

International Atomic Energy Agency

SUMMARY REPORT

ELEVENTH MEETING OF REPRESENTATIVES
OF RCA MEMBER STATES

21 SEPTEMBER 1982

VIENNA, AUSTRIA

SUMMARY REPORT

ELEVENTH MEETING OF REPRESENTATIVES OF RCA MEMBER STATES

21 September 1982

Hofburg, Vienna

The 11th Meeting of Representatives of RCA Member States was held on September 21, 1982 in Vienna. A list of participants of the meeting is attached as Appendix 1.

Prof. M. Zifferero, Deputy Director General, Department of Research and Isotopes, IAEA, formally opened the meeting with welcoming remarks and a statement on the major progress of the RCA programme during the past year. His remarks are attached as Appendix 2.

Mr. C. Velez Ocon, Deputy Director General, Department of Technical Cooperation, IAEA, presented a statement on the current status of the UNDP Industrial Project. It is attached as Appendix 3.

Prof. Zifferero called for the election of the Chairman of the meeting and Prof. M. Ghazali, Representative of Malaysia, was nominated and elected Chairman by acclamation.

The tentative agenda for the 11th Meeting of Representatives of RCA Member States was accepted. It was announced by the Chairman that Agenda item V "Other Business" would include (i) the venue of the 5th RCA Working Group Meeting, (ii) the extension of RCA, and (iii) comments or questions on the report of the experts' meeting on "Nuclear Safety Cooperation and Mutual Emergency Assistance". A copy of the agenda is attached as Appendix 4.

Agenda Item I

Report of the Fourth RCA Working Group Meeting
and Celebration of the 10th Anniversary of RCA

The summary report of the Fourth RCA Working Group Meeting, held in Kuala Lumpur from June 17-21, 1982, was presented to the Meeting by the IAEA Secretariat. The major conclusions in the report were explained by the Secretariat. The second phase plan for the Food Irradiation Cooperative Research Project and the change of emphasis in the Cooperative Research Project on Radiation Sterilization were reported on by the respective IAEA Scientific Officers. This report, which was formally submitted by IAEA to the Member States in the past, was accepted to serve as the Report and Recommendations of RCA/11. (Appendix 5).

Regarding the Cooperative Research Project on Food Irradiation, the IAEA Secretariat reminded the participants that the Agreement on this project entered into force on 28 August 1980 and will expire on 27 August 1983. It was recommended by the Secretariat that the possible extension of this Agreement be discussed at the Project Committee meeting, scheduled to take place in Thailand in November 1982.

A report on the Celebration of the 10th Anniversary of RCA, which took place in conjunction with the Fourth RCA Working Group Meeting on June 16, 1982, was presented and briefly explained to the Meeting by the IAEA Secretariat. (Appendix 6).

Agenda Item II

1982 Action Plan and 1983 Cost Projection

The 1982 Action Plan was presented by the Secretariat (Table I in Appendix 5) and accepted by the Representatives.

The cost projection for 1983 was presented by the Secretariat at a level of US\$3,658,317, including the costs for Cooperative Research Projects in the amount of US\$819,000 and for UNDP Industrial Projects in the amount of US\$2,839,317. The cost projection was accepted by the Representatives. It is attached as Appendix 7.

The Representative of India announced that his Government will contribute the sum of US\$50,000 in 1983 specifically to RCA in view of the importance of ongoing research on research reactor utilization and the interest of Member States in this field. He also mentioned that the contribution would be in addition to his Government's voluntary contribution and will be used mainly for the promotion of basic science using research reactors. In this connection, the Representative of India suggested that it may be opportune for the Agency to convene a further meeting on research reactor utilization similar to the meeting on this subject held in Bangkok in 1963. The written statement is attached as Appendix 8.

Prof. Zifferero expressed his appreciation on behalf of IAEA to the Government of India for this special contribution to RCA.

The Representative of Bangladesh pointed out that this special contribution from India comes at a very appropriate time since a research reactor in Bangladesh will be in operation in 1983, and expressed his deep appreciation.

The Area Officer for Asia and the Pacific, IAEA, pointed out the importance of identifying specific fields of research using reactors which would be most beneficial to the Member States in the region. He noted that some of the research reactors now in operation are under-utilized, and recommended that a survey of Member States in the region be made for the purpose of identifying the capacity of existing research reactors and clarifying the potential use of further research reactors before any new projects on research reactor utilization were initiated.

In summing up the discussion, the Chairman noted that there seemed to be agreement that a meeting on research reactor utilization should be held, if possible, in 1984 as suggested by the Representative of India, and that this meeting should be preceded by a survey of Member States on the utilization of research reactors.

Agenda Item III

Project Proposal on "Medical and Biological Applications of Nuclear Techniques"

The IAEA Secretariat presented the revised Project Proposal on "Medical and Biological Applications of Nuclear Techniques" (Appendix 9), which reflects the comments by RCA countries on the original proposal. The comments are summarized in Appendix 10.

The Representative of Thailand expressed his Government's strong support of the proposal.

The Representative of Sri Lanka voiced a question concerning the cooperation of WHO in this project. The IAEA Secretariat stated that support of this project by WHO should be available in terms of expertise, but no financial support can be expected.

The Representative of India commented that the Sub-project on Cancer Therapy contained in the proposal is of international interest, so that this subject should be considered on a global basis.

The Representative of Japan stated that in the proposed project his Government would put emphasis on the sub-projects on nuclear medicine and radiation therapy, and that a workshop on "Radiation Environment and Related Subjects" was held for RCA countries in Tokyo using Japanese funds from August 16 to September 10, 1982.

Agenda Item IV

Contact with the Asian Development Bank (ADB)
concerning financial support of ADB to RCA

The IAEA Secretariat reported on a meeting which took place between IAEA and ADB officials in Manila (Appendix 11), to explore the possibility of ADB's financial support to RCA. IAEA was informed that the ADB grant is extremely limited and destined mainly for preparation of projects which will be funded by soft loans. The proposal on medical and biological applications and food irradiation will be forwarded to ADB for their grant evaluation.

The Representative of Malaysia stated that soft loans of ADB, which are bi-lateral between ADB and individual countries, should be left to the governments and that RCA countries should try to get only ADB grants.

The Representative of Bangladesh pointed out that equipment which is purchased with soft loans can be utilized for RCA projects among participating countries.

The Representative of Australia requested information on the plan for implementing the project on medical and biological applications of nuclear techniques in case of failure to secure outside funding.

In response, the IAEA Secretariat mentioned that Phase I of the project, whose major activities are cooperative research projects, is expected to be funded through the IAEA regular budget, and that Phase II with the major component of training can be carried out under the Agency's technical cooperation programme. Phase III, which will aim at the establishment of a demonstration training centre equipped with LINAC, CT, etc., will only be possible if existing facilities are offered by participating countries to be used for the centre.

Agenda Item V

Other Business

The Representative of Bangladesh again formally conveyed his Government's offer to host the 5th RCA Working Group Meeting in Dhaka in 1983 and the offer was accepted by the Representatives. The exact time of the meeting, probably May or June, will be determined at a later date between the officials of the Government of Bangladesh and the IAEA Secretariat.

The Representative of India conveyed his Government's offer to host the 6th RCA Working Group meeting in Madras in 1984. Final acceptance of the offer will be discussed at RCA/12 in 1983.

The IAEA Secretariat reported that the Second Extension Agreement of RCA for a further five-year period with effect from 12 June 1982 entered into force on 9 June 1982 upon receipt by the Director General of IAEA of the notifications of acceptance from the Governments of Japan, Singapore, and Sri Lanka; subsequently, six further governments party to RCA submitted their notifications of acceptance to IAEA (Appendix 12).

The IAEA Secretariat presented the Agency Experts' Report on Nuclear Safety Cooperation and Mutual Emergency Assistance for the comments and questions of the participants (Appendix 13). No comments and questions were raised.

The draft report on the status of RCA activities which was submitted to the Technical Assistance and Cooperation Committee of the Board of Governors, was presented to the Meeting for information and comments of the participating RCA Member States (Appendix 14). The IAEA Secretariat requested the Representatives to submit their comments and suggestions for changes to the IAEA Secretariat by 6 October 1982 for the next draft.

The Representative of Japan confirmed his Government's position concerning RCA as described in the Summary Report of the 4th RCA Working Group Meeting. He also stated that his Government had not reached a decision concerning the extension of the Agreement for the Food Irradiation Project and would study the future plan. Concerning the availability of Japanese contributions to RCA at an increased level, the Japanese Representative stated that his Government would make every effort to achieve the level of planned contributions but that they were facing an extremely difficult financial situation.

The Eleventh Meeting of Representatives of RCA Member States was adjourned by the Chairman at 13:30 hours, 21 September 1982.

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ELEVENTH MEETING OF RCA REPRESENTATIVES

PARTICIPANTS

<u>NAME</u>	<u>POSITION</u>	<u>OFFICE ADDRESS</u>
<u>AUSTRALIA</u>		
Mr. D.G. Walker	Acting Director	Australian Atomic Energy Commission Research Establishment P.O. Sutherland 2232 N.S.W.
Mr. J.M. Rolland	Alternate to the Resident Representative	Australian Embassy Mattiellistrasse 2-4 1040 Vienna
Mr. R. Newton		Department of Foreign Affairs Canberra
<u>BANGLADESH</u>		
Mr. Anwar Hussein	Chairman	Bangladesh Atomic Energy Commission Dacca
Mr. Mizanul Islam	Head	International Affairs and Technical Assistance Division Bangladesh Atomic Energy Commission Dacca
<u>INDIA</u>		
Mr. R. Ramanna	Director Secretary to the Government of India	Bhabha Atomic Research Centre Trombay, Bombay 400 085
Mr. V.N. Meckoni	Director	Nuclear Safety and Reactor Operations and Maintenance Group Bhabha Atomic Research Centre Trombay, Bombay 400 085
<u>INDONESIA</u>		
Mr. A. Baiquni	Director General	National Atomic Energy Agency P.O. Box 85, Kebayoran Jakarta, Selatan
Mr. P. Suratno	Scientific Attaché	Indonesian Embassy Cottagegasse 49 1190 Vienna

JAPAN

Mr. M. Iwasaki	Director	Nuclear Energy Division Ministry of Foreign Affairs Tokyo
Mr. F. Sakauchi	Director	Research and International Affairs Division Atomic Energy Bureau Science and Technology Agency Tokyo
Mr. N. Oki	First Secretary Alternate to the Resident Representative	Embassy of Japan Argentinierstrasse 21 1040 Vienna
Mr. K. Yamada	Special Staff	Nuclear Energy Affairs Division Ministry of Foreign Affairs Tokyo
Mr. K. Kobayashi	Establishment Director	Takasaki Research Establishment JAERI Takasaki

REPUBLIC OF KOREA

Mr. Jong Hee Cha	President	Korea Advanced Energy Research Institute Seoul
Mr. Joon Keuk Chung	Head	Public Affairs and International Cooperation Office, KAERI Seoul

MALAYSIA

Mr. K. Ghazali	Director	Tun Ismail Atomic Research Centre PUSPATI 4, Jalan 1/4, Bandar Baru Bangi Selangor
Mr. Yusoff Ismail	Counsellor (Scientific)	Embassy of Malaysia Prinz Eugen-Strasse 18 1040 Vienna

PAKISTAN

Not represented

PHILIPPINES

Mr. Zoilo M. Bartolome	Commissioner	Philippine Atomic Energy Commission Manila
Mr. A.E. Refre	Department Head	DNRS Philippine Atomic Energy Commission Manila

