

RCA News Letter

THE FOURTH ISSUE | MAY 2023

4th Issue of the RCA Newsletter

This issue provides sketches of the International Symposium Celebrating the 20th Anniversary of the RCA Regional Office, held in Dec. 2022 in Daejeon, Republic of Korea. Including Mr Rafael Mariano Grossi, Director General of the IAEA and Mr Oh Tae-seok, Vice Minister of Science and ICT, about 250 participants from the RCA GPs, IAEA and related institutes participated in the symposium to review the footsteps of the RCARO made over the years and discuss future strategies for further development of the RCARO. It also features articles on Bangladesh's perspective on the role of the RCA for the development of NST, challenges and opportunities of the RCA TC Programme, Indonesia's collaboration with the RCARO on the RCA Research Project and reflection of an RCARO fellow. To subscribe the RCA Newsletter, please contact rcaro@rcaro.org.

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RCA News

International Symposium Celebrating the 20th Anniversary of The RCA Regional Office



Since it came into force in 1972 as the first regional cooperative agreement established under the auspices of the IAEA, the RCA has served as an effective framework for the Asia-Pacific Member States to promote the transfer and peaceful uses of nuclear science and technology as a means to tackle regional challenges and development priorities. As the RCA expanded its membership and activities in terms of their numbers and diversities, there arose a need to station a representative in the region to support effective implementation of the RCA Programme and communication of the stakeholders. Thus, the RCA Regional Office (RCARO) was inaugurated in 2022 in Daejeon, Korea, with the support of its host country and the other Government Parties.

Ever since, the RCARO has devoted itself into fulfilling its mandate which is to increase the RCA Visibility and RCA Viability. Moreover, it strenuously expanded its roles and activities as a way to increase the benefits of the RCA Government Parties (GPs) from diverse aspects. In result, the RCARO made significant contributions in assisting the RCA to address the common needs of the RCA GPs and achieve the sustainable development goals for the region.

One of the most notable achievements in the last year is the successful celebration and commemoration of the 20th anniversary of the establishment of RCARO, which was marked in 2022 along with the 50th anniversary of the RCA. It was an opportune time for the RCA and the RCARO to assess the performance of the RCARO in the past two decades and

set up future plans to enable the RCARO to further enhance the impact of its activities. To this end, the RCARO organized an International Symposium Celebrating the 20th Anniversary of the RCARO on 15 December 2022 in Daejeon, Korea, under the theme, “Cooperative Leadership in Nuclear Science & Technology and Sustainable Development in the Asia-Pacific Region: Future Vision of the RCARO.”

The symposium consisted of a number of speeches and presentations that focused on highlighting the achievements that the RCA and RCARO made through facilitating collaboration within and out of Asia and the Pacific, contributing to the dissemination of nuclear technologies for socio-economic development of the region. Renowned experts and stakeholders of the RCA contributed as speakers and panels to share their experiences and insights they gained through being engaged with the nuclear society in the Asia-Pacific region as well as with the RCA and RCARO.

In the morning of the symposium day, the mood in the venue was festive, filled with more than 250 international and domestic delegates from relevant organizations and institutes. Representatives from the RCA Chair countries, RCA experts and representatives from the IAEA also took part in the event to share the monumental moment. Mr Pill Hwan Park, Director of the RCARO, officially announced the opening of the event by welcoming the participants and expressing his gratitude for their time and willingness to celebrate the Anniversary together.



Mr Tae-Seok Oh, Vice Minister of Science and ICT of Korea, also extended his wholehearted welcome to the participants through his remarks. In his remarks, Mr Oh recited the notable achievements that the RCARO made throughout the past 20 years, especially in the aspects of training professionals and educating the young generation and increasing the influence of the RCA by expanding partnerships with other organizations. In the years to come, he assured continuing and strengthened commitment of the Korean government to support the RCARO become an impactful Think-Tank for the RCA and contribute to enhancing the regional capacity in NS&T based on Korea's advanced technologies. He concluded his remarks by emphasizing the significance of the symposium as an opportunity to devise strategies for pending challenges and sustainable development of the region amid the difficult and complex time that the world was undergoing.

