

A Brief History of the RCA

50 Years of Regional Cooperation in Nuclear Science and Technology

(1972 -2022)

By

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(Chair, RCA Programme Advisory Committee and
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Introduction

A new era of regional cooperation among the Member States of the International Atomic Energy Agency (IAEA) in the Asia and the Pacific Region began in 1972, with the birth of the RCA or the “Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology”. RCA is an inter-Governmental agreement established under the auspices of the IAEA, for regional cooperation in the peaceful use of nuclear science and technology, for socio-economic development in the countries that are parties to the Agreement. Since its modest beginning with just four Government Parties in 1972, over the past 50 years, it has expanded to an entity with 22 members and has contributed to the well-being of the populations of Asia and the Pacific region, through the use of nuclear techniques for socio-economic development.

This is a summary of the 50-year history of the RCA. It contains its main historical milestones, key policies and strategies adopted during this period, details of RCA projects, information on key personnel, and achievements.

The Beginning

The origins of regional cooperation in nuclear science and technology in the Asia and Pacific region could be traced to a five-year agreement among India, the Philippines, and the IAEA, which entered into force in 1964. Under this agreement, which was known as IPA 1964 (India, Philippines, and the Agency), India provided a neutron crystal spectrometer for installation at the 1 MW (thermal) research reactor of the Philippines Atomic Research Centre. IAEA bore the cost

of transportation of equipment and the travel cost of personnel. In addition to India and the Philippines, Indonesia, the Republic of Korea, Taiwan, and Thailand also benefitted from the IPA of 1964. It is worth noting the Chair of the IPA Committee was Dr. Raja Ramanna, who later became the Chairman of the Atomic Energy Commission of India. (Refs. 1 and 2)

The success of the IPA of 1964 led to a more comprehensive agreement between India and the Philippines under the auspices of the IAEA which entered into force in August 1969. The contracting parties agreed to cooperate in a) planning and executing collaborative programmes involving the research reactors of the Philippines Atomic Research Centre and Bhabha Atomic Research Centre of India, b) to cooperate in the application of radioisotopes in medicine, agriculture, industry, engineering, and general scientific research and c) to continue the activities initiated under IPA of 1964 in using the neutron crystal spectrometer for studies on solid state and nuclear physics. (Ref. 3)

It soon became apparent that many Member States of the IAEA in Asia and the Pacific could benefit from similar collaborative programmes in the peaceful uses of nuclear technology. The IAEA convened a meeting in Manila, the Philippines, in March 1969 and another meeting in Bangkok, Thailand, in July 1970 to examine the feasibility of creating a framework for promoting regional cooperative projects. Based on the recommendations of these meetings and the consultations carried out by the then Director General of the IAEA, Dr. Sigvard Eklund with the Governments of the IAEA Member States in South Asia, South East Asia, and the Far East, it was decided to formulate a regional agreement for this purpose. This Agreement, titled, "A Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology"¹ was formulated under the auspices of the IAEA in 1971 for acceptance by Member States. (Ref. 4)

RCA came into force on the 12th of June 1972 in accordance with its Article IV (Section 10), upon IAEA receiving the notification of acceptance by India (7th of June 1972) and Vietnam (12th of June 1972). According to Section 11 of Article IV, the period the Agreement was to be in force was 5 years.

¹ IAEA INFCIRC/167

The following sections describe the changes in the management of the RCA, the RCA Projects that were implemented, the achievements, the expansion of the parties to the RCA, and the IAEA personnel involved in the RCA Programme, during each of the last five decades.

The First Decade (1972 -1981)

RCA Management

From the inception of the RCA, the representatives of the RCA Government Parties have been meeting during the IAEA General Conferences (RCA GCM) to discuss matters related to the implementation of the Agreement. The first of such meetings was held during the IAEA General Conference of 1973, in Vienna, Austria. Representatives of India, Indonesia, the Philippines, Singapore, Thailand, and Viet Nam and staff members of the IAEA participated. Representatives of Australia, Bangladesh, Japan, the Republic of Korea, Malaysia, and New Zealand attended as observers.

The RCA GCM of 1978 took an initiative step to strengthen the cooperation by agreeing to hold additional yearly meeting in the one of the Member States for a more detailed discussion on project implementation and on outstanding issues. These meetings held a few months prior to the yearly General Conference Meeting, were called 'RCA Working Group Meetings (WGMs)' The first of such meetings, was held in Tokyo, Japan in October 1979. Representatives of 9 RCA Government Parties (AUL, BGD, IND, INS, JPN, ROK, MAL, PHI, and THA), Dr. H. Kakihana, the Deputy Director General of the IAEA for Research and Isotopes, and Dr. E. Fowler, the RCA Coordinator, attended the Meeting. The Meeting reviewed the progress of the ongoing RCA projects and proposals for future projects. (Refs. 5 and 6).

The RCA was extended to another 5 years in 1977.

RCA Projects

The initial focus of the RCA was on organizational and administrative matters associated with the implementation of the Agreement. The establishment of cooperative projects commenced in 1975. Based on the needs of Member States, the highest priority was given to the training of personnel in the medical use of radioisotopes, and in food and agriculture. The first regional

project under RCA was a Coordinated Research Project on the use of ionizing radiation for the preservation of fish and fishery products. (Ref. 4)

The other Coordinated Research Projects implemented during this period were on, improving legume grain production, improving domestic buffalo production, health-related environmental issues, material sciences, industrial isotope and radiation applications, maintenance of nuclear instrumentation, and hydrology and sedimentology. (Ref. 7)

At the meeting of the representatives of the Governments Parties to the RCA held during the IAEA General Conference of 1976, held in Rio de Janeiro, Brazil, it was decided that over the next five-year period of the RCA (1977-1982), "regional co-operation must be directed more toward solving industrial problems of the countries in the region, as these will assume primary importance toward the end of the century." In 1977 the IAEA Board of Governors approved a request for a regional technical assistance project for industrial isotopes and radiation applications. The implementation of this project commenced in April 1978. This was the first regional technical assistance project funded from the IAEA's own resources. (Ref. 4)

This period also saw the initiation of activities to obtain the support of the United Nations Development Programme (UNDP) to expand the activities in industrial applications of radioisotopes and radiation implemented with IAEA support. A UNDP Preparatory Assistance Project initiated for this purpose commenced in August 1980 and was completed in March 1982. (Ref. 8)

RCA Government Parties

India (1972), Vietnam (1972), Singapore (1972), Indonesia (1972), Thailand (1973), the Philippines (1974), the Republic of Korea (1974), Bangladesh (1974), Malaysia (1975), Sri Lanka (1976), Australia (1977), and Japan (1978), became parties to the RCA during this period, making the RCA membership 12 Government Parties.

IAEA Personnel

During this period the RCA Secretariat was in the former Department of Research and Isotopes of the IAEA (currently the Department of Nuclear Sciences and Applications). IAEA appointed a staff member designated as the RCA Coordinator for coordination of the RCA Programme. Dr. David Richman (1972-1975), Dr. Eugene Fowler (1975-1980), and Dr. Masatoshi Kobayashi

(1980-1983), functioned as RCA Coordinators during this period. (Ref. 5) Dr. Fowler was later appointed as the Project Director and the Chief Technical Adviser of the UNDP Regional Industrial Project.



Dr. Eugene Fowler
RCA Coordinator

The Second Decade (1982 -1991)

RCA Management

The representatives of the Government Parties continued to meet annually for half a day during the IAEA General Conference, and in one of the member countries for a longer period, to review the progress of implementation of the RCA projects. These meetings were known as RCA General Conference Meetings (RCA GCMs) and RCA Working Group Meetings (RCA WGMs) respectively. Each Government Party appointed a person designated as the National RCA Coordinator to coordinate RCA activities.



