RCA activities in the Asian and Pacific Region

by M. Kobayashi*

So-called "RCA" activities – practical work undertaken within the framework of a Regional Co-operative Agreement for Research, Development and Training related to Nuclear Science and Technology for the Asian and Pacific region – are widely regarded as an example of successful co-operative effort in the application of nuclear techniques at a regional level. Under the terms of the Agreement, which came into force in 1972, the participating countries aim to promote and co-ordinate research and development work in nuclear fields through collaboration between national institutions in the region. The Agency's rôle is to provide administrative, advisory, technical, and financial assistance, when needed, to secure the successful execution of the projects undertaken within the framework of the RCA.

To date, the costs of projects executed under the RCA umbrella have been met largely by contributions, both in cash and in kind, from the participating governments. The Agency's cash contributions have been limited to research contract funds and covering the costs of meetings. The programme has been assisted greatly by funds, equipment, facilities, and expert services made available by two relatively new parties to the Agreement,

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Table 1. RCA regional co-operative projects

Project title	Participants: Australia	Bangladesh	India	Indonesia	Japan	Korea, Rep. of	Malaysia	Pakistan	Philippines	Singapore	Sri Lanka	Thailand	Viet Nam
1. Use of induced mutations for the improvement of grain legume production		X	X	X		X	X	X	X		X	X	
2. Food irradiation		X	X	X	X	X	X	X	X		X	X	(X)
3. Use of nuclear techniques in improving buffalo production	X	X	X	X			X		X		X	X	
4. Radiation sterilization of medical supplies	X	X	X	X		X		X	X			X	
5. Health-related environmental research		X	X	X	X	X	X	X	X	X		X	
6. Maintenance of nuclear instruments		X	X	X		X	X	X	X		X	X	(X)
7. Isotope applications in hydrology and sedimentology	X			X		X	X					X	X
8. Semi-dwarf mutants for rice improvement		X	X	X	X	X	X	X	X		X	X	X
9. Basic science using research reactors		X	X	X		X	X		X		X	X	X
10. Industrial applications of isotopes and radiation technology (UNDP)	X	X	X	X	X	X	X	X	X	X	X	X	(X)
*11. Cancer therapy		X	X		X	X	X	X	X	X	X	X	
*12. Nuclear medicine	X	X	X	X	X	X	X	X	X	X	X	X	X
*13. Parasitic diseases		X	X	X			X	X	X		X	X	
*14. Tc-99m generators	X	X	X	X		X	X	X	X		X	X	

(subject to negotiation)

* expected participants.

Australia and Japan, and more recently also by India. A further development, which has accelerated the programme considerably, is the large-scale assistance provided by the United Nations Development Programme (UNDP) for a project aimed at introducing and establishing nuclear techniques in a wide variety of industries in the region, including mining, rubber, paper, chemicals and petrochemicals, metals, and electronics.

Thirteen RCA Member States are participating in and contributing to the Industrial Applications project, for which the total targeted expenditure exceeds US$ 12.5 million over its full term of seven years (1981–1987). Its funding is shared between participating governments (52%), regional industries (13%), and UNDP (35%). Of the total amount budgeted for RCA activities, which totalled more than US$ 7.5 million over the period 1978–82, approximately 54% was financed from Member States' contributions, and the balance by the UNDP and the Agency. This total does not include the value of the manpower and other facilities made available by institutes participating in RCA co-operative research projects, estimated to be more than US$ 8 million.

Activities undertaken to promote the transfer of nuclear technology within the framework of the RCA cover a large spectrum of nuclear appplications in agriculture and food production, medicine, study of the environment, industry, and physics. Fourteen projects are operational this year (1984). The subjects of active co-operative projects and the countries participating in each project are shown in Table 1, and a breakdown of funding for RCA activities over the period 1978–84 is given in Table 2. RCA Working Group meetings are held annually for the purpose of reviewing

Table 2. Funds allocated for RCA activities 1978–84 (US$)