The main part of the symposium was consisted of sessions and topics that covered diverse aspects and perspectives of regional cooperation in NS&T as follows:



Nuclear Technology and Sustainable Development by Mr Han-Gyu Joo, Presedient, KAERI
 Technical Cooperation in Nuclear Techniques for the Asia-Pacific Region: Challenges and Opportunities by Mr Pill-Soo Hahn, Former Director, IAEA

Session I: Strategic Approach to Goal Achievements for the RCA

Strengthening Nuclear Cooperation in Response to Global Issues in the Asia-Pacific Region by Ms Jane Gerardo-Abaya, Director, IAEA

RCA's Innovation Strategy for Sustainable Development by Ms Alumanda Dela Rosa, Chair, WG of the RCA MTS 2018-2023 Coordination

Technical Cooperation through Nurturing Young Nuclear Professionals by Mr Gyu-Seong Cho, Professor, KAIST

Session II: Dissemination of Nuclear Technology through Technical Cooperation

Dissemination of Nuclear Technology for Achieving SDGs by Mr Keon-Wook Kang, Chairman, ARCCNM

Cooperative Strategy for Capacity Building of the RCA GPs by Mr Tran Chi Thanh, RCA Chair and President of VINATOM

Results and Future Tasks of the RCA Research Projects by Ms Muhayatun Santoso, Senior Researcher, National Nuclear Energy Agency of Indonesia

Nuclear Cooperation for Sustainable Development – RCARO's Cooperative Leadership by Mr Pill-Hwan Park, Director, RCARO

Panel Discussion: RCARO Dreams – Future Vision for the RCA GPs participated by

Ms Suchin Udomsomporn, Immediate Past RCA Chair and Former Deputy Secretary General of OAP

Mr Derek Davies, Senior Advisor for International Affairs, ANSTO

Ms Young-Mi Nam, Principal Researcher, KAERI

Mr Sung-Chul Jung, Manager, KIRAMS

Mr Sinh Van Hoang, RCA Focal Person, IAEA

Mr Byung-Yeoup Chung, Principal Researcher, ARTI-KAERI

Details of the speakers and their presentation materials could be found from the event website (https://rcaro.org/rcaro_20th/program).

In particular, Mr Grossi, Director General of the IAEA, highlighted the remarkable achievements the RCA made in the Asia-Pacific region with nuclear technologies based on the results found by the socio-economic impact assessment of the RCA Programme that the IAEA conducted in commemoration

of the 50th Anniversary of the RCA. He acclaimed the RCA as an effective and successful framework for regional cooperation for promotion of NS&T. As he mentioned the pioneering initiatives of the IAEA, including Zoonotic Disease Integrated Action (ZODIAC), Nuclear TEChnology for Controlling Plastic Pollution (NUTEC Plastics) and Rays of Hope, he expressed his expectations for the RCA to continue the close cooperation with the IAEA to address existing and emerging challenges by utilizing nuclear technologies and techniques in the coming decades. In the end of his speech, he emphasized the potential of Asia and the Pacific, endowed with substantial intellectual, economic and technological strengths. He urged the GPs to explore creative and innovative solutions to harness and synergize those resources to further realize the RCA Vision, assuring strong commitment and full collaboration of the Agency.

The last session of the symposium, the Panel Discussion, covered the expectations to and proactive strategies for the improvement of the RCARO. The panels consisted of some key stakeholders who had been taking substantial part in the RCARO's activities. The panels provided insightful opinions and constructive suggestions for enhancing the role and impact of the RCARO and successfully achieving its future vision.

Ms Udomsomporn from Thailand shared her insights she gained while serving as the RCA Chair in the previous year. Ms Udomsomporn mentioned that it is important to strengthen the basis of the RCARO by taking actions in terms of laws and agreements, which will allow its Missions to become more extensive. For this purpose, she underlined the collective support of the GPs for the institutionalization and operation of the RCARO. She urged the GPs take into account the benefits of the strong network they would obtain as a whole once the responsibility and commitment for the RCARO are shared among the GPs.



Ms Nam from Korea recalled her memory of taking part in the opening ceremony of the RCARO in 2002. Based on her experience as an active participant of a number of RCARO activities, she emphasized three major points for further improving the RCARO in the future: securing greater financial and human resources through various channels for upscale the scope and number of its activities; enhancing the RCA database to serve as an effective repository; and expanding partnerships proactively to facilitate resource mobilization and generate synergies.

Mr Jung, who is also a member of the Programme Advisory Committee, has been a close supporter of the RCARO for more than a decade. He offered strategies to carry out the RCARO's future roles, which share similar views with the previous panels: conducting systematic data collection and analysis as a RCA information reservoir; outreaching new partnership; and larger commitment of the GPs, such as reinforcing legal binding between the RCA and the RCARO as well as sharing financial responsibility for its sustainable functioning.