SINGAPORE

Not represented

SRI LANKA

Mr. K.G. Dharmawardena	Chairman	Sri Lanka Atomic Energy Authority 5, Elibank Road Colombo 5
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THAILAND

Mr. S.P. Kasemsanta	Secretary General	Office of Atomic Energy for Peace Thanon Vibhavadee Rangsit Bangkhen, Bangkok 9
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Mr. S. Thamagasorn	Industrial Attaché	Embassy of Thailand Peter Jordan-Strasse 8 1190 Vienna
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VIET NAM

Mr. Nguyen Dinh Dien		National Institute of Nuclear Energy 67, Nguyen Du Hanoi
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NEW ZEALAND (OBSERVER GOVERNMENT)

Mr. C.K. Stone	Chairman	New Zealand Atomic Energy Committee c/o DSIR Private Bag, Lower Hutt
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Mr. H. Judd	Resident Representative	Permanent Mission of New Zealand to the International Organizations in Vienna Hollandstrasse 2/XII 1030 Vienna
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IAEA

Mr. P.M. Cate	Mr. D. Nethsinghe
Mr. H. Collins	Mr. M. Nofal
Mr. J. Dargie	Mr. C. O'Neal
Mr. H. Eisenlohr	Mr. B. Payne
Mr. E.E. Fowler	Mr. B. Price
Mr. M. Fried	Mr. C. Velez Ocon
Mr. Ha-Vinh Phuong	Mr. P. Vuister
Ms. T. Iwasaki	Mr. M. Zifferero
Mr. T. Kawai	Mr. S. Machi
Mr. D. Lindquist	
Mr. P. Loaharanu	
Mr. R. Mukherjee	

OPENING SPEECH

Prof. M. Zifferero

The 11th Meeting of Representatives
of RCA Member States

September 21, 1982

Distinguished delegates and guests from RCA Member States, Ladies and Gentlemen.

It is my great honour and pleasure to open the 11th RCA Meeting here in Vienna.

On behalf of the Director General I would like to cordially welcome all the Representatives from the countries party to RCA and observers from countries in Asia and the Pacific.

As an established tradition of the RCA annual meetings, I would like to briefly review the progress of our activities during the past year since we last met in September 1981.

The consolidated budget apportioned to the 1982 RCA Action Plan amounts to ~ 3.1 million dollars which represents 2.7% of the consolidated Agency budget.

The largest share of funds made available to RCA activities is devoted this year to the UNDP project on industrial applications of isotopes and radiation technology that was formally established on 1 April 1982 for a period of five years. Twelve RCA governments are taking part in this regional project, the preparatory phase of which started in August 1980 and for which the total resources are targeted at about 12.5 million dollars.

My colleague, Dr. Velez, will give you additional information on how this most important programme is progressing.

Cooperative research projects were budgeted this year at the level of approximately 500,000 dollars. Funding will come from the Agency's regular budget with an allocation of US\$355,000 and the balance will be contributed by Japan and Australia. I take this opportunity to express once again our gratitude to the Governments of Japan and of Australia for their continuing support and generous contribution, both in cash and in kind, to RCA activities.

It must be underlined that the Agency's allocation has been increased by 25% this year and brought to 11% of the total Agency expenditures for research contracts. This increase has permitted to activate the project on radiation induced mutants in rice which was approved two years ago but kept dormant due to lack of funding. A second new project on the radiotherapy of cancer has now been approved and will be the precursor of a fairly large-scale project on the medical and biological application of nuclear techniques.

Wide support to these new projects on medical application was given by RCA Member Countries at the 4th Working Group Meeting in Kuala Lumpur and comments made at this occasion are reflected in the revised proposal which is now before you for approval.

Funding of these new projects is still the main problem. Some suggestions put forward at Kuala Lumpur have been explored and the outcome will be reported to you during this meeting. While the Secretariat will make every effort to find extra-budgetary resources, a parallel effort should be deployed by participating countries to seek ways to increase their contributions.

Increasing attention is given to the RCA activities by the Agency's Board of Governors. At its request a detailed information document on the progress and achievements of RCA was prepared and is tabled today. It was also requested that, starting from 1983, the Annual Report on the Provision of technical cooperation and assistance should include a separate section on RCA activities. Finally, the expert group on nuclear safety cooperation and mutual emergency assistance in connection with nuclear accidents has prepared its report, a copy of which has been included in your papers for your information. This document is now under consideration at the Board of Governors and a decision is expected on the actions recommended by the experts.

Ladies and Gentlemen, distinguished delegates. The celebration of the 10th Anniversary of RCA which took place in Kuala Lumpur last June, the extension of the Agreement for an additional five years, the attention given by Latin American countries to this new form of scientific and technical cooperation, are different indicators but they all point to the validity and vitality of a concept based on friendship and self-reliance.

Statement

C. Vélez Ocón, Deputy Director General

Department of Technical Cooperation

11th RCA Meeting

21 September 1982, Hofburg

It is my pleasure to inform you of the following important developments in the UNDP Regional Industrial Project:

1. The five-year Project was initiated on 1 April 1982 for a period extending through 31 December 1986.
2. A Project Plan and budget dated 1 April 1982 has been prepared and was officially approved by UNDP and IAEA in early May this year.
The Project Plan incorporates all essential provisions of the Project Document proposal dated 30 June 1981 and which was agreed to by all participating Governments.
The Plan is the management document for the Project and copies have previously been made available to all participating Governments.
3. The Project budget includes planned financial contributions as follows:

UNDP	US\$4,381,516	(35%)
Governments	US\$6,427,457	(52%)
Industry	US\$1,653,440	(13%)
4. An interim UNDP/IAEA Project Office (14 June 1982 - 30 June 1983) became fully operational on 5 July 1982 in Tokyo with Mr. Fowler continuing as Project Director and Chief Technical Advisor through the same interim period ending 30 June 1983. IAEA agreed to the establishment of the interim office based upon the generous offer from the Government of Japan and I wish to take this opportunity to thank the Government for its contribution in helping to establish and carry out the responsibilities of the Office.
5. The IAEA and the Government of Indonesia have now signed a formal agreement to create the permanent Project Office at the Centre for Isotopes and Radiation Applications, BATAN, Indonesia, beginning 1 July 1983. A copy of the Agreement has been made available to Representatives to this meeting.

This action has been taken based upon IAEA's invitation letter dated 18 June 1981 to RCA Governments requesting expressions of interest in hosting

the Office and the Government of Indonesia's formal proposal in response to the invitation.

The IAEA wishes to express its appreciation to the Government of Indonesia in agreeing to host the permanent Office and for the very generous facilities and other accommodations to be made available to the Project Director including administrative-secretarial staff.

6. The Agency is continuing its search for a new Project Director to be appointed effective 1 July 1983. As Governments have earlier been informed we plan to complete our search and to announce IAEA's selection by 31 December 1982. The UNDP's position has been and continues to be the selection of a national from a developing RCA country and IAEA shares this view.

We have informally consulted with most Governments on the appointment over the past year and your opinions have been most welcome and useful to us. During the course of the General Conference I am making special efforts to continue these consultations and to receive further opinion from country delegations as you consider desirable.

7. Upon the specific recommendation of the UNDP a Senior Board of Advisors for the Project has now been established with its first meeting to take place 4-5 November 1982 in Jakarta with the Government of Indonesia serving as host.

Four members of a five member Board, have been formally invited to accept appointment to three year terms. These are:

Professor A.J. Lynch, Director, Julius Kruttschitt Mineral Research Centre
University of Queensland, Australia

Dr. G. Mukherjee, Vice Chairman, Steel Authority of India

Dr. Datuk Ani Arope, Director, Malaysian Rubber Research Institute

Mr. Chamnan Suntornwat, General Manager, The Siam Kraft Paper Company, Thailand.

We expect to complete our action leading to the appointment of a fifth member to the Board at an early date.

The Board will have oversight responsibilities for the Project, including annual review and evaluation of Project direction, progress and financial requirements. As such it will have a high-level management function with responsibilities for recommending to both the IAEA and the UNDP changes in Project direction, priorities as well as financial management and resources requirements. Accordingly, the Board will assume a major role in overall Project management and direction. This function recognizes the specific responsibilities of the Project Director for coordinating and managing day-to-day operations of the Project and its activities. The Project Director will serve as the IAEA/UNDP Representative to the Board and its Secretary.

8. To coincide with the Board meeting the First IAEA/UNDP Industrial Technology Transfer Workshop is scheduled for 1-3 November 1982. The Workshop will be participated in by all officially designated national Project counterparts, selected other Government representatives and industrial persons. IAEA has issued formal invitation letters to Governments for participation in the Workshop along with an identification of topics to be discussed. The purpose of the Workshop is to integrate national counterparts more closely into the Project technology transfer process and to formulate strategies and procedures to be followed. The Workshop will also importantly include inputs from industrial persons who have direct experience in the commercial applications of the technologies selected for transfer under the Project and information is to be provided not only on technical but on the economic aspects as well. We are hopeful that each of the participating Governments in the Project will look seriously upon this First Workshop and the ones to follow as an important part of the process for technology transfer to Regional industries which is the goal and the measure of success of this important Regional undertaking.

11th Meeting of Representatives
of RCA Member States

Tuesday, September 21, 1982

Room 202, Hofburg, Vienna

AGENDA

11:30 - 13:30

Introductory Remarks

Prof. M. Zifferero
Deputy Director General
Head of the Department
of Research and Isotopes

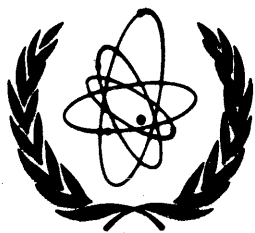
Statement on the
UNDP Industrial Project

Mr. C. Velez-Ocon
Deputy Director General
Head of the Department
of Technical Cooperation

Election of Chairman

Adoption of Agenda

- I. Report on the Fourth RCA Working Group meeting
and Celebration of the 10th Anniversary of RCA
- II. 1982 Action Plan and 1983 Cost Projection
- III. Project Proposal on "Medical and Biological
Applications of Nuclear Techniques"
- IV. Contact with the Asian Development Bank concerning
financial support of ADB to RCA
- V. Other Business



International Atomic Energy Agency

CELEBRATION OF THE 10TH ANNIVERSARY OF RCA

REPORT

KUALA LUMPUR, MALAYSIA

JUNE 16, 1982

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CELEBRATION OF THE 10TH ANNIVERSARY OF RCA

KUALA LUMPUR, MALAYSIA

June 16, 1982

PROGRAMME

09:00 - 10:30	Opening Remarks	Prof. M. Zifferero Deputy Director General Department of Research and Isotopes International Atomic Energy Agency
	Welcoming Remarks	Dato' Amar Stephen K.T. Yong Minister of Science, Technology and the Environment, Malaysia
10:30 - 12:30	Invited Lecture "Japanese Experience in Nuclear Science and Technology"	Prof. T. Mukaibo Acting Chairman Atomic Energy Commission of Japan
	Invited Lecture "Application of Nuclear Technology for Development - The Australian Atomic Energy Commission Experience"	Dr. D.G. Walker Acting Director Australian Atomic Energy Commission Research Establishment
	Invited Lecture "Developments in Nuclear Science and Technology in India"	Dr. R. Ramanna Director, Bhabha Atomic Research Centre, Secretary to the Government of India
	Invited Lecture "Development of Nuclear Science in Malaysia"	Prof. M. Ghazali bin Hj. Abdul Rahman Director, PUSPATI
13:30 - 16:00	Panel Discussion	Chairman: Prof. H. Kakihana
	"Development of Nuclear Energy Application and International Cooperation in Asia and the Pacific"	

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10th. Anniversary of RCA Opening remarks
by M. Zifferero, IAEA

Mr. Minister, distinguished representatives and guests of RCA
Member States, Ladies and Gentlemen:

I am indeed honoured and pleased to open, on behalf of IAEA's Director General, this celebration of the 10th Anniversary of the establishment of the Regional Cooperative Agreement for Research, Development and Training related to Nuclear Science and Technology for the Asian and the Pacific Region.