Participants of the 8th RCA Working Group Meeting held in 1986 in the Republic of Korea
 RCA Chair, Dr. Byong Whi Lee –ROK (5th from the left), Dr. Noramly Bin Muslim DDG TC (5th from the right) and Dr. Peter Airey, RCA Coordinator (4th from the right) are seated in the first row.

The Regional Cooperative Agreement of 1972 was extended for another 5 years in 1982. A more comprehensive Agreement was introduced in 1987². The responsibility of coordinating the RCA activities was moved from the Department of Research and Isotopes to the Department of Technical Cooperation of the IAEA in 1986.

RCA Projects

25 RCA projects implemented under the Technical Cooperation Programme of the IAEA were initiated during this period, comprising 2 projects each in Agriculture, Environment and Energy Planning, 6 projects in the Industrial Sector, 7 projects in the Health Sector, 3 projects on Research Reactors, and one project each on Nuclear Instrumentation, Radiation Protection, and development of TCDC (Technical Cooperation among Developing Countries). The agricultural projects were on grain legumes and food irradiation, and the environmental projects were on isotope hydrology and marine contaminants and sedimentation. The focus of the projects in the

² Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology, 1987- INFCIRC/167Add. 13. The cover page of this document erroneously referred to this as the Third Extension of the 1972 Agreement. This error was corrected by INFCIRC/167/Add 13.Mod.1

health sector was in areas of brachytherapy, radioimmunoassay, nuclear imaging, and radiation sterilization of tissue grafts. Seven projects were completed during this period. (Ref. 9)

UNDP Project on Industrial Applications

The RCA project on industrial applications of nuclear technology implemented during this period with the financial support of the UNDP deserves a special mention. The overall objective of the project was “to increase the use of nuclear technology in regional industries and, through this, further regional economic development and industrial competitiveness.” The total budget of the project was 12.5 million US\$. The contributions of the participating Government Parties, the UNDP, and participating industries were 6.42 million US\$ (52%), 4.38 million US\$ (35%), and 1.65 million US\$ (13%) respectively. The project was implemented in two phases, with Phase 1 (RAS/79/061) from 1982 to 1986 and Phase 2 (RAS/86/073) from 1987 to 1991.

RCA Government Parties Australia, Bangladesh, India, Indonesia, Japan, Republic of Korea, Malaysia, Pakistan, the Philippines, Singapore, Sri Lanka, and Thailand participated in the project.

The project comprised five main components, namely, industrial tracer applications, non-destructive testing, nucleonics control systems, radiation processing, and nuclear instrument maintenance. RCA Government Parties well advanced in these technologies played leadership roles in implementing the project. The Bhabha Atomic Research Centre (BARC) of India contributed to the component on industrial tracer applications by conducting training programmes and demonstrations. Under the component on non-destructive testing (NDT), advanced training courses on radiography and ultrasonic inspection were carried out at the Singapore Institute for Standards and Industrial Research and at the Japanese Society for Non-destructive Inspection in Tokyo.

A semi-commercial irradiation plant was constructed at the Centre for Applications of Isotope and Radiation (PAIR) in Jakarta as a regional centre for radiation processing. This 300 kCi cobalt-60 irradiation facility was inaugurated in September 1983. The Rubber Research Institute of Malaysia and the Takasaki Radiation Chemistry Research Establishment of the Japan Atomic Energy Research Institute (JAERI), Japan, also contributed to this project, mainly in research on radiation vulcanization of natural rubber latex (RVNRL).

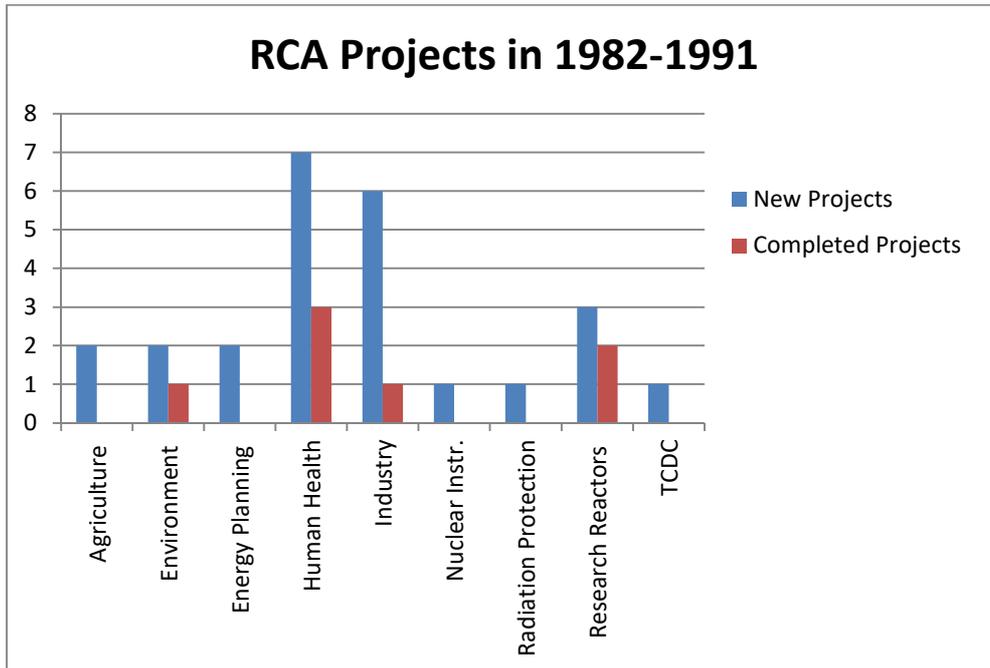
A demonstration nucleonic control system for use in paper production was installed at the Siam Kraft Paper Company, Thailand, and training courses were held in Thailand and Japan. A thickness gauge for use in steel production was installed at the Bokhara Steel Plant, India, and was used in training and demonstration courses held in India and Japan. Australia provided leadership and expertise for the transfer of nucleonic technology and methods to the minerals industry. Under the component on nuclear instrumentation, workshops and on-the-job training courses were held in Japan, in co-operation with the Japan Atomic Industrial Forum and the Japanese industry.

It was estimated that a total of US\$190 million was invested by the public sector (40 million US\$) and the private sector (150 million US\$) over 5 years as a result of this project. The investment in radiation technology alone was 117million US\$. (Refs. 8, 10, and 11)



Mr. S.P. Kasemsanta, the Project Coordinator of the UNDP Industrial Project (second from the left) and staff from Australia and the Philippines visiting analytical laboratory during a Training / Demonstration Course

Credit: IAEA Bulletin



RCA Government Parties

Pakistan (1982), Peoples' Republic of China (1987), and Mongolia (1992) became parties to the RCA during this period, increasing the number of Government Parties to 15.

RCA Chairpersons

Year	Chairperson	Country
1982	Prof. M. Ghazali	Malaysia
1983	Dr. K.G. Dharmawardena	Sri Lanka
1984	Dr. P.K. Bhatnagar	India
1988	Mr. Wang Chuanying	Peoples' Republic of China
1989	Dr. David Cook	Australia
1990	Dr. Suchat Mongkolphantha	Thailand
1991	Dr. Nguyen Tien Nguyen	Vietnam

IAEA Personnel

Dr. Masatoshi Kobayashi (1980-1983) and Dr. Sueo Machi (1983-1986) functioned as RCA Coordinators during this period while the RCA Secretariat was in the Department of Research and Isotopes. Dr. Machi was later appointed as the Deputy Director General and Head of the

Department of Research and Isotopes of the IAEA. He was also the first Coordinator of the Forum for Technical Cooperation for Asia (FNCA) and played a key role in establishing collaboration between FNCA and RCA. He was a Fellow of the Japan Atomic Energy Agency.