Mr Hoang from the IAEA firstly recognized the substantial contribution of the RCARO to the facilitation of the RCA and betterment of the GPs. Taking into account the possibilities and potential of the Asia-Pacific region, he made suggestions to the RCARO in order to address the global and regional challenges as a whole. He requested the RCARO to take actions regarding the promotion of nuclear R&D cooperation among the GPs by setting up a network of national nuclear research institutes and organizing a R&D programme within the network. He also mentioned to support a long-term nuclear education and training programme through establishing partnership with universities and industries related to NS&T. Assisting in forging partnerships with target stakeholders and promoting public awareness and acceptance for the application of nuclear technologies in support of sustainable socio-economic development of the region were the other suggestions.

Mr Chung from Korea focused on the major obstacles that the RCA is currently facing, including the gap in research capabilities of the GPs with different development levels and lack of well equipped facilities and trained personnel. Then, he suggested practical solutions that the RCARO could take to assist the RCA in tackling the challenges. Firstly, Mr Chung claimed that the GPs should build up roadmaps for bringing and utilizing nuclear technologies in their countries, referring to successful cases of developed countries with advanced technologies. He also suggested the RCARO to initiate expanded nuclear education programmes, in cooperation with world-class research institutes of Korea so as to secure additional finance and broaden courses for education.

He recommended the University of Science and Technology (UST), an interdisciplinary organization with numerous courses offered by Korean national research institutes, as a promising partner. Lastly, he mentioned that it is necessary to provide enough on-site experiences to the professionals in the GPs to enhance their understanding of and identify their needs for nuclear facilities.

Held in the very end of the year, the International Symposium turned out to be as an opportunity for the participants and other stakeholders as well to look back on the path that the RCARO and the RCA community came along and look ahead into the future in pursuit of further improvement to better contribute to the RCA GPs and the region. The RCARO assures its complete commitment to the RCA in the years to come and will continue to put in its best effort and devise innovative strategies to unlock the potential that the region possesses. On the other side, the RCARO highly appreciates the active support and confidence that the GPs have shown and asks for their continuing close cooperation. ✓



Director's Speech at the International Symposium Celebrating the 20th Anniversary of the RCA Regional Office

RCA: 50 Years of Progress and Contribution
Daejeon, Korea. 14 December 2022

as prepared for delivery

Rafael Mariano Grossi
Director General, IAEA

Ladies and gentlemen, distinguished delegates and guests,

The peaceful applications of nuclear science and technology support more than half of the UN Sustainable Development Goals directly and all of them indirectly. But not a single life would be bettered or saved without the dedicated people who make it happen.

The RCA and the regional office (RCARO) are where it happens! I am very pleased to be here to celebrate two important milestones – 50 years of RCA and 20 years of RCARO – and to congratulate you and to thank you personally for your contribution to “Atoms for Peace and Development” in Asia.

Nuclear science and technology have a role in assisting countries in overcoming their biggest challenges and in embracing their greatest opportunities. Energy, healthcare, food security, pollution – nuclear can help. And it is helping in Asia because of you.

Since being established in March 2002, with the mandate of increasing the ownership, visibility and partnership of the RCA, RCARO has made many valuable contributions. Notable achievements of the RCARO include:

- setting up and running the RCA website.
- Promoted research in air quality and in radiotherapy
- Established partnerships with UNDP and ASEAN
- Supported Fellows and students

Just a few months ago we had a special event to mark RCA's 50th anniversary at the IAEA's General Assembly just a few months ago, where a Joint Declaration was signed, confirming the strong commitment and determination of RCA State Parties to work together for a better future. I am confident the future is in good hands.

Since its inception, RCA has blossomed from a group of just four founding members in 1972, to 22 State Parties 50 years later. The Agreement shows exemplary regional cooperation and has many tangible successes. Here are some examples of that excellent work.

173 RCA technical cooperation projects have been implemented, with funding of 58 million dollars and 29 million Euros. Some 10,000 professionals have taken part in all kinds of training courses. 7,000 professionals have participated in regional workshops and meetings. 4,500 experts have shared their knowledge, experience and skills on the safe, effective and efficient use of nuclear technologies with end users.

In mutation breeding, 7,300 breeding lines with superior quality traits have been created, and more than 250 mutant varieties of crops certified and released.

In radiotherapy, the radiotherapy specialist workforce has increased by 230%. This has improved local tumour control rates from 39% in 2000 to 55% in 2020, and cancer survival rates from 38% in 2000 to 51% in 2020.

The RCA has recently taken the initiative to conduct social and economic impact assessments of RCA programmes in three sub-thematic areas, covering mutation breeding, radiotherapy, and non-destructive testing. These impact assessments capture the accomplishments that the RCA has supported in its State Parties. It is very important for us all to have this insight into the social and economic impact of TC projects, and the assessments provide us with excellent examples to look back on as the RCA celebrates 50 years of success.