Title of project/activity	1978	1979	1980	1981	1982	1983	1984	TOTAL (by activity)
Use of induced mutations for the improvement of grain legume production	19 000	49 309	49 200	81 500	71 000	80 000	73 000	423 009
Food irradiation	8 000	27 400	76 000	80 000	80 000	40 000	82 500	393 900
Use of nuclear techniques in improving buffalo production	28 000	50 243	50 200	70 700	52 000	44 000	85 000	380 143
Radiation sterilization of medical supplies	–	30 000	51 000	35 000	39 000	35 000	30 000	220 000
Health-related environmental research	18 260	6 000	20 000	44 000	48 000	30 000	74 000	240 260
Maintenance of nuclear instruments	–	52 700	47 500	53 500	65 000	45 000	60 000	323 700
Neutron scattering	27 500	35 400	23 000	12 700	–	–	–	98 600
Basic science using research reactors	–	–	–	–	–	40 000	40 000	80 000
Isotope applications in hydrology and sedimentology	–	74 447	105 300	105 000	95 000	55 000	25 000	459 747
Semi-dwarf mutants for rice improvement	–	–	–	–	50 000	68 000	73 000	191 000
Industrial applications of isotopes and radiation technology (UNDP)	92 085	24 892	123 798	2 284 753	2 996 626	2 759 668	1 802 759	10 084 581
Improvement of cancer therapy	–	–	–	–	–	48 000	130 000	178 000
Nuclear medicine for thyroid and liver diseases	–	–	–	–	–	30 000	155 000	185 000
Nuclear techniques for tropical parasite diseases	–	–	–	–	–	31 000	40 000	71 000
Development of Tc-99m generator systems	–	–	–	–	–	22 000	50 000	72 000
RCA Working Group meetings	–	–	–	3 600	4 000	4 000	4 000	15 600
TOTAL	192 845	350 391	545 999	2 770 753	3 500 626	3 331 668	2 724 259	13 416 540

progress, discussing new proposals, and formulating future work plans. Findings and recommendations emanating from the Working Group meetings are submitted to the annual RCA meeting for review and approval.

As mentioned earlier, RCA activities have been or are being supported from various sources:

(a) Research contract funds from the Agency's Regular Budget;

(b) Special cash contributions made by Australia, India, and Japan. A project in the field of Isotope Applications in Hydrology and Sedimentology has been supported by Australia, and a project in Basic Science using Research Reactors is being supported by India. A project in Food Irradiation processing has been supported by Japan, and the Medical and Biological Applications of Nuclear Techniques, including four sub-projects, will be supported by Japan;

(c) Contributions in kind from RCA countries;

(d) Assistance provided under the Agency's Technical Co-operation programme; and

(e) UNDP funds for the Industrial Applications project. This project, established with the strong backing of the participating countries, has also been supported financially by Australia and Japan, all the participating developing countries, and regional industries. The resources made available for this project during 1978–82 and budgeted for the years 1983–87 are shown in Figure 1 and listed in Table 3.

Current RCA co-operative research projects

Use of induced mutations for the improvement of grain legume production: Radiation-induced mutations of grain legumes are being evaluated and improved cultivars introduced into farm production. The project will be extended further.

Food irradiation: Significant progress has been achieved. The financial support provided by Japan during 1981–83 made possible research and development on the use of radiation processing to reduce spoilage and losses of many food items in the Asian and Pacific region; and all the participating countries have shown interest in launching a Phase II pilot-scale project to accelerate the commercialization of food irradiation in the region. Most of the participating countries are interested in establishing their own pilot-scale or commercial food irradiation plants.

Nuclear techniques to improve domestic buffalo production: Work on characterizing the reproductive capacity of different breeds of buffalo in different countries has continued. Radioimmunoassay and isotope-based studies of nutrition and pathogenesis have been carried out successfully. Phase II of the project will be initiated early in 1984.

Sterilization of biological tissue grafts: Quantitative studies have been carried out. The future aim of the project is to develop safe practices for radiation sterilization, and to seek to establish tissue banks.

Health-related environmental research: Considerable interest has been shown in the use of nuclear analytical methods in the study of environmental contamination with heavy metals.

Nuclear instrument maintenance: This programme aims at establishing maintenance strategies and practices in pilot laboratories, and creating centralized national maintenance facilities. Major efforts are to be made to improve local training courses.

Basic science using research reactors: With the support of India, a three-week workshop on the use of micro-processors in research reactor utilization was held in Bombay earlier this year.

