable) Network(ARAN); the Regional Emergency Responders’ Network; and the Regional Regulators’ Network. Under this project, the networks have been successfully established or initiated with the action plans for each area aimed at sustaining radiation protection and their sustainable development and maintenance.



### Improving Nuclear Medicine and Radiation Oncology Services in the Region through E-education

DATOL has been used to train more than 700 students in the detection and treatment of illnesses, from infectious disorders to non-communicable diseases such as cancer and cardio-vascular disease, most notably in Asia and the Pacific region and Latin America. ASOC has helped provide specialist training for oncologists in subjects that underlie clinical practice. From the early days of delivery of ASOC via direct distribution of CDs to its current distribution via the internet using educational software such as Moodle, ASOC has had a significant global outreach, contributing to addressing the ever-growing need for radiotherapy service in treating cancer patients. E-education through the RCA is having a profound effect on the quality and extent of training of professionals and practitioners in nuclear medicine and radiation oncology, not only in the Asia-Pacific region, but well beyond.



### Enhancing the Regional Capability in using Innovative Radiotracer and Sealed Source Techniques for Investigation of Complex Industrial Systems

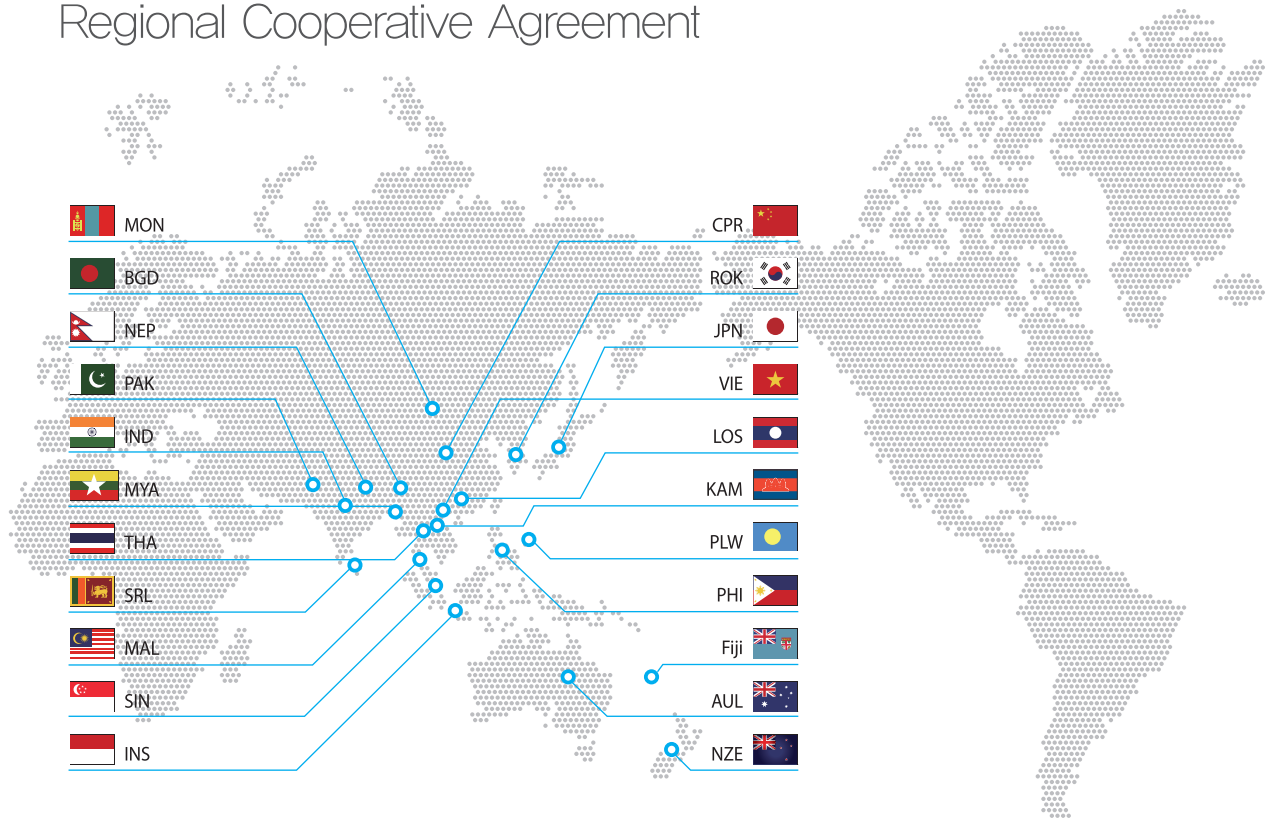
The Regional Cooperative Agreement (RCA) has made considerable progress previously in promoting the industrial applications of radiotracers and sealed sources in the region through implementation of various projects in this area since 1997. As a result, many conventional radioisotope techniques have been established and are in routine use in most of the countries in the region.

These techniques allow detection, diagnosis and remedy of industrial system malfunctions. The capacity built through previous RCA projects provided a suitable foundation to take a step forward to initiate a new RCA project entitled “Characterizing and Optimizing Process Dynamics in Complex Industrial Systems using Radiotracer and Sealed Source Techniques”. The project contributed to significant progress in the development of new radiotracers for use in multiphase flow systems and human resource development in the region.



# RCA

Regional Cooperative Agreement









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