Under the terms of this Agreement, which came into force almost exactly 10 years ago, and which was recently extended for additional five years participating countries aim to promote and coordinate research, development and training projects in the nuclear field through an effective collaboration between Relevant National Institutions of the region. The role of the International Atomic Energy Agency is to provide, when needed, organizational, administrative, advisory, technical and financial assistance.

The RCA's approach to the complex problem of promoting adequate technical cooperation and achieving an effective technology transfer is the result of an evolutionary process which deserves, I believe, a short description.

When, in the late fifties, the IAEA started its technical assistance programme this consisted mainly of small scale projects in individual countries aimed at developing a particular technology or training a particular group of national staff in nuclear techniques. At that time nuclear technologies were available only in the most advanced countries, since only these countries could sustain the economic burden of the preliminary research and only in these countries sufficiently developed scientific and industrial infrastructure were available.

During this early period, which extended through the sixties, the Agency's role can be described as a "selective dissemination" of assistance, acknowledging the fact that its resources were far too limited to permit a comprehensive build-up of nuclear technologies in all of its developing Member States.

It was only in the early seventies that a gradual shift was possible from an exclusively vertical transfer of assistance towards a strategy which combined vertical with horizontal modes. At that time it was recognized that while vertical transfer was still essential in certain technologies, much benefit could be gained by promoting mutual self-assistance and cooperation. This approach became known in the UN system under the popular acronym of TCDC (Technical Cooperation between Developing Countries).

This new philosophy brought along, by natural development, the concept of regional projects involving input from countries of a given geographical area. In general terms the agricultural, industrial and health problems experienced in a developing area tend to be similar. For instance, agriculture in some Asian regions is largely labor intensive, with rice as the basic diet, and with climate and cultural practices similar throughout the region. It is logical to assume that many agriculture related problems are not country specific but affect the entire region.

It therefore makes sense to pool available resources and work together on common problems whose solution would have a collective benefit.

It was in effect the recognition of the potential advantages of mutual cooperation by the countries in the region, as well as by the Agency, that led to the formulation, ten years ago, of the Regional Cooperative Agreement for Asia and the Pacific Region.

If we look back at the past ten years we are impressed by the acceleration in the number of projects, progressively brought within the frame of the Agreement. Since 1975, when the first project on food irradiation was started, activities have been gradually and continuously expanding and today a total of nine regional projects, including a large UNDP project, are under way.

The cover such diversified areas as food preservation, animal production, mutation breeding, radiation sterilization of medical supplies, nuclear instruments maintenance, hydrology and sedimentology,

environmental research and, under a large UNDP project, a number of industrial applications of isotope and radiation technology.

Parallel with the expansion of RCA activities, the number of scientists and technicians of RCA Member States involved in the different projects has grown from a few tens to several hundreds. With the initiation of the UNDP industrial project, the official budget for the 1982 RCA programme amounts to USS 3.1 million, but if full account is taken of the resources (in manpower and investments) that participating countries contribute to the ongoing coordinated research programmes, a more realistic figure of 6-7 million dollars per year can be safely assumed.

This means that, to date, the cost of RCA projects have been largely met by the contributions of the participating countries. In this connection I would like to underline the assistance made available to the programme by means of funds, equipment, facilities and experts by two parties to the Agreement, Australia and Japan. In acknowledging this valuable support we express the hope that it will be continued and, if possible, further extended.

The future development and the possibility of expanding the roster of activities under the Regional Cooperative Agreement will be debated this afternoon in a special Panel discussion.

Mister Minister, Ladies and Gentlemen. In concluding I would like to point out that RCA started as an experiment for the countries in the region as well as for the Agency. The experience of ten years has shown its potential as a vehicle for furthering cooperation and mutual assistance in scientific, technical and industrial development, for promoting and effective technology transfer and for increasing national self-reliance.

Recognizing the economic and social significance of this undertaking the IAEA, upon the request of a number of countries in Latin America, is now considering the establishment of a second regional agreement patterned after RCA. For this purpose current RCA projects in this part of the world will be visited this summer by a group of leading Latin American experts coming from Bolivia, Columbia, Equador Peru and Venezuela. This is certainly convincing evidence of our and your success, as well as a favourable omen for the future on international cooperation.

10th. Anniversary of RCA Opening Remarks
by the Honourable Minister of Science,
Technology and the Environment
Dato' Amar Stephen K.T. Yong

Y.B. Prof. M. Zifferero,
Deputy Director General,
Department of Research and Isotopes
of the International,
Atomic Energy Agency (IAEA);

Your Excellencies;

Y.B. Tan Sri - Tan Sri, Datuk-Datuk;

Y.B. Dato' Wan Sidek bin Hj. Wan Abd. Rahman,
Ketua Setiausaha,
Kementerian Sains, Teknologi dan Alam Sekitar,

Y.B. Datuk Prof. Mohd. Ghazali
bin Hj. Abd. Rahman,
Pengarah PUSPATI;

Distinguished Participants;

Ladies and Gentlemen:

I am very pleased to be here with you this morning, and to be given the honour of addressing you at the official opening of the 4th RCA Working Group Meeting. It is indeed an honour for Malaysia to host this meeting which coincides with the 10th RCA Anniversary celebration. It, therefore, gives me great pleasure, this morning, on behalf of the Malaysian Government to extend a very warm welcome to all the delegates and distinguished guests present.

Ladies and Gentlemen,

In Malaysia concerted efforts in the use of nuclear science and technology for national development can be said to have started in 1972. This was when the government made the decision to set up PUSPATI (Tun Ismail Atomic Research Centre) in 1972. Happily though this was the year in which the Regional Cooperative Agreement (RCA) under the auspices of IAEA was established.

The RCA, as I am aware, is to primarily encourage and foster research, development and training in nuclear science and technology to meet some socio-economic needs of national development effort. Since then, the development of nuclear science and technology in Malaysia and the growth of activities of RCA seem to have gone on parallel tracks.

Based upon the needs of the Malaysian development the highest priority during the first five years of our involvement with the Regional Cooperative Agreement had been in the areas of activity which were closely tied up to the needs of Malaysian socio-economic development. And these are generally the areas of development of manpower in nuclear science and medical use of radioisotopes as well as in the applications of Nuclear Science in food and agriculture. While these areas continue to receive strong emphasis, Malaysia together with the other member countries recognised that research programmes should also be developed and be directed more towards industrial problems of the countries. This is particularly important as most of the member countries of RCA are currently preoccupied, in one way or other, with industrial development. It is therefore relevant that we in Malaysia, despite being new in the field of nuclear science and technology, have already several on-going regional cooperative projects in the fields of grain legume improvement, food irradiation, buffalo production improvement, environmental research, instrument maintenance, hydrology and industrial applications of isotopes and radiation technology. These projects, now being carried out at various Universities and Research Institutions in Malaysia are progressing at a commendable rate.

Ladies and Gentlemen,

On this auspicious occasion of the 10th RCA Anniversary, I'm most happy to announce that, for Malaysia, this year's most significant achievement in the field of nuclear technology is to be the commissioning of our Reactor Triga Mark II at Tun Ismail Atomic Research Centre (PUSPATI) in July this year. This reactor will be

fully utilized for research in nuclear science and technology, as well as for providing services on instrumentation maintenance to other institutions in this country. It is hoped that with the setting up of the Isotope Department in PUSPATI, it will provide continuous and at the same time inexpensive supply of radioisotopes for medical and research applications.

Ladies and Gentlemen,

In our endeavour to industrialise, through the application of nuclear science and technology, we should not lose sight of the problems that it might have on the environment. The most immediate of these problems is the question of disposal of radioactive wastes. At present, in Malaysia, all users of radioactive substances are individually responsible for the handling and disposal of their own radioactive wastes. Besides the decay process, no other treatment is currently being applied. There is therefore the urgent need to establish a national waste treatment centre in Malaysia. In this connection, I'm happy to announce that PUSPATI has been given the responsibility for the waste treatment and disposal of all the radioactive wastes in the country.

Ladies and Gentlemen,

In our efforts to accelerate the development process, Malaysia like most other developing countries, faces the twin problems of availability of financial resources and adequate scientific and technical manpower. The availability of sufficiently trained manpower is also significant in terms of sustaining the application of nuclear techniques in these countries.

My Ministry through PUSPATI and other related agencies has spent the whole of the latter half of the 1970's and early 1980's in undertaking numerous programmes and projects to increase the number of scientists, engineers, doctors and skilled technicians in the fields of nuclear science and technology. I recognise, this is not an easy task to be achieved. The International Atomic Energy Agency, of course, has always been a constant source of aids, and the assistance we have been receiving from the IAEA is very significant. Malaysia has also

received further assistance from almost all the RCA countries in this particular fields of endeavour.

In order to overcome the problem of shortage of manpower we would like to propose that RCA should put more emphasis on training. Training is a catalyst to the upgrading of involvement and commitment.

In this connection, it is perhaps worth-while for RCA to do a through and critical evaluation of the training needs of all the member countries which are of developing status and then formulating and implementing the programme that would fit all the shortcomings. In this way we would be able to build up this cooperation on a firmer basis than it has been.

I believe that, it is the desire of all the RCA countries to see that through the successive and successful implementation of their various plans and programmes they could eventually realise the full potentials of regional collaboration and cooperation and become self-reliant in the field of nuclear science and technology. This objective will only be achieved when there is adequate financial resources as well as sufficient scientific and technical manpower to meet the challenge of nuclear science and technology development.

Ladies and Gentlemen,

In closing, I wish to remind you of the background against which RCA was established and this was on the assumption that there was a need for a major commitment to the peaceful promotion of nuclear science and technology for the betterment of our people. It is my sincere belief that participants will leave this meeting with the feeling of reaffirmed confidence in that commitment.

It is with great pleasure that I now declare this Fourth RCA Working Group Meeting officially opened.

Thank you.

JAPANESE EXPERIENCE IN NUCLEAR SCIENCE
AND TECHNOLOGY*

By Prof. Takashi Mukaibo
Acting Chairman,
Atomic Energy Commission
of Japan

Mr. Chairman,
Distinguished Delegates,
Ladies and Gentlemen;

It gives me a great pleasure and honour to take this opportunity of offering my sincerest words of congratulations to Mr. MAURIZIO ZIFFERERO, Deputy Director General of the IAEA, and all those gentlemen who have helped to organize this successful ceremony. Especially on this memorable occasion, I would like to pay my great respect to H.E. Mr. DATUK AMAR STEPHEN YONG, Minister of Science, Technology and Environment, and other distinguished personnel of Malaysia which plays host to this special meeting commemorating the 10th anniversary of RCA cooperation.

Indeed, I take it a great honour for me to be given this opportunity of not only taking part in this memorable occasion, but also making a speech in the presence of such a distinguished audience.