Isotope hydrology and sedimentology: This project was originally proposed by Australia, which has provided funds. It emphasizes the application of environmental isotope techniques in the study of groundwater problems; research has been done on the use of environmental caesium-137 in studies of sedimentation and soil erosion. Environmental tritium analytical facilities have been set up in Indonesia and in the Republic of Korea, and carbon-14 analytical facilities are operational in Indonesia. Scientists from these countries have been trained at a research establishment of the Australian Atomic Energy Commission. One co-ordinated research programme entails studies of groundwater in and around Bangkok, Jakarta, and Seoul. Studies have also been carried out in Malaysia and Sri Lanka.

Semi-dwarf mutants for rice improvement: A large number of new semi-dwarf mutants have been obtained as a result of mutagenic treatment of local varieties; they are to be evaluated in field conditions.

UNDP Industrial Applications project: The focus of this project is on industries of major economic importance to the region. It comprises at present the following sub-projects:

(a) tracer technology in industry;
(b) non-destructive testing;
(c) radiation processing, including the radiation sterilization of medical products;
(d) nucleonic control systems; and
(e) maintenance of nuclear instruments.

Tracer technology in industry: The Bhabha Atomic Research Centre in India is co-operating in training, and demonstration workshops have been conducted in Bombay and in Singapore.

Non-destructive testing: An advisory group has prepared a draft of a certification scheme for NDT specialists.