As we look ahead to the next 50 years and beyond, we can see that our planet faces more challenges: climate change, energy demand, plastic pollution, zoonotic diseases, and cancer, to name but a few. There is no doubt in my mind that the RCA will continue to cooperate closely with the IAEA to address both existing and emerging challenges, using nuclear technologies and techniques.

To support Member States in adequately facing those challenges, I launched initiatives including Zoonotic Disease Integrated Action (ZODIAC) to strengthen MS preparedness and response capabilities to zoonotic disease outbreaks; and NUClear TEChnology for Controlling Plastic Pollution (NUTEC Plastics) to assist MSs in dealing with plastic pollution through recycling using radiation technology and marine monitoring using isotopic tracing techniques. Meanwhile, the IAEA's Rays of Hope initiative is adding new impetus to closing global inequality in cancer care.

The Asia and Pacific region is endowed with substantial intellectual, economic and technological strengths. Partnerships and resource mobilization is crucial to the RCA in meeting the region's goals and achieving Members' development priorities and Sustainable Development Goals. I urge the RCA State Parties to explore creative and innovative solutions to forge partnerships, and to mobilize, harness and synergize these potential resources to expand the RCA programme and meet its goal of "enhancing socio-economic well-being and contributing to sustainable development in the region".

Human resource development in nuclear science and technology is critical for the RCA to sustain the successes of the past and foster future achievements. I encourage you to formulate and implement a long-term nuclear human resource development programme to ensure that the peaceful application of nuclear science and technology will be sustained and developed in the Asia and the Pacific region.

In closing, let me assure you all that you can count on the strong commitment and full collaboration of the IAEA, and of me personally.

I congratulate you again for your tireless endeavours and remarkable achievements over the past 20 years for RCA's Regional Office and the past 50 years for RCA, and I look forward to many more in the years to come. ✓



Articles by GPs

The Role of RCA for the Development of Nuclear Science and Technology in Bangladesh

Syed Mohammad Hossain

Director & Chief Scientific Officer, Planning and Development Division
Bangladesh Atomic Energy Commission

Bangladesh is an independent, secular and democratic country in South Asia that became a member of the RCA in 1974. Since then, RCA activities have significantly contributed to developing Nuclear Science and Technology applications in Bangladesh, particularly in the thematic sectors identified by RCA that are linked to the national goals set forth in line with the SDGs (sustainable development goals) of the United Nations. Zero hunger, developing a sustainable and cleaner power generation system using nuclear technology, ensuring good health, keeping a pollution-free environment and industrial development are the priority sectors for Bangladesh.

In addressing zero hunger, food and agriculture sectors in Bangladesh have been improved significantly using nuclear technologies. In the last few decades, our crop production has been increased by 2-3 fold disregarding the deteriorating climate conditions and soil salinity. Production of short-duration mutant varieties and saline resistance crops using radiation-induced plant mutation breeding process are remarkable achievements through the close cooperation of IAEA and RCA [RCA Projects: RAS-5088, RAS-5077, RAS-5070, RAS-5056, RAS-5045, RAS-5040, RAS-5037]. Bangladesh Institute of Nuclear Agriculture (Bina) received "Outstanding Achievement Awards" [Fig.1] at the 58th General Conference of the IAEA in Vienna for its success in releasing nine improved mutant varieties of fiber jute, vegetable jute, mung bean and chickpea with improved yield and quality traits and are widely accepted by farmers for cultivation, which has increased yield from 20 to 45% compared to other existing crop varieties [1].

Suppression/eradication of Blowfly using Sterilized Insect Technology (SIT) to reduce loss of sun-drying marine fish is another achievement. SIT technology has been conducted on a pilot basis in Sonadia Island (south-eastern Bangladesh). A noticeable progress has also been achieved in gamma radiation processing for agricultural and industrial products including environmental preservation and remediation approaches with the help of IAEA and RCA [RCA Projects: RAS-5084, RAS-5057, RAS-5046, RAS-5042, RAS-5034, RAS-5020].



Fig.1. IAEA Director General Yukiya Amano and Representative of Permanent Representation of Bangladesh

It is also noteworthy that creditable progress has been achieved in the area of Nuclear Medicine and Oncology in Bangladesh through the close cooperation of IAEA and RCA [RCA Projects: RAS-6101, RAS-6100, RAS-6098, RAS-6097, RAS-6096, RAS-6093, RAS-6087, RAS-6086, RAS-6083, RAS-6071, RAS-6076, RAS-6065, RAS-6062, RAS-6066, RAS-6064, RAS-6049, RAS-6048, RAS6041, RAS-6042, RAS-6038, RAS-6037, RAS-6035, RAS-6033, RAS-6029, RAS-6028, RAS-6027]. About half-a-million patients get health services from the 14 INMAS (Institute of Nuclear Medicine & Allied Sciences) and NINMAS (National Institute of Nuclear Medicine & Allied Sciences) spread throughout the country under the auspices of the Bangladesh Atomic Energy Commission (BAEC). To meet the rapidly raising demands of nuclear medicine (both therapeutic and diagnostic), 8 new INMAS are now under construction. Most of the INMAS and NINMAS are well equipped with modern facilities like, SPECT (43), SPECT-CT (18), PET-CT (8), BMD (23), Thyroid Gamma Camera (29), etc. Radioimmunoassay (RIA) is very much popular in Bangladesh for the diagnosis of Hormonal Disorders.