For the development of the world economy and for the betterment of the welfare of mankind, it is essential to secure stable supply of energy at a reasonable cost. This

* Delivered at the special meeting commemorating the 10th anniversary of IAEA/RCA held in Kuala Lumpur on 16 June 1982.

in fact is a critical problem common to all nations in the world not only today, but also over a long future.

Ever since the oil crisis which hit the world economy twice in 1973 and 1978, strenuous efforts have been devoted not only for energy saving but also for the development of other energy source including effective utilization of coal, solar energy, biomass energy and others. Among others, utilization of nuclear energy has attracted strong expectations. For such a country as Japan which is poor in energy resources, the importance of nuclear energy is undoubtedly great.

Our country started the development and uses of nuclear energy for peaceful purposes in the middle of the 1950s, approximately the same time as the birth of the IAEA. Today the size of nuclear power in Japan comprises 24 commercial power plants with about 17,180 MW which represents approximately 17% of the total generated electric power in Japan. Efforts are being made to expand our country's future nuclear power stations to the level of 46,000 MW in 1990 and 90,000 MW in 2000, which are expected to represent 30% and 40% respectively of the nation's generated electric power. It is, therefore, considered necessary to make stepped-up efforts for further development of nuclear energy to let it play the role of a central figure as a substitute for oil, from both the quantitative and economic viewpoints.

Furthermore, uses of radiation and isotopes are also important for the development of our economic society and promotion of health. In our country, these are extensively

used in industries and irradiated potatoes are available in the market nowadays. They are also rapidly finding their way in the field of medical treatment recently.

History of Nuclear Energy Development in Japan

Here, I should like to look back on the history of nuclear energy development in Japan:

For a while, since the end of World War II, all research activities related to nuclear energy were prohibited in Japan. In 1953, President Eisenhower made his famous speech at the UN General Assembly calling for international cooperation for peaceful uses of atomic energy for the benefit of mankind. This is the famous speech of "Atoms for Peace". In 1955, negotiations for atomic energy research cooperation between Japan and the USA were started and the cooperation agreement was concluded in 1956.

Based upon this agreement Japan began immediately the research and the development for peaceful uses of nuclear energy with the cooperation of the US, starting with the supply of information. The domestic system for the development of nuclear energy was also constituted. A special law by the name of "Atomic Energy Basic Law" was enacted incorporating the basic policy to limit uses of nuclear energy strictly for peaceful purposes. Subsequently, the Japan Atomic Energy Commission was set up to plan and determine policies for research, development and uses of nuclear energy. The Japan Atomic

Energy Research Institute (JAERI) acts as the centre of atomic energy research in Japan and the National Institute of Radiological Sciences (NIRS) and other institutes were established as well. The Japan Atomic Industrial Forum (JAIF) was organized by the private sector for the cooperation among industries and other businesses. In major universities, laboratories and courses were gradually established for the progress of related basic sciences and for increasing manpower in the field.

Since that time, our country, which had to make a late start compared with the advanced countries of Europe and North America - advanced in the nuclear energy technology, made an all-out effort to catch up with those countries in this field by spending intensively the available funds and manpower into the nuclear research and development system.

In order to facilitate the smooth flow of information as well as the supply of nuclear fuel and the related equipment and materials from countries advanced in the nuclear technology, agreements for cooperation including uses of nuclear energy for power were concluded with the US and UK in 1958.

In the field of uses of radiation or radioisotopes, an experimental station was set up in 1960 for agricultural researches such as breeding, and in 1963, a big radiation facility was built in Takasaki by the Japan Atomic Energy Research

Institute (JAERI). The domestic production of radioisotopes was also initiated by using an experimental reactor in JAERI.

The second decade of our nuclear energy development was the period when efforts were directed to develop uses of nuclear energy for the generation of electricity. The positive introduction of power reactors from abroad was carried out first, and then the digestion, assimilation and improvement of imported technologies were made to increase the proportion of the share of domestically manufactured reactors as much as possible. However, in order to ensure the radiation safety, the government and industries had to pay tremendous efforts for the stringent safety control as well as an enormous amount of investment for the research works for ensuring safety.

Along these efforts and development, we began to establish our own nuclear fuel cycle, and large scale projects for development of such types of reactors as best suited to our nation's energy resources situation were started one after another. Along this line, the Power Reactor and Nuclear Fuel Development Corporation (PNC) was established in 1967 to assume the role of a central organ for uranium exploration, uranium ore processing, nuclear fuels fabrication as well as for developing advanced thermal and fast breeder reactors for the effective use of uranium. The PNC also positively engaged itself in the development of a centrifugal separation process, a technology for uranium enrichment, and the reprocessing of spent fuel.

Following the progress of the development and uses of nuclear energy, there loomed up serious social issues centering on the nuclear safety. Such troubles as the occurrence of cracks in piping of LWR caused mainly by stress corrosion aroused a lot of controversies centering around the safety of nuclear power plants. This has constituted a major factor for the subsequently arising opposition movements against siting of new nuclear power plants. On the other hand we judged that many projects on nuclear energy in Japan had reached the stage where we could move on to the more advanced level of practical use.

Our experimental fast breeder reactor "JOYO" with thermal output of 75 MW reached criticality in 1977, and the advanced prototype thermal reactor "FUGEN" with electrical output of 165 MW became critical in 1978. Both of them have been in successful operation. Similarly, a uranium enrichment pilot plant run by the centrifugal process and developed by our own technology, went into operation in 1977. Our reprocessing facility at Tokai, the technology of which was mainly introduced from France, has also been in operation since 1977. The second and larger reprocessing plant is in the process of designing. In addition, in the field of nuclear fusion, a TOKAMAK type machine called JT-60 is under construction. Also researches of nuclear fusion using the inertia confinement and other types of facilities are also being developed in the universities. Uses of radiation are being

developed in extensive areas; especially in the medical sector its application is in progress at an accelerated pace.

In 1978, in order to enhance the confidence of people in the system of ensuring safety of nuclear facilities, the function of safety regulation was separated and made independent from that of the Atomic Energy Commission, and a Nuclear Safety Commission was newly established for it. At the same time, a system of public hearing was formally set up in order to reflect the voices of the local people in the neighbourhood of nuclear power plant sites.

Now, ladies and gentlemen, I would like to introduce some of the events related to basic research field. As facilities and equipment are very expensive even in the basic fields of nuclear energy, the Government has set up special systems for the university researches. One is the system to make available the facilities of JAERI for university professors supported by a special fund. The other is the establishment of a research centre for universities other than JAERI in the western part of Japan, which is operated by a national university and used jointly by all university researchers in Japan. Those systems worked successfully in promoting the activity of universities in the field.

Foregoings are some of the salient events of which I am reminiscent in the history of Japan's nuclear energy development.

Speaking of our country's future direction in this field, our Atomic Energy Commission has already been working more than one year on the formulation of a new long-term programme, which will be finalized soon. According to the draft of the programme, the following three directions are indicated:

- (i) Further stepping-up of use of atomic power as the source of stable and low-cost energy which is to be supported by the establishment of nuclear fuel cycle including the appropriate treatment and disposal of radioactive wastes.
- (ii) Further promotion of technologies which have been developed and approaching the commercial stage such as those on advanced reactors, uranium enrichment and reprocessing.
- (iii) positive international cooperation benefiting both sides and aiming at the development of peaceful uses of nuclear energy compatible with the nuclear non-proliferation.

It is my pleasure to inform you, ladies and gentlemen, that along the line of the above mentioned basic policy, our country intends to offer positive cooperation with respect to the RCA projects, hoping that the projects will be expanded and strengthened in both scale and contents so that they can further contribute to the development of peaceful uses of nuclear energy in RCA member countries.

Thank you very much for your attention.

APPLICATION OF NUCLEAR TECHNOLOGY FOR DEVELOPMENT

"THE AUSTRALIAN ATOMIC ENERGY COMMISSION EXPERIENCE"

DR. D.G. WALKER, ACTING DIRECTOR,
AAEC RESEARCH ESTABLISHMENT

Thank you, Mr. Chairman,

Introduction

On this occasion of the 10th Anniversary of the Regional Cooperative Agreement, an agreement concerned primarily with the application of nuclear technology for developmental purposes, it is opportune to review the experience of a particular national authority concerned with nuclear technology transfer, both nationally and internationally.

The Australian Atomic Energy Commission (AAEC) is a statutory authority established by an Act of the Australian Parliament. Broadly speaking, it functions as the technical agency of the Government in matters associated with nuclear science and technology.

When founded in 1953, the Commission's primary task was to promote the rapid development of Australia's known uranium resources, and to foster new discoveries. Despite the priority that uranium production demanded, early consideration was given to the establishment of a nuclear research laboratory, and in October 1955 site clearing of an area of 70 hectares began at Lucas Heights, some 30 km south of Sydney in the State of New South Wales.

To acquire a trained and competent staff quickly, the AAEC relied heavily on overseas training. In the years before usable research facilities existed at Lucas Heights, an agreement was concluded with the United Kingdom Atomic Energy Authority through which some 50 professional officers, recruited by the AAEC, were attached for training to the AERE, Harwell. On their return to Australia, these staff provided the nucleus for the build-up of research divisions. Regular 'state-of-art' oversea visits allow AAEC staff to keep abreast of recent developments in their particular field. Providing staff with overseas experience has continued to be a feature of the AAEC's policy.

Although a broad spectrum of nuclear research has always been maintained, for many years research program priority was accorded to nuclear power reactor development. At first the aim was to develop a small reactor system suitable for remote locations, but later the objective became large systems for integrated electric distribution systems. By the mid 1960's, in the face of rapid commercialisation of nuclear power overseas, the focus changed from indigenous reactor development to that of establishing the basis for introduction and regulation of overseas designs in Australia.

The AAEC became the lead agency in a Commonwealth Government proposal to build a nuclear power station at Jervis Bay on the south coast of the State of New South Wales. However in the early 1970's it became evident that a combination of factors,

such as Australia's favourable position as regards coal resources and their distribution, new oil and gas discoveries, and the rapidly escalating costs of nuclear power stations, would delay the introduction of nuclear power to the country for the next decade or two.

Since that time, the effort devoted to power reactors in the AAEC's research program has declined and the emphasis has changed to generic safety issues. At the same time, work related to the fuel cycle has increased in parallel with the discovery and later exploitation of Australia's large uranium deposits.

Approximately 12 months ago, the Australian Government decided that part of the AAEC's staff and resources at Lucas Heights would be transferred to its sister organisation, the Commonwealth Scientific and Industrial Research Organisation (CSIRO), to carry out non-nuclear energy research. Both AAEC and CSIRO will be co-located at the Lucas Heights Research Laboratories.

The restructured AAEC will continue to work on nuclear science and technology. Priority is accorded to research in a broad spectrum of nuclear matters, particularly in relation to uranium mining, extraction and enrichment; environmental science especially as related to the uranium industry; radioactive waste management; nuclear science including nuclear physics and materials science; applications of radioisotopes and radiation; nuclear techniques for industry, medicine and research; nuclear fission technology principally in support of the operation of the high flux nuclear reactor HIFAR; and nuclear fusion.

The provision of products and services will also be continued as a major activity. As early as 1956, the AAEC established an advisory service for radioisotopes and commenced production and distribution of appropriate materials as soon as HIFAR reached a sufficient power level.