After the Secretariat of the RCA Programme was transferred to the Department of Technical Cooperation in 1986, Dr. Peter Airey (1986-1990) and Dr. John Easey (1990 -1995) served as RCA Coordinators. Dr. John Easey made an unparalleled contribution to the advancement of the RCA as the RCA Coordinator and as a very active member of the RCA family afterward. He served in several RCA Working Groups and was responsible for developing the RCA Profile in 2010. He was a member of the expert panel that prepared the RCA Strategic Priorities for 2012-2017 and was the Chair of the RCA Programme Advisory Committee (PAC). All the contributions of Dr. Easey to the RCA are too numerous to mention.

Dr. Noramly Bin Muslim was the Deputy Director General and Head of the Department of Technical Cooperation during 1986-1992. Dr. Eugene Fowler served as the Project Director and the Chief Technical Adviser of the UNDP Regional Industrial Project. Dr. A. Tajuddin of Malaysia served as the Coordinator of the project until 1988 and Dr. Manoon Aramrattana of Thailand was the Coordinator during 1988-1991. Prof. Pham Duy Hien of Vietnam served as the Chief (regional) Technical Officer of the project and was stationed in Indonesia. Dr. Wandowo of Indonesia served as a long-term expert on Tracer Technology and Dr. Shi Hua of the Peoples' Republic of China served as the long-term expert on Non-Destructive Testing.



Dr. Noramly Bin Muslim
Deputy Director General -TC



Dr. John Easey
RCA Coordinator



Dr. Suelo Machi
RCA Coordinator



Dr. Manoon Aramrattana
Coordinator RCA/UNDP Project

The Third Decade (1992 -2001)

RCA Management

A transformation in the RCA management structure took place during this decade. The 18th RCA Working Group Meeting (RCA WGM) held in 1996 in the Republic of China, appointed a Working Group to “Review the Management Structure of the RCA Programme and Develop Proposals for the Future”. National RCA Coordinators of Indonesia, Japan, Malaysia, New Zealand, Pakistan, the Philippines, and Sri Lanka were members of the Working Group, which was chaired by Dr. John Rolland, the National RCA Coordinator of Australia. Two of the working group members, Dr. Carlito Aleta (the Philippines) and Dr. Prinath Dias (Sri Lanka), later served as IAEA RCA Coordinators.

The Working Group met in Vienna on 11-13 September 1996, and its report was presented to the 19th RCA WGM held in March 1997 in Myanmar. The specific issues discussed were a) mechanism for new project proposals b) project review and reporting c) RCA WGMs, RCA GCMs, and the RCA Annual Reports d) project implementation e) IAEA-RCA interaction, and f) increased regional management and coordination. The Working Group made 12 recommendations. Some of the more notable recommendations are given below.

It was recommended that, in the future, only a Member State (i.e an RCA Government Party) should be able to table a new project proposal. It was also recommended that the National Coordinators Meetings for each project assume the responsibilities of the Project Committee, as

set out in Article VI of the RCA Agreement, and that the focus of the RCA WGMs should be on policy issues rather than the review of RCA projects. Another recommendation was on improving coordination to avoid duplication of RCA and non-RCA regional projects. The Working Group also recommended the development of a mechanism for implementation of regional activities by RCA Member States (i.e. Government Parties). Commencement of RCA projects fully funded by the Member States, or a non-Agency source at any time within the biennial programming cycle, was also a recommendation. Another recommendation was on stationing a senior RCA Representative in the region by January 2000. (Ref. 12)

The first RCA Guidelines and Operating Rules (GOR) were adopted during this period (RCA GCM of 1997). Other developments that took place during this period include the of Lead Country Coordinators (LCCs) and Regional Resource Units (RRUs). There were some changes in the terminology as well, to improve alignment with the RCA Agreement of 1987. The RCA National Coordinators were renamed RCA National Representatives and RCA Working Group Meetings (WGMs) were renamed Regional Meetings of RCA National Representatives.

The Regional Cooperative Agreement of 1987 was extended to another 5 years in 1992 and in 1997.



Participants of the 15th RCA Meeting of RCA National Representatives held in 1993 in the Philippines

RCA Chair, Dr. Carlito Aleta-PHI(Extreme left), Dr. Qian Jihui DDG TC (centre) and Dr. John Easey, RCA Coordinator (extreme right) are seated in the first row.

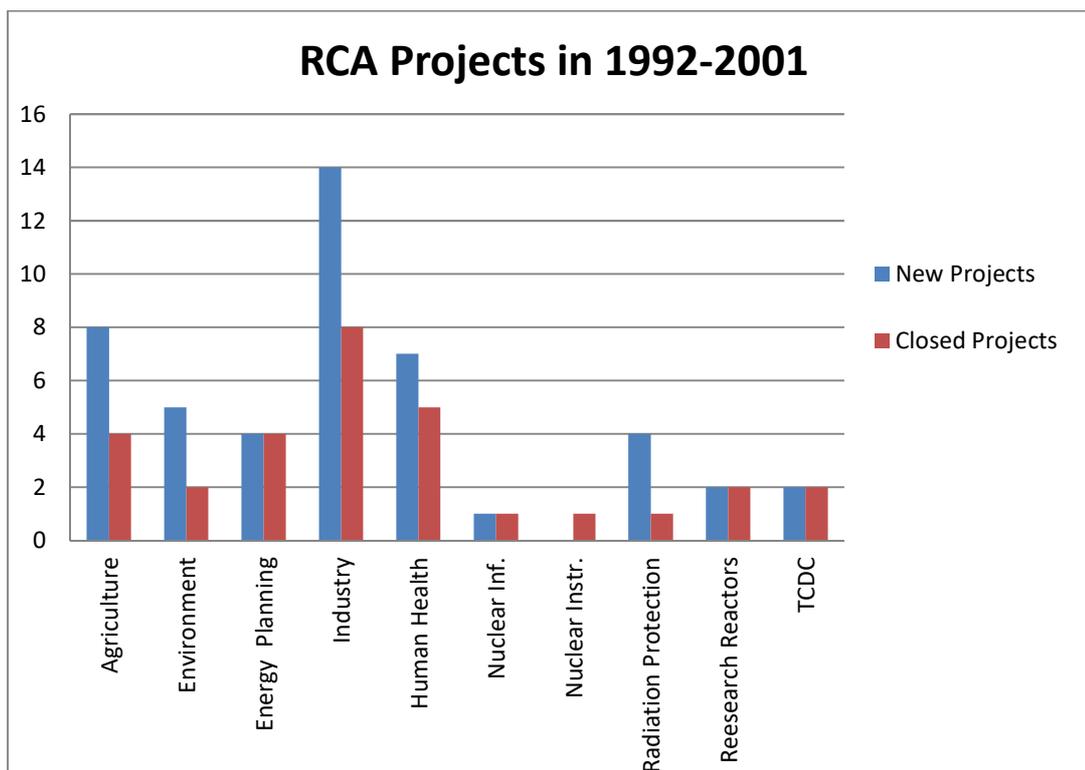
RCA Projects

47 RCA Projects implemented under the Technical Cooperation Programme of the IAEA were initiated during this period, comprising 8 projects on agriculture, 5 on environment, 4 on energy planning, 14 projects on industry, and 7 projects on human health. There were also 4 projects on radiation protection, 2 on research reactors, 2 on development of TCDC, and one project on nuclear information.