Newborn Screening for the diagnosis of congenital Hypothyroidism (CH) is also going on in Bangladesh under the umbrella of Nuclear Medicine through Dried Blood sample (DBS) based Immunoradiometric Assay (IRMA) and DELFIA (Dissociation-enhanced lanthanide fluorescence immunoassay).

Bangladesh has been trying hard to keep its environment pollution-free, which also is the part and parcel of UN-SDGs. As a testimony, a mention can be made of controlling the air quality in Dhaka City through assessing the Impact of Urban Air Particulate Matter. A high Lead pollution level was determined, and its possible sources were provided to the end users through the RCA projects [RAS-8082, RAS-7029, RAS-7023, RAS-7015, RAS-7013]. This achievement has resulted in the Government taking action to change over to unleaded gasoline from 1st July, 1999. After this action taken by the Government, the yearly average of lead concentration in the APM of Dhaka has dropped to about one-third of the previous value [2]. Due to the removal of two-stroke engines and old buses, which are older than 20 years in December 2002, the air quality in Dhaka has dramatically changed. About 40% of PM_{2.5} has decreased due to the policy intervention by the Government of Bangladesh [3].

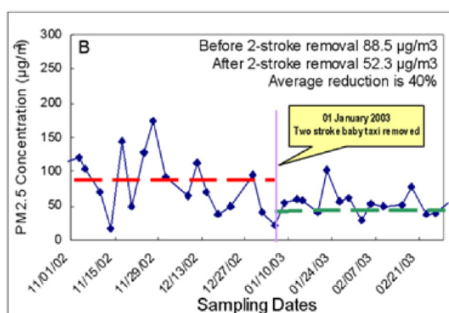


Fig.2 PM_{2.5} concentrations as a function of time showing the likely effect of banning two-stroke baby taxis on the air quality in Dhaka

NDT capability has developed in Bangladesh through a series of IAEA/RCA projects (RAS-1029, RAS-1022, RAS-1013, RAS-8110, RAS-8105, RAS-8100, RAS-8085). A number of scientists achieved certification on proficiency Level-2 of Digital Industrial Radiographic Method as per international standard ISO 9712 & thus skilled manpower on this advanced technology has been developed for Industrial practices to meet up the requirements of the local industries including Rooppur NPP project.

The isotope hydrology technique has been successfully used to define the problem as well as to find the alternative for safe and sustainable sources of drinking water in the Deltaic basin. Modern and sophisticated lab facilities have been developed to monitor the hydrosphere as well as soil erosion. Throughout a series of training programmes, manpower resources have been



Fig.2 IAEA/RCA Regional training course on application of DR and CT to metal, non-metal and composite materials under RAS-1.020, held in Dhaka from 26-30 July 2015.

developed for investigating the critical features of aquifer-oriented problems [RCA Projects: RAS-8104, RAS-8097, RAS-7040, RAS-7035, RAS-7030, RAS-7022].

Starting its journey with a research reactor back in 1986, Bangladesh is now implementing its first nuclear power plant project at Rooppur to meet the ever-increasing demand of electricity. While implementing the project, the top priority is being given to the issues of radiological protection as well as nuclear safety and security. IAEA-RCA is a strategic partner of this journey which is helping us in developing the technical man-power as well as the technical advancements [RCA Projects: RAS-9092, RAS-9042, RAS-4026, RAS-4020, RAS-4022, RAS-4019, RAS-4011].

Bangladesh Government is very much committed to developing nuclear science & technology for the development of the socioeconomic conditions of the country. Unfortunately, global climate changes are having quite an adverse impact on our weather pattern. So, we expect that the RCA will play a value-added role in addressing the climate change issue with its accompanying effects through the utilization of nuclear technologies.