For some years, production was geared primarily to industrial applications but the upsurge in interest in in-vivo diagnostic medical use of radioisotopes in the late 1960's initiated a major expansion in their production. Coupled with this expansion in isotope production has been an expansion of the AAEC's radioisotope and radiation consulting activities, and the supporting research effort. Transfer of technology to government institutions and private companies is carried out through the application of new techniques and knowledge in specific areas. These will be discussed in more detail later.

Firstly, I will discuss technological transfer at the national level through joint enterprises, then the provision of products and services in radioisotopes and radiation. Finally, I will outline our interaction in the international arena through bilateral and multilateral associations.

NUCLEAR TECHNOLOGY AT THE NATIONAL LEVEL

Joint Enterprises

The AAEC was instrumental in establishing two joint enterprises to facilitate national research and training using the unique facilities at Lucas Heights. These are the Australian Institute of Nuclear Science and Engineering (AINSE) and the Australian School of Nuclear Technology (ASNT).

Australian Institute of Nuclear Science and Engineering

In deciding to set up a nuclear research establishment, the Australian Government was concerned to ensure that the benefits of the peaceful atom would be available to Australia. A corollary of this policy was the need to provide access for the scientific community to the unique technological facilities at Lucas Heights. To achieve this aim, the AAEC took the lead in founding the Australian Institute of Nuclear Science and Engineering (AINSE) in 1958 as a collaborative venture with the Australian universities. From the earliest days, therefore, the AAEC recognised the Research Establishment's role as a national facility and a major provision has been made to support research activities which fall beyond the boundaries of the AAEC's own programs.

The major objectives of AINSE are to ensure that universities and similar organisations have direct access to the special facilities (nuclear reactors, accelerators etc) at Lucas Heights and to encourage their active cooperation in nuclear research and training.

The Institute has its administrative headquarters at Lucas Heights and is managed by a small permanent staff supported by professional and technical staff working in scientific areas of special interest, for example, neutron scattering. Institute funds come from annual subscriptions from each of the 17 member Australian universities and from grants by the Australian Government donated through the AAEC. Recently CSIRO has joined AINSE as a consequence of their co-location with the AAEC at Lucas Heights.

AINSE activities include the award of studentships, fellowships and grants, organisation of conferences, provision of staff, services and equipment at Lucas Heights and organisation of operations involving cooperation between people from academic institutions and scientists and engineers at Lucas Heights.

AINSE-supported research activity covers a wide variety of fields including radiation biology, plasma physics, nuclear physics applications, materials research, radiation chemistry, engineering research and the use of techniques such as neutron diffraction in areas of biology, geology, physics and chemistry.

Independent reviews have highlighted AINSE as an outstandingly successful example of the way in which a large government scientific facility can be efficiently shared under a well-organised system permitting access and assistance with the maximum of self-help and independence.

The second joint venture is the Australian School of Nuclear Technology.

Australian School of Nuclear Technology

In 1964, the Australian Atomic Energy Commission and the University of New South Wales cooperated to establish the Australian School of Nuclear Technology, located at Lucas Heights. The School was created primarily to help meet the need for additional facilities for instruction in nuclear science and technology.

The Principal of the School is responsible for course development and controls its day-to-day activities. A small number of

permanent staff are supplemented by additional lecturing staff drawn from the Universities, from CSIRO, from New South Wales State Health Commission, hospitals, private companies and the AAEC.

Courses, normally of four weeks duration, are offered in various phases of nuclear science such as Radioisotope Courses for University Graduates and Non-graduates, Radionuclides in Medicine, Radiation Protection, Nuclear Technology and a future course is planned on Industrial Applications of Radioisotopes.

Each course is restricted to 20 participants. The courses do not lead to the award of a degree or diploma, but the successful participants are awarded a course certificate. In relevant cases, however, students attending courses at universities may obtain credit for successful attendance at a course by application through the normal university channels.

Participants from 31 different countries have attended these courses. A number of the overseas participants have been sponsored by the Colombo Plan or the Special Commonwealth African Assistance Plan. In certain instances, the overseas sponsoring governments have funded their own nationals. The School is thus an active participant in Australia's overseas aid program.

Subsequent to completing courses at the School, a number of the overseas participants are attached to Australian organisations such as the universities, the CSIRO, the AAEC and various hospitals.

I wish now to discuss the AAEC's involvement in the field of radioisotopes and radiation.

Radioisotopes & Radiation

The most obvious example of a successful transfer of nuclear technology in Australia is through the application of radioisotopes and radiation in research, industry and medicine.

The broad and unique subject coverage and concentration of facilities and expertise has resulted in the AAEC's Research Establishment becoming, in effect, a national centre for radioisotopes and radiation research and applications. It works or advises on problems which involve the supply, application and safe handling of radioisotopes and radiation for the benefit of the nation's science, industry and medicine. Regulatory aspects are the responsibility of Commonwealth and State Departments of Health.

Commercial/Advisory Services

The AAEC is involved in a number of commercial and advisory enterprises concerned with the use of radioisotopes and their applications. It produces radioisotopes and labelled compounds for industry and medicine.

Production, Sales & Distribution of Radioisotopes

The value of radioisotopes sold by the AAEC exceeds \$2 million annually, primarily in-vivo diagnostic products based on Technetium 99m. In recent years, emphasis has been placed on reducing costs and raising production and distribution efficiencies. Improvements have been made in the techniques used for irradiation of target materials in the HIFAR reactor, more efficient and larger capacity production plant has been installed, new products (including an improved technetium generator) have been developed and the range of radiopharmaceuticals offered to hospitals and medical centres has been increased to include a comprehensive range of in-vitro

radioimmunoassay products. Part of the radioisotope service offered is based on the importation of radioisotopes, for example, cyclotron-produced materials.

Radiation Advisory Service

Technical advice is provided to industry, universities and research institutes, public health authorities, State and Federal Government departments and members of the public on various aspects of radiation technology. Some topics covered are decontamination and sterilisation of liquid and solid wastes; veterinary products and animal feed; medical items including enzymes, ophthalmic preparations and vaccines; industrial products such as adhesives, plastics and paper disposables; food items, for example, fruit and vegetables, poultry and milk; and other applications including the radiation stability of materials, radiation cross-linking of polymers, polymerisation of monomers, and grafting onto a variety of substrates.

Radiation Sterilisation of Medical Products

In many countries, including Australia, pharmaceutical companies, therapeutic goods manufacturers and plastic industries use large-scale radiation facilities for sterilising some of their products. As generally practised, sterilisation involves exposing goods to radiation for the time required to ensure that all types of products receive identical doses, the minimum dose being specified in national regulations.

Radiation sterilisation doses of 25 kilogray (minimum) are used routinely by the two Australian commercial radiation facilities.

For some years, the AAEC has been investigating the validity of this dose for locally manufactured medical products.

Radiosotope Consultancy Service

As mentioned earlier, in 1975, the AAEC re-established its advisory and consulting service on the use and the applications of radioisotopes which had been discontinued in the mid-1960's. The main demands on the service are concerned with problems associated with the dispersion studies of water, solutes and sediments in rivers, estuaries and oceans, leak testing and wear testing.

For example, silt movement in Moreton Bay, Queensland, is being studied to determine the efficiency of the present dredged spoil dumping ground in retaining silt. In the Barron River Delta north of Cairns, Queensland, the movement of both off-shore and on-shore sand is being studied to examine the possible influence of sand dredging in the Barron River on the stability of the adjacent beaches.

Another application is the study of the dispersion of sewage. Some Sydney beaches are claimed to be polluted by the sewage solids released from ocean-based treatment works. Sewage solids have been labelled with gold-198 and their behaviour monitored to determine whether any specific fraction of the sewage treatment program gives rise to beach pollution. Such information will allow the treatment procedures to be modified.

One rather unusual application has been to termite tracing and eradication. Termites cause considerable damage in Australia.

In New South Wales alone they are responsible for some \$A20 million of damage annually. The AAEC has developed a radioisotope method for tracing these subterranean insects which are difficult to follow by any other means. The extent of a colony can be determined with minimal disturbance and valuable information can be gained on the social behaviour of termites in their natural environment.

The AAEC work has been extended from radioisotope tracing to the development of a technique for termite eradication. This technique can be utilised in the different climatic areas of Australia, for example, the Northern Territory and New South Wales. Patents have been granted in Australia and are pending in other countries.

I now turn to the AAEC's involvement in nuclear technology at the international level.

It is essential, given the inherent limits on scientific research in Australia, for Australian scientists to have access to the world's scientific effort. Bilateral and multilateral associations with countries facilitates an interchange of technical expertise and provides access to sources of international thinking on the peaceful uses of atomic energy.

Bilateral Associations

International associations are significant in at least two areas. Collaborative effort can compliment scientific research in specific areas and can also be used by more developed countries to assist less developed countries. I shall use two examples of bilateral associations to illustrate these two areas.

The first concerns a US Nuclear Regulatory Commission contract awarded to AAEC. The AAEC has entered into a three-year contract with the US Nuclear Regulatory Commission (NRC) to undertake a systematic study of the migration of uranium, thorium, protactinium and radium in the vicinity of major uranium orebodies in the Northern Territory of Australia. The program is designed to contribute to the US Department of Energy's research into the long-term storage of radioactive waste. Geo-chemical analogues will be used to study the possible effects of geological time on the nature of the adsorption process of soils. The study will provide basic knowledge for application in international programs for development of waste disposal facilities.

The second example is the AAEC-PUSPATI collaboration program. During 1979, the AAEC entered into an arrangement with the Australian Development Assistance Bureau to provide training over a period of two years for officers of the Tun Ismail Atomic Research Centre. This training complements training undertaken by Malaysian scientists and technicians in the UK, Japan, West Germany and the USA. Over the two-year training period, a total of 35 scientific and technical officers have been trained in varying periods up to 12 months each.

Training included environmental monitoring, health physics, nuclear research, aspects of engineering design, workshop practices, site services, maintenance and security, isotope production and quality control and applications. Trainees also attended a variety of courses conducted by the Australian School of Nuclear Technology and, where relevant, visited other laboratories and organisation in Australia for additional experience.

In August 1981, the Australian and Malaysian Governments entered into a Memorandum of Understanding whereby a consultancy was set up under which advice would be provided to the Malaysian Authorities by the AAEC in such areas as the construction and commission of buildings and associated services, the planning and introduction of essential site services, including health and safety procedures, waste management and environmental monitoring; the production of radioisotopes and radiopharmaceuticals; and the development of research programs. This consultancy is now well under way.

The provision of this assistance is consistent with Australia's policy of cooperation with countries which share Australia's aim in giving the strongest possible support for the Nuclear Non-Proliferation Treaty and for international safeguards.

Finally, I wish to briefly describe the AAEC's involvement in multilateral associations.

The AAEC has an ongoing close association with international organisations, in particular the International Atomic Energy Agency and OECD-Nuclear Energy Agency. Collaboration with these organisations complements the many bilateral international associations and facilitates investigations in areas of common concern.

The AAEC interacts with these Agencies both as an operator of nuclear plant and as an organisation concerned with research and development in nuclear science and technology.

The AAEC is actively involved in IAEA priority programs which are concerned with technical assistance, safeguards and nuclear safety.

An example of technical assistance is Australia's participation in the IAEA Regional Cooperative Agreement. This form of regional collaboration is an important means of transferring technology. As with its bilateral associations, the AAEC has tended to concentrate its efforts on specific projects of short term. The AAEC was instrumental in the development of two significant RCA programs on the use of isotopes in the study of hydrology and sedimentology and in the study of on-stream analysis and control of mineral concentrations.