The agricultural projects were on food irradiation, plant breeding, animal production and health, and soil fertility. The environmental projects were on assessment of air pollution, management of marine pollution, management of drinking water sources, investigation of geothermal energy sources, and dam safety. The projects on energy planning included comparative assessment of electricity generation options, options for mitigating greenhouse gas emissions, and planning for nuclear power. The focus of the projects on human health was in areas of nuclear medicine, quality assurance in radiotherapy and sterilization of tissue grafts, and LDR and HDR brachytherapy. Two projects on distance learning in nuclear medicine and radiation oncology were also initiated during this period. The focus of the projects on industry continued to be tracer technology, non-destructive testing, radiation processing, and nucleonic control systems. The projects in radiation protection were on harmonization of practices, environmental monitoring, and disposal of radioactive waste from non-power applications. The projects on research reactors were focused on improving their operation and utilization.

30 projects, including projects that were initiated during the previous decade, were completed during this period. (Ref. 9)





Achievements

The following are some of the achievements of RCA during this period. Further details can be found in RCA Regional Profile (Ref. 13).

- As a result of the RCA projects on food irradiation, several countries adopted regulations on food irradiation, established irradiation plants, and processed a significant amount of food products by irradiation.
- New varieties of soybean, groundnut, mung bean, wheat, sorghum, and sesame were developed and released to farmers through RCA projects on plant breeding.
- Projects on soil fertility enabled the identification of promising crop, soil, and fertilizer management practices for increasing crop production in rice-based cropping systems through the use of Nitrogen-15 techniques.
- Projects on animal production and health enabled an increase of income to farmers through the use of medicated feed blocks to combat diseases. New feeds with a cost-benefit ratio of 1:3.7 were introduced to farmers in 5 countries. (Ref. 13)

- RCA projects on Energy Planning made it possible for RCA GPs to use energy planning tools developed by the IAEA, in expansion planning of electrical power systems. (eg. WASP, ENPEP, MAED).
- In the Environmental sector, the project on air-pollution monitoring enabled the participating countries to develop the capability of collecting and analyzing air-pollution data for source identification and apportionment.
- Countries that participated in RCA projects on the management of marine pollution developed capabilities for the collection and preparation of marine sediments and the analysis of chemical and radioactive pollutants.
- Through the RCA projects on water resources, the participating countries developed the capability to undertake a quantitative assessment of water resources and to assess the impact of industrialization and urbanization on these resources.
- The project on dam safety enhanced the capabilities of RCA GPs to assess the safety of dams, particularly in investigating dam and reservoir leakages through the application of isotope technology.
- Participating RCA GPs developed the capability of applying isotope techniques, with the aid of both natural isotopes and artificial radiotracers, in the management of their geothermal reservoirs. In particular, benefits were extended to seven geothermal fields with a total installed electric power generation capacity of 1320 MWe.
- RCA projects on tissue grafting enabled RCA GPs to produce tissue grafts of skin, bone chips, and ligaments for use in surgical operations and amnion for dressing of wounds and burns.
- The capability to provide radiotherapy for cervical cancer improved in the RCA GPs as a result of the RCA projects on radiotherapy. They also enabled the development of harmonized protocols for quality assurance in LDR and HDR brachytherapy.
- Distance learning programmes in nuclear medicine and in radiation oncology prepared under two RCA projects have been made available to the RCA GPs and are being used for the training of nuclear medicine technologists and radiation oncologists.
- The RCA projects on Non-Destructive Testing (NDT) implemented during this period, with the financial support of UNDP, enabled RCA GPs to establish national programmes in NDT and to form national NDT societies. These GPs have developed indigenous capabilities for training NDT technologists up to Level 3 and providing professional NDT inspection services to industry. (Ref. 10)

- In the projects on radiation technology, several participating GPs were able to develop the capability to provide radiation sterilization services to industry. Several GPs established new irradiation facilities. (Ref. 10)
- Under the projects on radiation protection, it was possible to compile data for an Asian Reference Man. These data had been published in IAEA TECDOC-1005 and provided to ICRP. Assistance was also provided to RCA GPs to establish radiation protection infrastructures conforming to Basic Safety Standards (BSS)³. It was also possible to develop distance learning material for training personnel of RCA GPs on radiation protection, during this period.
- As a result of projects on research reactors implemented during this period, participating GPs improved coordination and information exchange on common research reactor operation and safety-related problems and achieved additional technical know-how.

RCA Government Parties

New Zealand (1997) and Myanmar (1998) became parties to the RCA during this period, increasing the number of Government Parties to 17.

RCA Chairpersons

Year	Chairperson	Country
1992	Dr. Masanori Wada	Japan
1993	Dr. Carlito Aleta	The Philippines
1994	Professor A. Djalois	Indonesia
1995	Dr. Ahmad Sobri Haji Hashim	Malaysia
1996	Dr. Li Donghui	Peoples' Republic of China
1997	Dr. Tin Fflaing	Myanmar
1998	Dr. Peter Roberts	New Zealand
1999	Dr. Tan Teng Huat	Singapore
2000	Dr. A.K. Anand	India
2001	Prof. Naiyyum Choudhury	Bangladesh

³ Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards

IAEA Personnel

Dr. John Easey (1990-1995), Dr. K. Yanagisawa (1996-1997), and Dr. Carlito Aleta (1997-2003) functioned as RCA Coordinators during this period. In between the appointment of RCA Coordinators, the Section Heads of former East Asia and Pacific Section, Dr. Javed Alsam (November 1995 - March 1996) and Dr. M.N. Razely (March - July 1996) and Director, TC Division for Africa and Asia, Dr. P.M. Baretto assisted by Dr. Alexander Rogov (June - November 1997), served as RCA Coordinators in acting capacities. Dr. Qian Jihui was the Deputy Director General and the Head of the Department of Technical Cooperation during this period.



Dr. Carlito Aleta
RCA Coordinator



Dr. Qian Jihui
Deputy Director General - TC



Staff of the IAEA RCA Office celebrating the 25th Anniversary of the RCA in 1997
 L-R: Ms. Madeleine Mandorff (partly hidden), Ms.Thoko Muller, Ms. Evelyne Ranharter, Ms. Fran Wright, Dr. Paulo Baretto and Dr. Alexander Rogov

The Fourth Decade (2002-2011)

RCA Management

One of the main developments during this period was the establishment of the RCA Regional Office (RCARO) in the Republic of Korea. As a follow-up to the recommendation made by the Working Group on RCA management⁴ in 1997 to station a senior RCA representative in the region, a proposal to establish an RCA Regional Office in the Republic of Korea was submitted for the consideration of the 29th RCA General Conference Meeting (RCA GCM) held in September 2000. Following discussions at the 23rd Regional Meeting of the RCA National Representatives (RCA NRM) held in March 2001 in Bangladesh, the 30th RCA GCM held in September 2001, taking into consideration the recommendations of the Working Group appointed in this regard, the RCA GPs agreed in principle to the proposal and adopted by consensus on the establishment of a Regional Office in the Republic of Korea and further adopted the Working Paper on its establishment containing its role, operation, staffing and legal actions. The Regional Office was opened in March 2002 during the 24th RCA NRM held in the Republic of Korea. Dr. Jin-Kyoung Kim was the first Director of the RCARO.