Bangladesh always considers RCA as a powerful strategic partner to advocate research, development and training in the realm of nuclear science and technology for the member states. A firm promotion of RCA extension activities including, but not limited to, knowledge and technology transfer and enhancement may be considered in the next logical goal of cooperation. We strongly believe that the RCA Government Parties are in a position to solve any problematic issues related to Nuclear Science and Technology within the cooperation agreement. ✓

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Featured Articles

Challenges and Opportunities Being Faced by the RCA TC Program

Pil-Soo Hahn

Former Director, Division of Radiation/Transport/Waste Safety, IAEA

Uses of nuclear and radiation sources

The prevailing serious climate issue due to global warming is expected to trigger the discussion of the earlier introduction of nuclear power plants (NPP) by some developing countries. However, the technological provision, like human resources, regulatory framework, national technical expertise, etc. for the initial introduction of NPP requires a relatively long lead-time. Consequently, in the coming years, there may be an increased need of technical cooperation (TC) in the field of nuclear power in those developing countries with this intention.

Currently, the use of nuclear technology in developing countries is mostly limited to the application of radiation sources. Even now, they are widely used in various applications including medicine, industry, food/agriculture, water/environment, security checks, etc. With the economic development of these countries, these applications can be expected to be increased and expanded. Especially for medical applications like X-ray diagnosis, cancer treatment and nuclear medicine, the procedures are expected to drastically increase as time goes on. Currently, worldwide statistics show that the cases of X-ray diagnosis are about 4 billion/year, and nuclear medicine examinations are reaching around 30 million/year in more than 70 countries. According to the data released by UNSCEAR (United Nations Scientific Committee on the Effects of Atomic Radiation), the estimated cases of cancer treatment by radiotherapy will reach around 21 million/year by 2030.

The use of radiation for applications other than medicine is for the management of environmental issues like environmental isotopic studies, wastewater treatment, insect pest control, etc. as well as for the sterilization of food, medical products, blood, etc. They are also extensively used for non-destructive testing in the automobile industry, aero industry, electronic industry and integrity testing for bridges and pipelines.

Risk and protection

One aspect we need to highlight is that the use locations of radiation sources are widely scattered all around the country and they are being managed by private institutions and corporations. This typical feature means that those applications are practiced in the neighborhood of our living atmosphere which is vulnerable to radiological accidents.

Once any type of accident occurs, then they mostly lead to environmental contamination and subsequent social unrest in urban areas. There have been examples of such incidents and accidents that occurred even in the RCA Governmental Parties (GPs) mainly due to the loss of control of sources. Lessons learned from the previous radiological accidents to improve the situation can be summarized as:

- **An adequate regulatory framework for both safety and security should be in place.**
 - Legislative framework. Regulatory body.
 - Regulatory body.
 - Proper implementation practice: Safety culture and Security culture.
- **Radiation sources should be controlled over their whole life cycle.**
 - "From cradle to grave."

Technical cooperation in the Asia-Pacific region

Even though the developing countries in the region have attained some level of expertise and experience in the fields of radiation applications over the past decades, the level still varies from country to country. Therefore, simple technology input to least developed countries does not naturally result in expected consequences, and therefore, the meaningful outcome of the proposed Technical Cooperation (TC) program can only be expected when TC is provided for more receptive recipient GPs. Furthermore, effective and sustainable technology transfer can only be assured if it is tailored to the specific GP's capabilities, capacities, and needs. In coping with the situation, IAEA has introduced the concept of Technical Cooperation among Developing Countries (TCDC) and partnership program. Over the decades, this new approach has also been adopted to the RCA TC program and shown the effectiveness of the implemented program. The following aspects need to be considered in the course of the implementation of the TCDC.

- **Correct self-assessment by each GP on:**
 - Status, strengths and weaknesses of a particular technology within a GP.
 - Capabilities of their national experts.
 - Requirements for assistance from other GPs.

- **Partnerships by more industrialized GPs:**

- Provided essential human resource.
- Extends their expertise and enhances their potential to contribute to TCDC.

Challenges and opportunities

Ever since the introduction of the TCDC and partnerships in 2008, many activities of the RCA TC program have been involved with and benefitted from such interactions. However, the establishment of a formally adopted Implementation Plan, integrating the aims and objectives and linking these to the enhancement of national and regional sustainability of the TC program, has remained as an issue that needs to be continued and improved.

Another important aspect we need to focus more on in the coming years is the issue of safety assurance associated with the use of high radioactive sources. As mentioned above, they could be vulnerable to missing or theft and even may be targeted by terrorists.

The following summarized items are part of the major challenges being faced by the on-going and future RCA TC program.

- **Limited Financial Resources**

- Diversifying sources and efficient finance allocation needed.