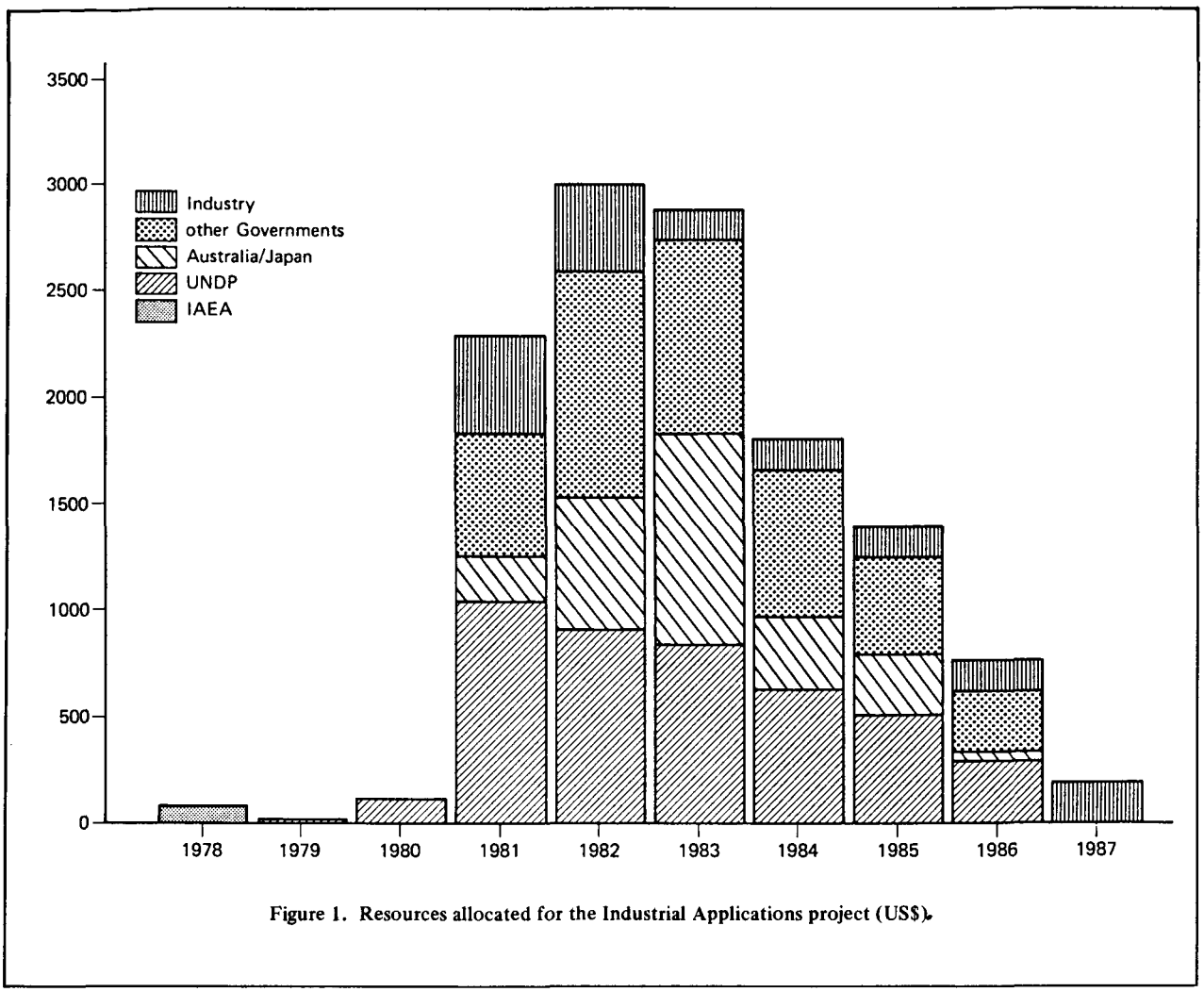

Figure 1. Resources allocated for the Industrial Applications project (US$).

Table 3. Resources allocated for the Industrial Applications project, as of January 1984 (in US$)

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Technical Co-operation programme	92 085	11 357	–	–	–	–	–	–	–	–
UNDP funds	–	13 535	123 798	1 043 454	910 347	724 983	630 200	514 450	294 900	–
Contributions: Australia and Japan*	–	–	–	213 110	618 050	987 617	337 646	279 472	44 631	–
In kind contributions:										
Other participating Governments	–	–	–	572 689	1 053 229	899 800	678 644	454 855	278 714	–
Participating industries	–	–	–	455 500	415 000	147 268	147 269	145 829	145 819	196 755
TOTAL	92 085	24 892	123 798	2 284 753	2 996 626	2 759 668	1 802 759	1 394 606	764 064	196 755

* In cash and in kind.

Mr S.P. Kasemsanta, the Project Co-ordinator of the UNDP Industrial Project (second from the left) and staff from Australia and the Philippines visiting an analytical laboratory during the Training-demonstration Course.

This draft is expected to be approved officially after the comments of the participating countries have been received. Advanced training courses on radiography and ultrasonic inspection in accordance with the certification scheme have been carried out at the Singapore Institute for Standards and Industrial Research, and at the Japanese Society for Non-destructive Inspection in Tokyo.

Radiation processing: A semi-commercial irradiation plant is to be constructed at the Centre for Applications of Isotope and Radiation (PAIR) in Jakarta as a regional centre for radiation processing. A 300 kCi cobalt-60 irradiation facility was inaugurated in September 1983, and a long-term training and demonstration programme on the radiation vulcanization of natural rubber latex has been in progress since October 1983. Developmental research for the industrialization of radiation-vulcanized rubber has been carried out in co-operation between PAIR, the Rubber Research Institute of Malaysia, and the Takasaki Radiation Chemistry Research Establishment at the Japan Atomic Energy Research Institute (JAERI), Japan. A 350 kV low-energy electron accelerator is now under construction for use in the radiation curing of wood surface coatings. Two commercial-size pilot plants in India and the Republic of Korea for the radiation sterilization of medical products, which were set up under previous UNDP/IAEA sponsored projects, are being utilized for industrial training and demonstrations.

Nucleonic control systems: Nucleonic control systems for minerals exploration, mining, and process operations such as paper and steel production have been demonstrated on site as a part of the training programme. A demonstration nucleonic control system for use in paper production has been installed at the Siam Kraft Paper Company, Thailand, and training courses have been held in Thailand and Japan. A thickness gauge for use in steel production, installed at the Bokaro Steel Plant, India, has been used in training and demonstration courses in India and Japan. Australia is providing leadership and expertise for the transfer of nucleonic technology and methods to the minerals industry, for which training and demonstration courses have been carried out in Australia and the Philippines.

Nuclear instruments maintenance (sub-project): The immediate objective of this sub-project is to create the capability within the region for maintaining, servicing, and providing essential components for the efficient and reliable use of nuclear electronic instruments for industrial process control and manufacturing operations. Under this sub-project, workshops three weeks in duration and on-the-job training courses lasting two months have been held in Japan, in co-operation with the Japan Atomic Industrial Forum and Japanese industry, for participants from Asian countries.