⁴ Working Group to Review the Management Structure of the RCA Programme and Develop Proposals for the Future, 1997



Opening of the RCA Regional Office, March 2002, Republic of Korea

The status of the RCARO was formalized through a resolution adopted at the 32nd RCA GCM held in 2003. The functions of the RCARO were identified as, a) pro-actively seeking out opportunities for the RCA to participate in projects being formulated and designed by major regional and international donors, b) negotiating and securing funding for RCA projects, c) promoting the peaceful uses of appropriate nuclear technology to assist in addressing regional and national needs, and, d) enhancing the visibility of the RCA at regional and national fora. (Ref. 15). With the development of the RCA, these functions have been expanded to various activities, such as performing secretariat roles in assisting the Agency based on the Practical Arrangements(PA) and the RCA Chair, and implementation of projects/activities to complement the RCA Programme.

All the operational costs of the RCARO are borne by the Government of the Republic of Korea, the host country of the RCARO.

An advisory committee (RCARO Standing Advisory Committee – RCARO SAC), comprising the current RCA Chair, the previous Chair, the next Chair, the RCA National Representative of the Republic of Korea and the RCA Focal Person has been formed to advise the RCARO on operational matters and to review its Work Plans and Progress Reviews. The RCARO SAC meets twice a year prior to the annual RCA NRM and RCA GCM.

Since its establishment, the RCARO has made a very significant contribution to RCA by numerous means. Some of the notable contributions made over the past 20 years are the establishment and management of the RCA website, establishing partnerships with several regional organizations including UNDP, UNOSSC, publication of RCA Success Stories and RCA brochures, representing RCA at international fora, and funding and managing the RCARO managed projects including the RCA Research Project. A detailed description of all the contributions of the RCARO is beyond the scope of this document.

Another notable development was the Strategic Session held during the 26th RCA NRM held in 2004 in Pakistan, under the topics of a) formulation of an RCA Medium-Term Strategy b) procedure for the formulation of new RCA projects c) appointment and roles and responsibilities of RCA stakeholders, and d) format of the RCA Annual Report. The recommendations of the Strategic Session on the above topics were incorporated in the RCA Guidelines and Operating Rules. (Ref.16). Criteria for RCA Projects, a revised procedure and timeframe for development of RCA projects, the concepts of National Project Teams and National Work Plans, and a revised format of the RCA Annual Report aimed at improving the visibility of the RCA, are some of the outcomes of this Strategic Session.



Participants of the 26th RCA Working Group Meeting held in 2004 in Pakistan

RCA Chair, Dr. Munim Awais-PAK (Extreme left), Dr. Peter Salema, DIR-TCAP (fourth from the left) and Dr. Prinath Dias, RCA Coordinator (third from the left) are seated in the first row.

As a follow-up to one of the recommendations of the Strategic Session held during the 26th RCA NRM, a Working Group comprising RCA National Representatives of Australia, New Zealand, India, Malaysia, and the Philippines was appointed to draft a Medium-Term Strategy for the RCA by the 27th RCA NRM held in 2005 in Malaysia. The report of the Working Group, which was chaired by the RCA National Representative of Australia, Dr. Ronald Cameron, containing the RCA Medium-Term Strategy for 2006-2011, was adopted at the 28th RCA NRM held in 2006 in Thailand. The 28th RCA NRM also recognized the need to identify RCA strategic priorities. (Ref. 17)

The RCA Medium-Term Strategy (RCA MTS) for 2006-2011 was subsequently extended to 2012-2017 by a Working Group comprising RCA National Representatives/nominees of Australia, China, India, Indonesia, Japan, Malaysia, New Zealand, and Pakistan. The report of the Working Group, which was also chaired by Dr. Ron Cameron of Australia, was adopted at the 38th RCA GCM held in 2009. The RCA MTS for 2012-2017 contained an updated version of the MTS for 2006-2011 and an Implementation Plan. (Ref. 18)

The Working Group appointed to extend the RCA MTS to 2012-2017 also recommended identification of RCA Strategic Priorities for this period. The procedure recommended by the Working Group, namely, a) conducting a survey to determine the needs and priorities of the RCA Government Parties, b) developing a Regional Profile, and c) forming Working Groups in each Thematic Area, was approved by the 38th RCA GCM.

Following the decision of the 38th RCA GCM, the RCA Regional Profile was drafted by former RCA Coordinator Dr. John Easey of Australia. It contained the outcomes of the survey conducted to identify the needs and the priorities of the RCA Government Parties and an analysis of the past RCA Projects. (Ref.13). The Working Groups comprising experts in each Thematic Area and chaired by an RCA National Representative met on 22-26 February 2010 at the IAEA headquarters in Vienna. The report containing the RCA Strategic Priorities for 2012-2017, prepared based on the recommendations of the respective Working Groups, was adopted at the 32nd RCA NRM held in the Philippines in 2010 (Ref. 18,19) and was used in identifying the priority areas for the RCA projects during this period (2012-2017).



Participants of the 38th RCA General Conference Meeting held in 2009 in Vienna

RCA Chair, Dr. Alumanda Dela Rosa-PHI (seventh from the left), Dr. Ana Maria Cetto, DDG-TC (sixth from the left), Dr. Dazhu Yang, DIR-TCAP (second from the left), and Dr. Prinath Dias, RCA Focal Person (fifth from the right) are in the first row.

The restructuring of the Department of Technical Cooperation of the IAEA in 2006 had an impact on RCA and other Regional Agreements. The IAEA Secretariats of the Regional Agreements were brought under the direct supervision of the Directors of the relevant regional divisions and Focal Persons were appointed to assist the Directors, replacing the Coordinators of the Regional Agreements. Another change that impacted RCA was the amalgamation of former East Asia and West Asia Sections under the Director for the Division for Asia and the Pacific (DIR-TCAP), which increased the number of IAEA Member States participating in non-agreement regional TC projects managed by this Division.

The Regional Cooperative Agreement of 1987 was extended to another 5 years in 2002 and in 2007.

30th Anniversary of the RCA

A Scientific Forum was held during the 24th RCA NRM held in the Republic of Korea in 2002, to celebrate and in recognition of the 30th Anniversary of the RCA. Presentations were made on ‘The Legend of the RCA’ by Mr. A.K. Anand (IND), ‘Serving for Human Needs’ by Prof. Naiyyum Choudhury (BGD), ‘New Challenges with Nuclear Techniques’ by Dr. Sueo Machi (JPN), ‘For a Better Partnership’ by Dr. John Easey (AUL), and ‘Toward a Viable Economic Development’ by Prof. Byong-Whi Lee (ROK).

RCA Projects

48 RCA Projects implemented under the Technical Cooperation Programme of the IAEA were initiated during this period, comprising 5 projects on agriculture, 10 on environment, 3 on energy planning, 10 on human health, and 11 projects on industry. There were also 4 projects on radiation protection, 3 on research reactors, and 2 on development of TCDC.