- **Efficiency, effectiveness and sustainability of the intended technology transfer.**

- Wide deviation on the level of nuclear technology and skills from country to country still prevailed.
- Effective use of up-to-date “Integrated Information System” on the level of nuclear techniques for each GPs required.
- TC program tailored to the specific GP’s levels needed.
- TCDC and partnerships approach need to be maintained to maximize the outcome.

- **COVID19 Pandemics**

- here has been restricted environment for meetings, training courses, scientific visits, etc. since the end of 2019.
- The substituted on-line events during the period has shown the limited effectiveness.

- **Increased interests by some RCA GPs in nuclear energy.**

- Nuclear Power as an energy source without the emission of GHG.
- Long lead-time inevitable for HR development and other technological provisions.
- Risky initial large-scale investment.

- **Enhanced alert on radiation safety and security.**

- Increasing use of high radiation sources in many different applications.

- Scattered use-locations for high radiation sources in the neighborhood of our living atmosphere.
- Safety and security are not a concern only to a nation.
- Governmental level approach needed.

Over the last 20 years, successful implementation of the RCA projects has provided a greater assurance of success, cost-effectiveness and sustainability of the overall IAEA TC program. RCARO has undertaken various cooperative activities that complemented and expanded the ongoing RCA program.

In the coming years, RCARO is expected to facilitate regional cooperation by exploring various strategic approaches like the diversification of its activities, expansion of its partnerships, etc. The existing Integrated Information System needs to be taken into consideration in the design process of a new TC program for the program to be tailored to the specific GP's conditions. Digital technologies and IT environment as an innovative tool for an effective TC program, should also be fully utilized for managing and transferring the required knowledge as well as for nurturing young experts from the next generation.

In summary, lists of opportunities that can be considered for more effective implementation of forthcoming TC program are:

- **Improved level of expertise and experience in RCA-GPs.**

- Over the past two decades, many RCA-GPs have attained substantial improvement in the field.
- The application of radiation sources to address certain developmental challenges has been subsequently extended.

- **IT environment and easy on-line access.**

- Easier connection between donors and recipients.
- Possible real-time communication.
- Use of Web-seminars, lectures, etc.
- Various existing e-learning tools.

- **Continued positive role played by RCARO.**

- Strengthened regional representation.
- Built resilient community.
- Monitored result after each TC project.
- Existing channel with NLOs of each RCA GPs through continued interaction.
- Harmonized approach with IAEA TCAP
- Overall TC program led by IAEA.
- Supportive role by RCARO. ✓

Projects

"Collaborative Efforts by RCARO and Indonesia for Continuous, and Long-term Actions to Enhance Air Quality in Indonesia"

Muhayatun Santoso and Diah Dwiana Lestiani

National Research and Innovation Agency of Indonesia (BRIN)

Air pollution is a major issue in Indonesia, with many cities in the country suffering from high levels of particulate matter and other harmful pollutants. Air pollution is a major global concern that affects the health and well-being of millions of people. The country's rapid industrialization and urbanization has led to an increase in the number of vehicles on the road and the burning of fossil fuels, resulting in high levels of air pollution. To address this problem, RCARO, the Regional Office of the RCA (Regional Cooperative Agreement) has launched a regional research project for Government Parties of the RCA, to carry out air quality research. This partnership brings together the expertise of RCARO in designing, monitoring, and evaluating regional projects, promotes the uses of nuclear science and technology, enhances the collaborations with end users and supports the local facilities and resources in several countries that have been tacking with air pollution.

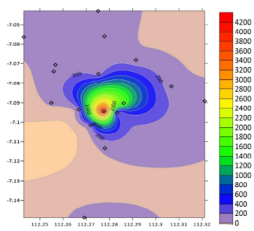
RCA is a regional agreement that promotes cooperation among member states in the Asia-Pacific region to develop and utilize nuclear science and technology for peaceful purposes. Indonesia is the country that has been designated as the Lead Country Coordinator of this project, to provide leadership in implementing collaborative, continuous, and long-term actions aimed at improving air quality. This collaboration has involved various stakeholders, including government agencies, academia, and civil society organizations, to identify and address the sources of air pollution, especially in the industrial impact on the air quality in East Java, Indonesia. The research project was started in 2018, through the implementation of projects aimed at transferring highly sophisticated nuclear technologies. These technologies were used to monitor air particulate matters (APM) and analyze the carbonaceous, chemical composition and heavy metals of pollutants, contributing to the facilitation of regulations on air pollution and efforts resulted in the establishment of a database on air pollutants. The analysis of these databases has proven to be an effective means of identifying the source apportionment solutions using the positive matrix factorization algorithm, the origin of both local and regional air pollutants, and enabling the tracking of long-range transport of pollutants over hundreds of kilometers.