I will outline briefly the background and work program of these two major RCA programs:

Isotope Hydrology and Sedimentology Project

In announcing Australia's accession to the IAEA Regional Cooperative Agreement, the Australian Minister for Foreign Affairs in 1977 pledged an annual contribution of \$100,000. To-date this money has been almost entirely committed to the Australian-initiated project on Isotope Hydrology and Sedimentology.

The specific aim of this project is the application of isotope techniques in support of environmental investigations of water resources and soil erosion. It is expected thereby that local practising hydrologists and soil scientists will become more familiar with these techniques and procedures and

that eventually self-sustaining activities based on national needs will evolve.

The strength of the RCA concept as illustrated by the Hydrology Project is that the support can be provided not only through the letting of research contracts and the arranging of periodic meetings of project leaders, but also by the provision of capital equipment and training of key personnel. Thus it is possible to combine the best elements of the Agency's technical assistance and research contract programs.

To-date activities have been concerned with investigations of water resources, investigations of soil erosion and sediment accumulation and the provision of capital equipment. Scientists from the Republic of Korea, Indonesia and Sri Lanka have been training in isotope hydrology techniques at the AAEC Research Establishment at Lucas Heights. A scientist from Malaysia has recently commenced a four month attachment to the AAEC Research Establishment.

In terms of potential impact of scientific results, it can be noted that as a direct result of isotope measurements in the Han River Valley (Republic of Korea), it was clearly shown for the first time that the mechanism of recharge to the groundwater depends on the degree of urbanisation. In metropolitan Seoul it was shown that recharge is by seepage from the Han River but in the country areas it is from rainfall infiltration.

A similar effect appears to have been confirmed in Jakarta

and probably applies to most of the rapidly expanding cities in the third world where unregulated use of groundwater is causing a rapid lowering of the water table.

Two points can be made here. Firstly, these insights could only be made with isotopic techniques because hydraulic data were unavailable. Secondly, and more importantly, the isotopic indicators of the recharge water in metropolitan areas will almost certainly move through the ground more rapidly than chemical and biological pollutants and will hence provide an early warning of possible pollution.

Results from Bangkok, Jakarta and the Kelantan Basins in Malaysia suggest that a systematic study of the isotopic composition of rainwater and groundwater will provide very useful information on water balances in the tropical monsoonal areas.

The second program relates to on-stream analysis and control of mineral concentrations.

On-stream Analysis and Control of Mineral Concentrations Project

Australia will make a major contribution to the Regional Cooperative Agreement Project on Industrial Applications of Isotopes and Radiation Technology through an Australian-initiated sub-project on on-stream analysis and control of mineral concentrations.

This sub-project provides for the application of modern

technologies to the concentration of valuable minerals from their ores. Technology transfer activities will include the application of nucleonic techniques to mineral processing, and 'in plant' training in the control of a mineral concentrator in the Philippines.

Two training courses related to the project and each of four weeks duration will be held in Australia, one in 1983 and the other in 1985.

The Philippines Atomic Energy Commission will provide four one-week courses relating to the application of on-stream analysis to copper mineral slurries.

The Dizon operation of the Benguet Corporation will be the centre for 'in plant' control studies on their copper concentrator. Each participant will obtain training in control over a three month period, working under the supervision of an expert from the Julius Kruttschnitt Mineral Research Centre. During this period, control of the mineral concentrator will be improved based on information from on-stream analysis and other sensors. The economic improvement resulting from better control will be established.

Australian institutions involved in the project will be the CSIRO, the AAEC, the Australian School of Nuclear Technology and Julius Kruttschnitt Mineral Research Centre, the University of Queensland and the Australian Mineral Development Laboratories.

In addition to these projects, collaborative effort has been undertaken in other areas. For example, AAEC scientists have

participated in a mission on the collection and application of nuclear data and in addition are involved in an IAEA program concerned with the conversion of research reactors from highly enriched fuel to low enriched fuel. AAEC scientists have participated in IAEA regional training courses, for example, on Radioisotope Techniques in Industry for Process and Quality Control, held in Kuala Lumpur in October/November 1981.

Safeguards Research & Development

In keeping with the Australian Government's announced policy of working to strengthen international nuclear safeguards, Australia has embarked on a program of assistance to the IAEA in safeguards R&D. This program is spread over a three-year period with a total budget of more than half a million dollars.

After discussions with the IAEA, it was decided that Australia's R&D effort in this area should be directed towards safeguarding centrifuge enrichment facilities, which is an area of relevance both to Australia, because of its interest in a possible enrichment industry, and to the IAEA for improved safeguarding capability.

The AAEC's task was to develop an instrument by which the IAEA could measure the enrichment levels of UF_6 gas samples taken from a commercial gas centrifuge enrichment plant.

This task presented two challenges, firstly, to demonstrate the technical feasibility of undertaking such measurements and incorporating them in an instrument, and secondly, to develop a

reliable and relatively inexpensive system which would meet the exacting requirements of the IAEA.

The approach adopted was to measure the total uranium concentration and the uranium-235 content of a gas sample. A key to its simplicity of use is the use of the mini-computer to make appropriate calculations and to lead the operator through the steps required for the measurement.

Following a visit to Australia earlier this year by senior IAEA safeguards technical staff, the Agency has recommended proceeding to the next phase of the project which will take place in July or August and involve field testing of the instrument at a commercial enrichment plant, probably in Europe or Japan.

Upon the satisfactory completion of the project, Australia proposes to donate two operational devices to the IAEA for immediate installation.

In conclusion, Mr. Chairman, I would thank you for this opportunity to describe the AAEC's involvement in technology transfer, both nationally and internationally.

On behalf of my colleagues of the AAEC, I emphasise our commitment towards the continuing success of the regional Cooperative Agreement.

DEVELOPMENTS IN NUCLEAR SCIENCE AND TECHNOLOGY IN INDIA

R. Ramanna

Director, Bhabha Atomic Research Centre and
Secretary to the Department of Atomic Energy,
Government of India

I am most happy to be present here today on the occasion of the 10th anniversary of the RCA. This year also marks the Silver Jubilee of the Bhabha Atomic Research Centre in Bombay, which is the premier institution in India for research and development in nuclear science and technology. We are also celebrating the 20th year of friendly co-operation between the countries of the region, since these activities started with the important meeting on research reactors held at Bangkok in 1963. This led to the Indian-Philippines-Agency agreement involving close collaboration and to greater mutual reliance in the field of pure and applied science within the developing countries of the region. I am, therefore, thankful to the Agency and the Malaysian Government for giving this opportunity to share the experiences.

The main objectives of the Indian Atomic Energy programme are the generation of electrical power, the application of isotopes and radiation technology in medicine, agriculture, hydrology and industry, and the overall impetus to the growth of the scientific and technological efforts in the country.

In my talk today, I propose to highlight our current R&D efforts in the field of research reactors, fuel development, accelerators, lasers and isotope applications.

The Bhabha Atomic Research Centre has so far built four research reactors for use in neutron physics research, isotope production and reactor technology development.

R-5

The 5th reactor, R-5, a 100-MW thermal research reactor, is being built at Trombay as a part of our efforts to augment the research facilities for sustaining the tempo of the scientific activity and to diversify the activities to new areas not open to our researchers so far due to lack of facilities. Planning of experimental facilities in R-5 was done by a group which has been engaged in the past in research reactor utilization. Future programmes, non-availability of similar facilities in existing research

reactors and feasibility of accommodating the facility into the reactor structure formed the basis of the decision on the final provision of facilities in R-5.

The reactor has a vertical axis calandria which contains the heavy water moderator. The fuel assembly can be loaded into the reactor or unloaded from the reactor by an on-load fuelling machine. The guide tubes which guide the fuel assemblies and locate them in the core are themselves replaceable/removable, thereby providing for the flexibility of future modification or addition of new in-core experimental facilities. The reactor has an integrated heavy water circuit for core cooling and for moderator re-circulation. This feature enables the moderator to be available to ensure fuel cooling for the important initial period following an unlikely pipe break or a major leak.

The control of reactor is done by control of the moderator level. Two independent fast shut down systems, one based on solid mechanical shut off rods and the other based on liquid poison shut off tubes, have been provided. In addition, a slow moderator dump ensures full reactor safety during and due to change of experimental facilities.

The reactor is housed in a light water vault which serves as the thermal shield. The heavy concrete biological shield surrounds the thermal shield and accommodates a number of experimental facilities.

The main experimental facilities provided in the reactor system include a cold neutron facility (4°K), a hot neutron facility ($1500 - 1800^{\circ}\text{K}$), and several large sized beam holes. Isotope production facilities include several self-serve irradiation positions, and tray rod positions, with a maximum neutron flux of $1.3 \times 10^{14} \text{ n/cm}^2/\text{sec}$.

FBTR

The fast breeder test reactor (10 MWe) nearing completion at Kalpakkam near Madras would constitute a milestone in our effort to develop nuclear technology to meet long-term power generation needs. This system is expected to give us valuable first hand experience in engineering aspects of fast breeder reactors particularly in areas of materials development and technology associated with high temperature sodium systems. The basic design of the system is derived from the Rapsodie Fortissime systems of France. A small turbine (15 MWe) has been added to gain first hand

experience on the use of these systems as electrical power generators. Laboratories for studies with active fuel and structural materials, radiochemical studies and for reprocessing technology development have also been set up as a part of integrated development towards breeder technology. An intensive metallurgical and material science programme has also been launched simultaneously.

In addition to studies on the fuel and structural materials that would come out of regular FBTR core, the core would also accommodate special experimental irradiation assemblies to initiate development of advanced fuel sub-assembly designs aimed at achieving the high breeding ratio, short doubling time and long irradiation performance.

The FBTR is a loop type reactor with a double envelope on the entire primary circuit. The main reactor vessel with its double envelope is housed in a steel safety vessel. A system of rotating plugs at the top accommodates the control rod drive mechanisms and the refuelling flasks. A secondary sodium circuit transfers the reactor heat to raise steam in steam generators. Detailed design and manufacture of most of the components has been carried out indigenously.

FUEL DEVELOPMENT FOR THERMAL AND FAST REACTORS

The fuel development work at BARC has played a dominant role in our nuclear programme and has been successful in achieving indigenisation on all aspects of thermal and fast reactors fuel cycles of our interest.

The fuel development programme in BARC was initiated in the late fifties with the fabrication of aluminum clad metallic uranium fuel rods for the thermal test reactor, CIRUS. For more than twenty years, Atomic Fuels Division have been fabricating and regularly supplying one fuel core (185 fuel rods/core) per year for CIRUS. This expertise has now been extended to the fabrication of similar fuel for the R-5 reactor (630 Nos. 7-pin clusters/core) which is in an advanced stage of commissioning.

Zircaloy-clad uranium oxide fuels are being used in our boiling water reactors at TAPS and pressurised heavy water reactors at RAPS. The fabrication and reprocessing technology of the oxide fuel system has been well streamlined. The common modes of failure of zircaloy-clad UO_2 , namely hydriding and the pellet cladding interaction failures, have been well identified through post irradiation examinations in our hot cells and the necessary remedial actions have been established.

The first major plutonium fuel fabrication job executed in BARC was the manufacture of the fuel core for the zero energy fast reactor PURNIMA, involving some 25 kg of plutonium dioxide in 186 stainless steel clad fuel pins. The method adopted for fabrication of these fuel pins comprised the production of ceramic grade sinterable PuO_2 powders through the Pu(IV) oxalate route, manufacture of dense pellets by cold compaction and high temperature sintering followed by encapsulation of the sintered pellets in stainless steel tubes by TIG welding.