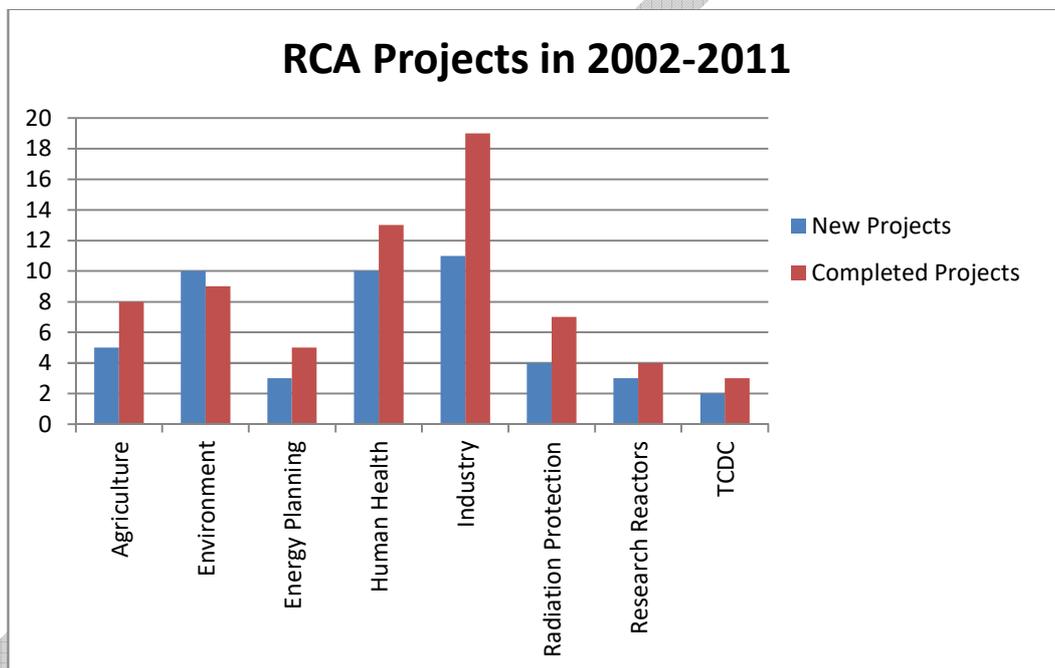
The agricultural projects were on food irradiation (sanitary and phytosanitary treatment), plant breeding for stress tolerance, and the management of soil erosion. The environmental projects were on characterization and identification of sources of air pollution, assessment of radiological impacts of nuclear power on the marine environment, the study of groundwater contamination in urbanized and industrial areas, and investigation of the possible impacts of the Fukushima radioactive releases. The project on environmental impacts of Fukushima accident was implemented fully with extra-budgetary funds provided by RCA Government Parties and was developed off the IAEA TC cycle, which reflected well on the flexibility of the RCA in addressing emerging issues/problems.

The projects on energy planning included studies on nuclear power and other energy options in competitive electricity markets and sustainable energy development strategies in the context of climate change.

The projects in human health included management of liver cancer using transarterial radioconjugate therapy, education and training of Medical Physicists, tumour imaging, positron emission tomography (PET), and 3D radiotherapy for predominant cancers. The projects in the industrial sector included modification of natural polymers using radiation technology, radioisotope technology for natural resource exploration and exploitation, advanced industrial radiography and tomography, and the use of radiotracers and sealed sources for diagnosing

industrial multiphase systems by process visualization. The projects in radiation protection were on harmonization of practices, assessment of radiological risks, radiological emergency response, and sustainable radiation protection infrastructures. The research reactor projects were on radioisotope production and neutron beam applications, and adding value to materials through irradiation with neutrons.

68 projects, including projects that were initiated during the previous decade, were completed during this period. (Ref. 9)



Achievements

The following is a summary of the achievements of RCA during this period. Further details can be found in References 13, 14, and 20.

- Several new varieties of crops with improved stress tolerance were developed during this period. They include barley, rice, soybean, papaya, and mung bean.
- Through projects on soil erosion studies the RCA GPs developed the capability of applying fall-out radionuclide technology (FRN) to investigate soil erosion.
- The projects on food irradiation made it possible for RCA GPs to apply novel methods of food irradiation.

- RCA projects on Energy Planning implemented during this period made it possible for RCA GPs to use tools and methodologies developed by the IAEA to carry out mitigation studies on greenhouse gas emissions.
- RCA GPs participating in the projects on air-pollution monitoring continued sampling of air-particulate matter, which were analyzed using nuclear techniques. (XRF, IBA, and NAA). They also carried out source identification and apportionment and long-range transport analysis. These results were provided to the environmental regulators.
- RCA projects on the protection of the coastal and marine environment contributed to the formulation of environmental protection policies and environmental protection guidelines.
- RCA projects in nuclear medicine enabled the development and adoption of guidelines for the establishment of PET facilities and guidelines on clinical applications of PET. These projects also contributed to the installation of new Gamma Cameras, SPECT CTs, and PET CTs in RCA GPs.
- RCA projects on radiotherapy helped RCA GPs to use 3D Conformal Radiotherapy (3D CRT) and Image-Based Radiotherapy and to develop quality assurance procedures for the techniques.
- RCA projects on Medical Physics produced guidelines for clinical training of Medical Physicists in Radiation Oncology, Diagnostic Radiology, and Nuclear Medicine (IAEA Training Course Series 37, 47, and 50) and are being used by all IAEA Member States.
- RCA projects on non-destructive testing (NDT) enabled RCA GPs to implement harmonization schemes for NDT certification in accordance with ISO 17024, develop the capability for digital radiography (DIR) and computed tomography (CT), and establish quality management systems (QMS) in accordance with ISO standards.
- RCA projects on Radiation Processing made it possible for RCA GPs to develop hydrogels to be used for dressing of burns and wounds, super water absorbents for use in irrigation, plant growth promoters, and toxic metal absorbers. Several new irradiation plants have been constructed in RCA GPs during this period.
- RCA projects on radiation protection continued to assist RCAGPs to develop their radiation protection infrastructures in conformity with the IAEA Basic Safety Standards. It was also possible to develop training material on the assessment of radiological risks and to enhance capabilities for responding to radiological emergencies.
- RCA projects on research reactors implemented during this period enabled participating RCA GPs to develop capabilities in isotope production and to improve neutron beamline applications. Guidelines on the enhancement of the value of semi-precious gemstones

through improving coloration by neutron radiation and neutron doping of silicon were prepared and provided to participating RCA GPs.

RCA Government Parties

The RCA membership remained at 17 Government Parties during this period. Palau and Nepal, which became Member States of the IAEA in 2007 and 2008 respectively, were invited to join the RCA.

RCA Chairpersons

Year	Chairperson	Country
2002	Dr. In-soon Chang	Republic of Korea
2003	Prof. R. Hewanamma	Sri Lanka
2004	Dr. Munim Awais	Pakistan
2005	Dr. Nahrul Khair Alang Md Rashid	Malaysia
2006	Dr. Somporn Chongkum	Thailand
2007	Dr. Ronald Cameron	Australia
2008	Dr. Le Van Hong	Vietnam
2009	Dr. Tsutomu Arai	Japan
2010	Dr. Alumanda dela Rosa	The Philippines
2011	Dr. Anhar Riza Antariksawan	Indonesia

IAEA Personnel

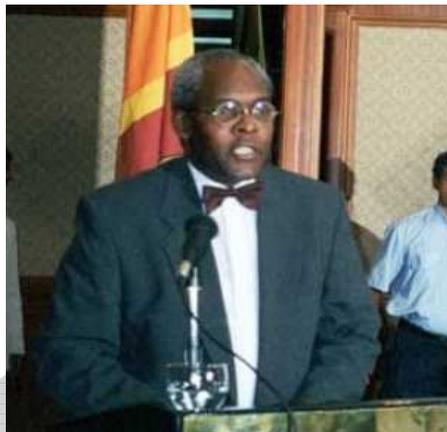
Dr. Carlito Aleta (1997-2003), Dr. Prinath Dias (2003-2010), Mr. Kesrat Sukasam (2011- 2013) functioned as RCA Coordinators/ RCA Focal Persons during this period. In between the appointment of RCA Coordinators, the Section Head of former East Asia and Pacific Section, Dr. M.N. Razely (February – May 2003) served as the RCA Coordinator in an acting capacity. Dr. Peter Salema (2002-2008) and Dr. Dazhu Yang (2009-2012) were the Directors of the TC Division for Asia and the Pacific. Dr. Ana Maria Cetto was the Deputy Director General and the Head of the Department of Technical Cooperation during this period.