The impact of several industrial activities on fine particulate matter PM2.5 in industrial sites in East Java has been identified, with higher concentrations of heavy metals such as Pb, Fe, and Zn compared to other cities in Java. This impact has not only been observed in the air but also the water and soil environments. Environmental samples, including water collected within a radius of less than 1 km, have shown high concentrations of Pb. Similarly, soil samples have demonstrated that concentrations of Pb in surface soil decrease significantly at distances further away from the industrial areas. Several findings have been published and communicated with the related authorities for scientific-based evidence to design appropriate and directed policies in dealing with existing pollution.

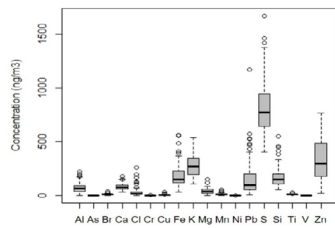


National training in Bandung, 22-26 April 2019

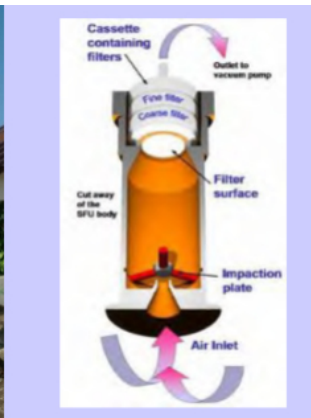
In summary, the air quality research conducted on industrial sites in East Java, Indonesia, is relevant to several SDGs and contributes to achieving sustainable development goals through the identification and mitigation of harmful industrial emissions and the improvement of air quality and the prevention of contamination not only in the air but also water and soil environments in the region. The important support of the RCARO has been pivotal playing a crucial role in these collaborative efforts with Indonesia for continuous, long-term actions towards enhancing air quality and the surrounding environment. ✓



Spatial distribution of Pb in soil collected from industrial sites in East Java (site 4)



Elemental concentrations of PM2.5 in East Java (Site 1)



Sampling of ambient PM2.5 in East Java

What's more

RCA FELLOWSHIP EXPERIENCE / REFLECTIONS

Ms Adeela Azam

Senior International Relations Officer, International Cooperation,
International Affairs Division, Pakistan Atomic Energy Commission

The RCA Fellowship Program at RCA Regional Office, Korea provides a platform to professionals from RCA Government Parties for networking, mutual learning and capacity building under the RCA/IAEA framework. My fellowship at RCA Regional Office, Republic of Korea for two months has been an amazing experience. The fellowship at RCARO offered a good combination of learning, hands-on experience, issue-based discussions and provision to apply what one has learned to contribute to the system. The fellowship is largely designed according to the aptitude and experience of the fellow. Additionally, the fellowship introduces some assignments which are different from the regular experience or strengths of the fellow. So, this combination helps the fellow to explore and learn new knowledge as well as capitalize on and improve the existing skills and capabilities.

Under this framework, assignments and activities were tailored in a manner wherein I learnt a lot. Overall, the fellowship is an interesting program with defined goals. The fellowship has provided me with a range of activities and experiences, including; participation in the RCA Regional workshop, lectures by Korean experts, and the opportunity to visit some technical facilities. Participants from the respective Government Parties attended the workshop. A pool of experts from KAIST, KAERI, KERI delivered lectures about Korea's technical experience, potential and technology particularly related to radiation equipment in the human health sector. The workshop provided the opportunity to learn about Korea's experience in the field of nuclear technology as well as it provided an opening to meet professionals from different RCA GPs who shared their knowledge and technical experience regarding Cyclotron and E-beam technology.

One of the highlights of the fellowship program was to write a country report explaining the role and contribution of the Pakistan Atomic Energy Commission in harnessing nuclear technology for the socio-economic uplift of Pakistan. During the process of research and analysis, I learnt a lot about PAEC, its contributions and its beneficial journey with the International Atomic Energy Agency. Further, the assignment of exploring and proposing options to advance cooperation among RCA GPs regarding the application of nuclear science and technology for the uplift of the people across the region –



the Asia Pacific, was very stimulating and enlightening. Putting all these elements of the program together, I focused on learning, improving and strengthening my abilities to be able to perform better.

The fellowship represented the real purpose of fellowship, not only from the perspective of learning and delivering results but even more so from a humanistic perspective. Through this fellowship, I have had an opportunity to work with amazing colleagues who encouraged and inspired me to learn and take the challenges to execute my tasks. Therefore, the combination of workload and expected output, coupled with a conducive environment made the overall experience dynamic. The Fellowship encourages and challenges one to learn, absorb, integrate, and articulate one's perspective efficiently and effectively. The knowledge acquired, and the skills learned have enhanced my professional competency to contribute effectively.

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