Fabrication flow sheet has been developed for the manufacture of aluminum-clad aluminum-plutonium plate-type fuel elements by the picture frame technique. This finds applications as a substitute fuel for the APSARA reactor and also in PHWRs as boosters. Al-Pu plate clusters containing 10% and 18% plutonium have been used for physics experiments in ZERLINA.

For the FBTR under construction near Madras, an oxide fuel fabrication facility has been set up and the fabrication of the mixed oxide fuel of FBTR specification has been demonstrated. Feasibility of the fabrication of alternative fuels like mixed uranium-plutonium mono-carbide and mono-nitride, which are considered as advanced fast reactor fuels, has also been established and a flow sheet for the preparation of these advanced fuels starting from UO_2 and PuO_2 feed materials has been developed. The FBTR oxide fuel fabrication facility has presently been modified in such a way that now it will be possible to fabricate both the conventional oxide and the advanced carbide/nitride fuels in this facility. BARC has also developed suitable sol-gel techniques for the preparation of mixed oxide or mixed carbide/nitride micro-spheres from uranyl nitrate and plutonium nitrate solutions. On the basis of this work a 500 g/day pilot plant is being set up.

Mixed uranium plutonium oxide fuel (up to a maximum of 7.0% PuO_2) has been planned as a substitute for the imported enriched uranium based fuel in our Tarapur Power Station. BARC has fabricated and tested UO_2 -4% PuO_2 in the CIRUS reactor and has set up a fuel fabrication facility,

In view of our vast thorium resources (320,000 tons) and somewhat limited uranium resources (52,000 tons) a long-term viability of fission power in India will depend on effective conversion of the fertile Th-232 to fissile U-233 and its subsequent utilization. The fabrication of high density ThO_2 pellets by the cold pressing sintering route has been well established at BARC. Thorium will be utilized as blanket material in FBTR.

Basic R&D work on fabrication aspects of mixed ThO_2 - PuO_2 fuels has also been initiated. This fuel can be utilized in our PHWRs for generating U-233 which can be subsequently used for near breeder PHWRs.

ACCELERATORS

Our present understanding of the structure of nuclei and nuclear behaviour has come mainly from the study of nuclear reactions induced by the accelerated beams of nuclear particles. Thus the role of the particle accelerators in unfolding the mysteries of nuclear behaviour cannot be over-emphasized. Today, in addition to nuclear and elementary particle physics, the accelerators are also making indispensable contributions to several other areas of research in materials science, condensed matter research, chemistry, biology, etc. The potential of the accelerator technology has also been recognized even for our down-to-earth problem of meeting the energy needs of humanity, and there are serious discussions on the possibility of accelerator breeding of fissile material and accelerated heavy-ion driven fusion systems.

Thus, recognizing quite early that nuclear accelerators have become an inseparable part of nuclear research programmes, we in India made a beginning in this area of research with a 5.5 MeV Vande Graaff machine. Over the years, this machine had been utilized to its fullest potential by our nuclear physicists. Our first major accelerator project, namely the variable energy cyclotron at Calcutta, has also now been completed and its utilization has just begun. The machine is designed to deliver protons and deuterons of energies up to about 60 MeV, and alpha particles up to 110 MeV, with a variable energy. The cyclotron was based on the Berkeley design but all its components - magnet, R.F. system, control system, vacuum system, injection extraction and beam transport system - were fabricated, tested and set up in the country. The 262 ton main magnet frame, fabricated at the Heavy Engineering Corporation, Ranchi, was assembled at site. The trim and valley coils were fabricated at the BHEL, Bhopal. All the rf panels, dee stem, dee, drive system and other mechanical components of the rf system, injection and extraction system, power supplies, control electronics and all the user facilities like scattering chambers, electronic modules, etc. were fabricated at BARC, Bombay.

Utilization of the cyclotron will now cover several areas such as the studies of (i) compound nucleus and transfer reactions, (ii) excitation and decay of nuclear collective states, (iii) nuclear-fission process, (iv) giant resonances and other high-lying excitations and (v) exotic nuclei formed in the reactions. In addition, this facility is also catering to the requirements of production of proton-rich isotopes for medical and other applications, and also to other areas of accelerator-based research in chemistry, radiochemistry and radiation damage studies.

Recently, we have also decided to set up a facility at Bombay exclusively for medium energy heavy ion research. This is a newly emerging area of research which is of considerable value as it allows one to probe certain aspects of nuclear behaviour such as its macroscopic features and large-scale collective motion, which cannot be studied by lighter projectile beam. This facility will be based around a 14 MW pelletron tandem machine, which in the second phase of the project will act as an injector to a superconducting linear accelerator which we plan to build indigenously. With this facility, we plan to investigate several other interesting features of nuclear behaviour such as heavy-ion deep inelastic scattering, heavy-ion fusion, fission following deep-inelastic collisions, fast fission phenomenon, nuclear behaviour at large angular momentum, etc. The pelletron accelerator will be operational by 1985, and it is expected to take another two years to fabricate and install the superconducting linear accelerator, thus making available to Indian scientists in about 5 years time heavy ion beams of energies 5 MeV/A-10 MeV/A for research in nuclear physics, nuclear chemistry, atomic physics and materials science.

Having generated sufficient experience in the various aspects of the accelerator technology, we have also just now entered into the more challenging phase of seriously planning advanced high energy accelerators in the country. A facility of this type, which is now already in the design stage, is a synchrotron radiation source for condensed matter research and also advanced spectroscopy. There is also a proposal to build a rapid cycling 1 GeV proton synchrotron which would be a multiple beam facility to provide intense pulsed neutron beam as well as beams of pions and muons.

LASERS

Apart from the obvious application of laser fusion, there are many other programmes of fundamental importance that could be pursued using lasers, in a nuclear energy programme.

All these applications depend upon the interaction of the laser radiation with atomic and molecular systems either in a highly selective manner or in an entirely non-selective process. The selective interaction is determined by the high monochromaticity, tunability and temporal range (picoseconds to cw), while the non-selective interaction is governed by the high power as well as spatial and temporal coherence. The applications depending on selective interaction are mainly of two types. One related to technological programmes like isotope enrichment, laser purification of materials, identification and analysis of materials in the ultra trace level under extremely adverse conditions, etc. The second type of selective interaction enables us to gain insight into fundamental problems in atomic and molecular physics.

In power reactors (BWR, PWR and Breeder), fusion reactors and MHD power generators, where a flux of high energy particles and radiation exist, fuel materials, containers and reaction products all exist in a complex equilibrium determined by parameters varying over short distances. The atomic, molecular and ionic species in vapour phase exist in these systems at extremely high temperatures and their identification under these conditions is essential for efficient operation of the systems. For example, presence of 0.1% metal atoms in a hot D-T plasma can make ignition impossible in a magnetically confined plasma.

A very convenient method for the detection of the species and analysis of these systems is by laser induced fluorescence.

Several trace isotopic analysis methods by laser absorption, fluorescence, optogalvanic and optoacoustic techniques, etc. have been developed on our laboratories during the past several years.

A tunable semiconductor diode laser, operating in the infrared around 10 μm has been used to develop methods for analysis of NH_2D in ammonia at natural concentrations. This analysis is of importance in the production of heavy water by NH_3 exchange.

In the optogalvanic spectroscopic technique, the number densities of atoms, ions and electrons in a hollow cathod, electrical discharge or flame can be changed by absorption of laser radiation by the various atomic and radical species and the induced change in the electrical parameters can be measured. The method is extremely sensitive and can be applied to various analytical problems encountered in nuclear technology.

In laser isotope enrichment programmes, laser purification of materials and laser induced reactions, very often trace amounts of the radiation absorbing species, primary or secondary reaction products, impurities, etc. have to be detected. The laser optoacoustic technique is a very convenient method for this.

ISOTOPE APPLICATIONS

Besides planning for nuclear power, the Indian Atomic Energy programme envisaged, from its very inception, a wide spectrum of radio-isotope applications in medicine, agriculture, hydrology, research and industry. The infrastructural facilities built for the isotope production and applications programme include the 1 MW APSARA and the 40 MW CIRUS reactors and the modern radioisotope processing facilities at the radiological laboratories of the Bhabha Atomic Research Centre. The Rajasthan power reactors produce large quantities of Cobalt-60 for radiation processing applications. The 100 MW R-5 reactor under construction and the Variable Energy Cyclotron at Calcutta will provide additional infrastructural support to the isotope programme.

India, with over 20 years of experience in the production and application of isotopes has achieved near self-sufficiency in materials, equipment and expertise.

The production and supply of radiopharmaceuticals for nuclear medicine and of radiation sources for tele-therapy and brachy-therapy has been an important area where significant progress has been made at BARC. Millions of patients have already derived the benefits of these advanced diagnostic and therapeutic procedures using the products and services provided by the Isotope Group of this Centre during the last ten years. Practically the entire range of reactor-produced radioisotopes and their pharmaceutical formulations have been developed and the large majority of these are in regular production schedule. A modern and well equipped radiopharmaceutical laboratory is in an advanced stage of construction at Vashi, 15 km away from the Trombay complex.

To ensure the availability of neutron deficient cyclotron produced radionuclides of medical interest such as Ga-67, In-111 and Tl-201, it is proposed to set up an isotope laboratory at the Variable Energy Cyclotron Complex at Calcutta. We have also planned the setting up of three regional dispensing and radioimmunoassay centres in the south, north and north-eastern parts of India in the sixth five-year plan period. These centres will ensure the ready supply of short-lived radiopharmaceuticals and also offer training and services in the areas of radioimmunoassay and hospital radiopharmacy.

Applications of radiopharmaceuticals and radioimmunoassays have thus far benefited millions of patients suffering from thyroid, liver, kidney, cardio and neurological disorders and diseases such as mal-absorption, anaemia and cancer. Realizing the tremendous potential of radioimmunoassay, an active R&D programme is under way to develop radioimmunoassays for tuberculosis and infectious diseases such as amoebiasis and hepatitis. We have already reached a stage where the APSARA and CIRUS reactors at Trombay have been fully utilized for production of radioisotopes. The commissioning of the high flux R-5 reactor will considerably augment our production capability and will also enable enhancing the specific activity of important radioisotopes such as Mo-99. Plans are also under way to set up one more large zonal radiation medicine centre in the eastern part of the country. These efforts will ensure that the benefits of advanced nuclear medicine procedures will soon percolate to a larger cross section of the population in our country.

The BARC has a strong isotope hydrology group which pioneered the application of radiotracer techniques for water resources management. The application of environmental isotopes in hydrological investigations is also fairly well advanced in India and a new laboratory for the environmental isotope hydrology is being set up in BARC with facilities for the analysis of deuterium, oxygen-18, carbon-14, and tritium in natural waters. The laboratory will be ready in about three to four months.

Among industrial isotope applications, thanks to the efforts at BARC, India is well advanced in the fields of isotope radiography and tracer technology in industry and medical supply sterilization. The ISOMED plant for the sterilization of medical products at Bombay is operated on commercial lines.

In the area of public hygiene, there is a great awareness of the need to go in for radiation disinfection of sewage and sludge. Having been convinced of the technological feasibility and the advantages of radiation disinfection over other methods, a pilot-scale plant has been designed for construction at Baroda in the State of Gujarat. This radiation plant which will be linked with a conventional sewage treatment plant will have a 100 KCi Cobalt-60 source and is designed to disinfect about 100 m³ of digested sludge per day. The plant will have laboratory facilities for process technology development. The experience gained in the operation of this plant will help in designing similar plants for other cities in India.