Dr. Ana Maria Cetto
Deputy Director General -TC



Dr. Dazhu Yang
Director TCAP (2009-2012)
Deputy Director General -TC (2016-2021)



Dr. Peter Salema
Director-TCAP



Dr. Prinath Dias
RCA Coordinator / Focal Person

The Fifth Decade (2012 -2021)

RCA Management

Several improvements were made to the RCA Management during this period as well. One of the main developments was the formation of a Monitoring Committee for RCA Programme Development in 2012, following a proposal made at the 34th RCA NRM held in China. Dr. Frank Bruhn, the RCA National Representative of New Zealand, was appointed as the Chair of this Committee, which was renamed the RCA Programme Advisory Committee (PAC) at the 42nd RCA GCM held in 2013. Following the appointment of Dr. Frank Bruhn as the Head of the TC

Section of Quality Assurance of the IAEA, Dr. John Easey (AUL) was appointed the Chair of the PAC in 2014. Dr. Easey was succeeded by Dr. Prinath Dias (SRL), who was appointed in 2020.

The main function of the PAC is to assist in the development of the RCA Programme. Since its inception, the RCA PAC has assisted the RCA National Representatives to develop the biennial RCA TC Programmes by reviewing the pre-Concepts and Project Concepts submitted by the RCA GPs and has assisted the LCCs with project designs, in addition to several other tasks assigned to the PAC. The RCA Regional Programme Framework (RPF) for 2024-2029, containing the RCA strategic priority areas for this period, was prepared by PAC, with the assistance of experts in the RCA Thematic Areas, following a survey conducted to identify the priorities and the needs of the RCA GPs. The Terms of Reference (TOR) of the PAC was revised at the same NRM, making the PAC responsible for advising the RCA National Representatives on matters related to the development, implementation, monitoring and evaluation of the RCA Programme.

Another notable development was the appointment of a number of Working Groups important to the strategic management of the RCA. These Working Groups (WGs), comprising the

The WG on RCA Medium Term Strategy for 2018-2023 was approved at the 42nd RCA GCM held at Vienna in 2013. The WG comprised of Bangladesh, China, Malaysia, Singapore, the Philippines, and Australia (as Consultant). Dr. Alumanda Dela Rosa, who served as the RCA National Representative (NR) of the Philippines from 1998 to 2015 was appointed as the Chair of the WG on MTS. The RCA Medium Term Strategy for 2018-2023, contained RCA strategic priority areas for this period, and was approved at the 46th RCA GCM held in 2017.

The WG on MTS recommended the formation of the following Working Groups to assist in the implementation of the RCA MTS: WG on Human Resources Development, WG on Financial Gap Analysis and Resource Mobilization, and WG on Medium Term Strategy Coordination (MTSC).) These WGs were approved at the 38th RCA NRM held in Mongolia in 2016. Dr. Alumanda Dela Rosa, who served as the RCA National Representative (NR) of the Philippines from 1998 to 2015, was appointed as the Chair of the WG on MTS. Dr. Dr. Syed Mohamed Hossain (Director HRD of Bangladesh Atomic Energy Commission), Mr. Steven McIntosh (NR of Australia), and Dr. Chris Daughney (NR of New Zealand),) Chaired the WGs on Human Resources, Financial Analysis, and MTS Coordination (MTSC), respectively. Later, Mr. Mark

Alexander, the ensuing NR of Australia, succeeded Dr. Daughney as Chair of the MTSC. The current Chair of the MTSC is Dr. Yoshiko Okamoto of Japan

The WG on MTS Coordination carried out a baseline review of the RCA MTS for 2018-2023 after developing detailed guidelines for the review of the implementation of the MTS. The Mid-Term review of the MTS was carried out by the RCA Programme Advisory Committee, according to these guidelines.

The RCA Medium Term Strategy for 2018-2023, prepared by the WG on MTS and which was approved at the 46th RCA GCM held in 2017, contained RCA strategic priority areas for this period. (Ref. 21) The WG on MTS Coordination carried out a baseline review of the RCA MTS for 2018-2023 after developing detailed guidelines for the review of the implementation of the MTS. The Mid-Term review of the MTS was carried out by the RCA Programme Advisory Committee according to these guidelines.

The RCA Regional Programme Framework (RPF) for 2024-2029, containing the RCA strategic priority areas for this period was prepared by RCA PAC, with the assistance of experts in the RCA Thematic Areas, following a survey conducted to identify the priorities and the needs of the RCA GPs. (Ref. 22). The RPF was approved at the 43rd RCA NRM held in 2021 in Thailand. The TOR of the PAC was revised at the same NRM, making the PAC responsible for advising the RCA National Representatives on matters related to the development, implementation, monitoring, and evaluation of the RCA Programme.

RCA mechanisms were recognized as examples of ‘best practice’ in the first Agency’s Technical Cooperation Best Practice awards in January 2013. (Ref. 23)

The Regional Cooperative Agreement of 1987 was extended to another 5 years in 2012. A revised Agreement titled “The Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology, 2017” was adopted in 2017.⁵ Unlike the Agreement of 1986, which was in force for periods of five years following extensions by RCA Government Parties, the Agreement of 2017 was of unlimited duration.

⁵ IAEA INFCIRC/919

40th Anniversary of the RCA

An exhibition highlighting the achievements of the RCA over the past 40 years was held during the 34th RCA NRM held in the Peoples' Republic of China in April 2012. The exhibits reflected the outcomes of RCA projects and other RCA activities in all Thematic Areas. Another celebratory exhibition and a Panel Discussion were held at the IAEA Headquarters in Vienna during the 41st RCA GCM. That 56th General Conference of the IAEA held in September 2012. The exhibition, organized by the RCARO, was declared open by Dr. Yukiya Amano, the Director General of the IAEA.

The Panel Discussion was chaired by Dr. Anhar Riza Antariksawan, the NR of Indonesia, and the keynote address was made by Dr. Prinath Dias, former RCA Focal Person, under the topic, "RCA – Yesterday, Today and Tomorrow." The other speakers were Ms. Heather Patterson (AUL), Prof. Liu Luxiang (CPR), Dr. Gursharan Singh / Dr. N. Ramamoorthy (IND), and Dr. Alumanda Dela Rosa, who spoke on RCA achievements in the Human Health, Agriculture, Industry, and Environment, respectively.



Opening of the RCA Exhibition by Director General of the IAEA



Panel Discussion Speakers and IAEA Staff

RCA Projects

46 RCA Projects implemented under the Technical Cooperation Programme of the IAEA were initiated during this period, comprising 10 projects on agriculture, 9 on environment, 17 on human health, 5 on industry, 1 on Radiation Protection, and 4 on the development of TCDC.