Medical and biological applications of nuclear techniques

A draft proposal for a project on medical and biological applications of nuclear techniques was discussed at the Fourth RCA Working Group meeting in Malaysia in 1982, and was approved by the Director General of the IAEA in 1983. The Agency has set up the following co-ordinated research projects:

(a) improvement of cancer therapy
(b) nuclear medicine for thyroid and liver diseases
(c) nuclear techniques for tropical parasitic diseases
(d) development of technetium-99m generator systems.

Projects (a) and (b) have been supported financially by Japan. Recently, the Japanese Government announced an offer to the IAEA of a teletherapy apparatus for uterine cancer treatment, to be given to one of the RCA countries to help create a regional centre of excellence in this field.

Future prospects

RCA activities were oriented initially to agricultural subjects. Projects for the advancement in other fields followed, and the RCA is now expanding into the medical and biological areas. As can be seen from the results of the Phase I project in Food Irradiation and the NDT project, the RCA has already promoted technology transfer. Given the co-operative spirit and efforts of RCA countries in the Asian and Pacific region, further success can be expected.

Mineral processing

Eleven metallurgists, chemical engineers and other experts from the Philippines, Republic of Korea, India, Malaysia, Pakistan, Thailand, and Papua New Guinea participated in a 16-week course starting on 29 August last year to study the application of nuclear techniques in mineral processing. The course, entitled "on-stream analysis and control of mineral concentrators", was a sub-project of a wider project on the industrial applications of isotope and radiation technology under the Regional Co-operative Agreement for Research, Development and Training related to Nuclear Science and Technology (RCA) for the Asian and Pacific regions.

A trilateral Memorandum of Understanding between Australia, the Philippines, and the IAEA, signed on 24 May 1983, formalized the participation of the three parties in the Minerals Sub-project of the RCA Industrial Project, which is supported by the UNDP. An agreement has also been concluded between the IAEA and Philex Mining Corporation, establishing specific responsibilities for the participation of both parties in the Sub-project. Over a five-year period, the Australian Governement will contribute A$ 655 000 to the Minerals Sub-project of the RCA Industrial Project.

The Sub-project provides training courses in Australia and in the Philippines related to the application of nucleonic techniques to mineral processing operations; the installation of a nucleonic on-stream analysis system and control equipment in a mineral concentrator in the Philippines; studies to improve control of this concentrator; and in-plant training of nucleonic techniques and control.

A part of the 16-week course on on-stream analysis and control of mineral concentrators was completed with a two-week training course at the Australian School of Nuclear Technology, at Lucas Heights, near Sydney. Participants then spent periods at the Australian Mineral Development Laboratories, South Australia; the Commonwealth Scientific and Industrial Organization, Division of Mineral Physics, New South Wales; and the Julius Kruttschnitt Mineral Research Centre of the University of Queensland; and inspected a mineral concentrator in New South Wales. One half of the participants then went to the Philippines for in-depth training in the control of mineral concentration (for three months). This training was supervised by an expert from the Julius Kruttschnitt Centre. The Philippines Atomic Energy Commission is providing training courses related to the application of on-stream analysis to copper mineral slurries. The Philex Mining Corporation will also meet all costs for plant modification, installation, and use of the on-stream analysis system, and co-operate in the training.

The RCA entered into force in 1972, initially for a period of five years, and its validity has been extended twice. As noted in the accompanying article by Mr Kobayashi, activities are co-ordinated through the Secretariat of the IAEA. Parties to the RCA include Australia, Bangladesh, India, Indonesia, Japan, the Republic of Korea, Malaysia, Pakistan, the Philippines, Singapore, Sri Lanka, Thailand, and Vietnam. The UNDP has provided support of US$ 4 255 927; and the financial viability of the project has been enhanced by Australian and Japanese membership of the RCA (in 1977 and 1978 respectively). India became a donor country in 1983 with a contribution of US$ 50 000 to the Project in Basic Science using Research Reactors.

1983 marked the transference of Australia's major contribution from an Isotope Hydrology Sub-project to the new Project on On-stream Analysis.