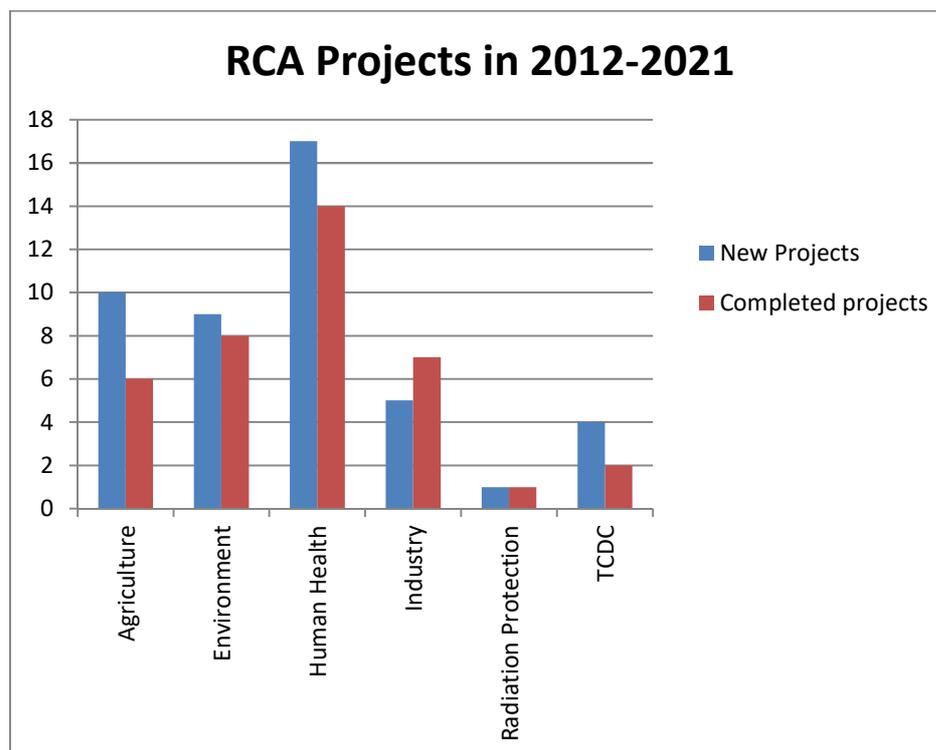
The agricultural projects included mutation breeding of crop varieties adaptable to climate change, improving soil fertility and land productivity, use of food irradiation to improve food security, food safety, and authentication of foodstuffs. The projects in the environmental sector were on the investigation of groundwater dynamics, sustainable management of deep groundwater resources, assessment of the impact of air particulate matter on urban air quality, assessment of the effect of sea-level rise due to climate change on coastal areas, and on the management of wetlands.

The projects on human health included 3D image-guided brachytherapy, stereotactic body radiation therapy for cancer treatment, hybrid nuclear imaging of cancer patients, nuclear medicine for cardiovascular diseases, intensity-modulated radiation therapy (IMRT), training of

medical physicists, and the production of cyclotron based radiopharmaceuticals. The distance learning programs in nuclear medicine and radiation oncology developed through previous RCA projects were further developed and updated.

The projects in the industrial sector were on optimizing process dynamics in industrial systems using radiotracer and sealed source techniques, advanced non-destructive examination for industrial safety, and development of advanced grafted materials by radiation technology. The project on radiation protection was on responding to radiological emergencies of Category II and III facilities.

38 projects, including projects that were initiated during the previous decade, were completed during this period. 18 out of the 46 projects initiated during this period were under implementation at the end of this period and 5 projects were awaiting closure. (Ref. 9).



Achievements

The following is a brief summary of the achievements of RCA during this period. Further details can be found in References 14 and 20.

- A large number of advanced mutants with significantly improved stress tolerance, quality, and yield potential characteristics in cereals, legumes, fruits and vegetables were developed in the RCA GPs during this period. 351 mutant lines were used in the regional multi-location trials and 102 well-characterized mutants were used for genetic studies. A recent case study on the social and economic impacts of the RCA mutation breeding projects showed a benefit to cost ratio of 11:1, meaning 1 euro investment yields an eleven euro return to the farmers and consumers of participating countries.
- Guidelines were developed on the audit and accreditation of irradiation facilities used for the sanitary and phytosanitary treatment of food and agricultural products. Most participating RCA GPs have amended their quarantine regulations to include irradiation as a phytosanitary measure.
- Studies carried out on the impact of the Fukushima accident on the marine environment showed there were no detectable releases in territorial waters of RCA GPs beyond Japan.

- It was also possible to improve the understanding of the impact of climate change in the marine ecosystem and the accumulation of contaminants/ pollutants through the utilization of nuclear techniques.
- The database containing levels of particulate air pollution, particularly PM2.5 particulate matter in the Asia and Pacific region was updated and provided to the RCA GPs.
- A database containing information on groundwater, surface water and precipitation in the region obtained from isotopic studies has been prepared.
- In the human health sector, the RCA projects on nuclear medicine have made it possible to enrich the knowledge of nuclear cardiology in the new generation of nuclear medicine specialists. Distance learning material on nuclear medicine, previously developed, has been updated and made more easily available to nuclear medicine professionals through a website. ([Human Health Campus - DATOL in English \(iaea.org\)](http://www.iaea.org/humanhealthcampus)).
- Advanced radiotherapy techniques such as stereotactic body radiation therapy (SBRT), 3D image-guided brachytherapy (IGBT), and intensity-modulated radiation therapy (IMRT), were introduced to the RCA GPs through projects on radiotherapy.
- RCA projects in medical physics enabled the development of distance learning material for the professional development of medical physicists (on-line tool AMPLE) and can be accessed through the IAEA's Cyber Learning Platform for Network Education and Training (CLP4NET).
- In the industrial sector, the RCA projects on radiation processing enabled the development of about 50 advanced radiation grafted materials (adsorbents, ion exchange membranes, catalysts bioactive carriers, tissue scaffold evaporator membranes, and active packaging materials).

RCA Government Parties

Cambodia, Fiji, Laos, Nepal, and Palau joined the RCA during this period, increasing the RCA membership to 22.

RCA Chairpersons

Year	Chairperson	Country
2012	Dr. Feng Dongxin	Peoples' Republic of China
2013	Dr. Khin Maung Latt	Myanmar

2014	Dr. Chris Daughney	New Zealand
2015	Dr. Syed Shaukat Hasan	Pakistan
2016	Dr. Mavag Chadraabal	Mongolia
2017	Engr. Jafar Sadique	Bangladesh
2018	Dr. Kim Young Eun	Republic of Korea
2019	Mr. T.M.R. Teneekoon	Sri Lanka
2020	Dr. Abdul Muin Abdul Rahman	Malaysia
2021	Dr. Suchin Udomsomporn	Thailand

IAEA Personnel

Mr. Kesrat Sukasam (2011- 2013) and Dr. Hoang Van Sinh (from 2014) functioned as RCA Focal Persons during this period. Dr. Ali Boussaha (2012- 2014), Dr. Najat Mokhtar (2015-2018), and Dr. Jane Gerado-Abaya (from 2019) were the Directors of the TC Division for Asia and the Pacific. Dr. Kwaku Aning (2011-2015) and Dr. Dazhu Yang (2016-2021) were the Deputy Director Generals and the Heads of the Department of Technical Cooperation during this period.



**Dr. Najat Mokhtar
Director -TCAP**



**Dr. Jane Gerado-Abaya
Director -TCAP**

(need photo)



Mr. Kesrat Sukasam
RCA Focal Person

Dr. Sinh Van Hoang
RCA Focal Person

Acknowledgments

The author wishes to express his appreciation to RCA National Representatives, Ms. Evelyne Ranharter (former staff member of the RCA Coordinator's Office), Dr. Carlito Aleta, Dr. Manoon Aramrattana, Mr. Kesrat Sukasam, Dr. John Chung (former staff member RCA Regional Office), Ms. Marie Hyun Kyoung Jeon (RCA Regional Office), Dr. Alumanda Dela Rosa, Dr. Sinh Van Hoang and the members of the RCA Programme Advisory Committee for their assistance in preparing this document by providing background material, by reviewing the draft and by other means.

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