Unlike many other applications of isotopes, the silent contribution made by radiochemicals to research in life sciences does not receive the attention it deserves. The use of carbon-14 and tritium labelled compounds has provided better understanding of life processes such as metabolic pathways, enzyme mechanism, photosynthesis, soil-plant relationship, pesticide management, drug metabolism, etc. BARC today produces and supplies over 100 compounds to about 1,000 users in India. Recognizing the rapid strides being made in different fields of research and consequent increase in the demand for the isotope labelled products, a new and advanced laboratory for their development and production is proposed to be built in the next few years.

From the foregoing account of the current and proposed activities in isotope technology, it is clear that India can and should be able to play a key role for the success of the RCA Industrial Project and other isotope programmes.

Development of Nuclear Science
in Malaysia

Prof. Mohd. Ghazali bin Hj. Abdul Rahman
Director, PUSPATI

Introduction

What lies ahead? In what ways will the activities of science, (in particular nuclear science) and technology, and the roles they play in society, come to differ from what they had been in the past? Forecasting is difficult. But since it is all too clear that the future is full of questions and problems, and undeniable that science and technology in general are major agents of change, it is important to try to look ahead.

What are then the criteria for scientific choice. In fact, several such criteria already exist; the main task is to make them more explicit. The criteria can be divided into two kinds; internal criteria and external criteria. Internal criteria are generated within the scientific field itself and external criteria are generated outside the scientific field and answer the question: Why pursue this particular science?

The internal criteria can be easily identified viz:

- (i) Is the field ready for exploitation?
- (ii) Are the scientists in the field really competent?

The external criteria are more important and relevant because scientists believe that the pursuit of science must be for society's good although this view should not be taken for granted.

However there are three external criteria viz technological merit, scientific merit and social merit. The first is fairly obvious: once we have decided, one way or another that a certain technological end is worth while, we must support the scientific research necessary to achieve that end. Thus, if we have set out to learn how to make breeder reactors, we must first measure painstakingly the neutron yields of the fissile isotopes as a function of energy of the bombarding neutron. As in all such questions of choice, it is not always so easy to decide the technological relevance of a piece of basic research.

The criteria of scientific merit and social merit are much more difficult: scientific merit because we have given little thought to defining scientific merit in the broad sense, social merit because it is difficult to define the values of our society. Of the two, social merit or relevance to human welfare and the values of man is the most controversial criterion. Two difficulties face us when we try to clarify the criterion of social merit: first, who is to define the values of man, or even the values of our own society; and second, just as we shall have difficulty deciding whether a proposed research helps other branches of science or technology, so we will have even greater trouble deciding whether a given scientific or technical enterprise indeed furthers our pursuit of social values, even when those values have been identified. Anyhow among the most attractive social values that science can help to achieve is international understanding and cooperation. It is a common place that the standards and loyalties of science are transactional. The costliness of scientific research has encouraged this phenomenon. Certain equipments are so expensive that such international laboratories such as CERN at Geneva are set up to enable several countries to share costs that are too heavy for them to bear separately viz the big accelerators. Bigness is an advantage rather than a disadvantage if science is to be used as an instrument of international cooperation. RCA, under the auspices of IAEA is another major international cooperative endeavour.

It is a matter of common knowledge that science has been growing rapidly including nuclear science. Before the war there was a gross inadequacy of resources to science but this is a different situation now - it is the large scale of expenditure on science rather than a small scale that must be considered. The new magnitude makes inescapable the problem of whether and how to plan science. As Bernal pointed out "We need a strategy for research which must be based on a science of science". The whole problem - economic, scientific, and political - must be regarded as one of a planned operation".

It makes admirable sense, naturally, that planning should be comprehensive, that economic, scientific and political aims should be in harmony and not a cross purposes. As with all planning however, there is a snag: what about the freedom of the individual? In this particular case, what about freedom of research? Here is a dilemma. We want good planning

to make things run smoothly, but freedom is a powerful counter-attraction. Amongst the scientific community, the right to choose one's own problems and mode of attack is a cherished ideal. Thus "any attempt at guiding scientific research towards a purpose other than its own is an attempt to deflect it from the advancement of science". But on the other hand how laudable is it for scientists to be concerned only with increasing knowledge, refusing to consider anything else? It seems that it is an excuse for not trying harder to predict.

What remains free is what is cheap. Experiments that require little in the way of apparatus, materials and manpower can easily be done. It is when demands on resources become substantial that the real test comes for freedom of research. Greenberg deduced that science, like agriculture, the military, labour, business or the civil rights movement, has vested interests, elites, down-trodden, alliances, bosses, loves and hates. The politics of science is in essence no different from the other politics.

Nuclear science, in particular nuclear physics, is the bone of contention because it poses the problem in its most acute form. Here is good science, indubitably, giving what is literally the most fundamental knowledge of the physical universe, but hugely expensive and may be offering no foreseeable practical application. When resources are not limitless, choices have to be made between possible projects and lines of research. Choices always tend to be agonising, but the agony becomes milder if there are clear criteria by which to make them.

Of course man, being the foremost social being must investigate all things around him placed by nature; it is his obligation, Man, as being but a tiny particle of this immeasurable and wonderfully organized universe and yet as being honoured by God with having at his disposition all things in Heaven and on Earth, must improve them and keep them from corruption and perversion. Finally, by consequence of what has just been said, man is under the strict obligation to improve this world and enjoy the fruits of his work. This he shall do in such a way as to preserve faith in God and guarantee dignity, justice, quality, liberty and peace among men without any distinction. He will act in conformity with the divine law.

Present Status

The utilization of radiation and radioactive isotopes has been applied to basic sciences, medical sciences, agriculture and lately industry and undoubtedly has become indispensable to man. Although man has long been exposed to radiation it was only after its discovery by Roentgen and the Curies that he dares venture to use it for his benefits. Of course there is the forever harmful effects of radiation. The greater the number of people in contact with radiation, the greater the importance of protecting them against its hazard. As a result it is now fully established in the mind of people concerned as well as the public to secure safety.

In Malaysia it is the field of medicine where the utilization of radiation and radioactive isotopes has become indispensable chemical diagnostic techniques since 1960 particularly radioiodine and gold. We realise its potential and with the establishment of PUSPATI our endeavour will become a reality.

With or without a nuclear reactor, radioactive isotopes have been standard teaching aids and in nuclear medicine. The neutron generator at the University of Science Malaysia and the two neutron sources in the University of Technology Malaysia are constantly being used for the various studies.

It is in the field of industry where its utilization is increasing though still in the infancy state. This is understandable as the country slowly embarks into the industrial era. To date 40 industrial premises are using equipment using radioactive materials. Below is a table showing the various industrial users.

Industrial Users in Malaysia:

<u>No. of Companies</u>	<u>Type of Equipment</u>	<u>Isotope Used</u>	<u>Hazard Grading</u>
9	NDT (Consultants)	^{192}Ir , ^{60}Co	**
4	NDT (Welding)	^{192}Ir , ^{60}Co	**
12	NDT (Electronics)	^{51}Kr , ^{147}Pr , ^{204}Tl	*
10	Gauge	^{241}Am , ^{90}Sr , ^{60}Co , ^{137}Cs	*
2	Analysis	^{147}Pm , ^3H , ^{137}Cs	*
1	Irradiation	^{60}Co	***
1	Manufacturing	^3H	*
1	Research	^{14}C	*

NDT = Non-destructive testing.

The equipment used can be classified into three categories based on the degree of hazard associated with its use viz:

1. Gauges and analytical equipment that use only small amount of radiation material,
2. equipment used in industrial radiography, and
3. equipment that use rather large amounts of radioactive material.

Low level gauges are currently being used in the three major breweries both in the bottling and canning of beer and in cement factory hoppers. Similarly, the three major tobacco companies, accounting for 98% of cigarette production in the country use nuclear gauges (Sr-90 sources) or radioisotope density gauges to control the amount of tobacco that is packed in a cigarette.

Gauges are also being used in a chipboard factory (Am-241) and in a sugar refinery (Cs-137). About five companies in the electronic industry are using gauges (promethium-147 and thallium-204) to measure coating thickness, while about 10 companies are using Krypton-85 gauges for the detection of defects in their integrated circuits.

Presently, the only commercially operating radiation processing plant in Malaysia is at Ansell's (Malaysia) Sdn. Bhd. This Australian based company has an in-house 600 kilocurie Cobalt-60 radiation plant for the sterilization of surgical gloves.

The NDT (non-destructive testing) facilities at SIRIM include dye penetrant facilities, ultrasonic flaw detector and an ultrasonic thickness gauge, magnetic particle inspection and X-ray radiography with x-ray tube of 260 KV maximum.

A feasibility study is presently being conducted in the field of industrial electron processing system. This process is unique in its innovation for the injection of energy in the form of accelerated electron beam by which various chemical reactions can be performed in a very efficient way. So far successful industrial application has been utilized in the plastic industry as well as in the cable industry.

Since Malaysia is an agrobased country, understandably radioactive isotopes are comparably widely used and priority agriculture items has been identified. In the area of food irradiation

the National University of Malaysia has initiated its use on black pepper because of the need to find alternatives for its storage and transport. This type of preservation technique is feasible particularly on agricultural produce and food without any adverse effect.

However the Ministry of Agriculture, an agency of the Federal Government, will definitely put its efforts in this field if the Malaysian Government decides to embark on this project. The Ministry has set up its priority list viz:

rice, cocoa, coffee, fish and prawn (both dried and frozen), spices, coconut, mangoes and bananas.

Of course before full scale operation could be launched intensive biological tests have to be made.

The Future

The setting up of the Tun Ismail Atomic Research Centre (PUSPATI) signals the beginning of nuclear era in Malaysia. It's main functions are:

- (a) to conduct research and development in nuclear science and technology
- (b) to produce short and medium-lived radioisotopes for applications in medicine, agriculture and industry
- (c) to promote and coordinate the use of nuclear technology in research at research institutes and universities
- (d) to conduct radiation monitoring and radiation protection for workers, the public and the environment
- (e) to organise training courses and to collect and disseminate information on nuclear technology.

In the research and development of atomic energy for peaceful uses PUSPATI will emphasise on mission-oriented research, especially the long term programmes. It will undertake research in energy and reactor system studies, nuclear instrumentation and semiconductor technology and radiation chemistry and radiation biology.

Physical Science

Areas of reactor systems, energy, nuclear instrumentation and semi-conductor technology will be emphasised. Study on corrosive agents in water and, effects to reactor materials together with microstructure and mechanical properties of materials will be conducted. The use of local materials as corrosion inhibitors in nuclear industry will be investigated. Nuclear instrumentation and semi-conductor studies where research on crystal growth, detector fabrication and fabrication of electronic spare parts will be carried out. Neutron spectrometry studies with the objective of establishing in-core dosimetry technique, obtaining dose information in the reactor for its utilization and the development of reactors and developing radiation damage models in order to correlate damage to neutron fluence and spectron will be carried out.

Chemical Science

Studies on uranium and thorium will be conducted. In order to establish the country's capability in terms of resources, three main areas were looked at, viz:

- (i) assessment of potential uranium and thorium resources
- (ii) monitoring the development in the international supply and demand trends
- (iii) monitoring of development in policies formulated by international bodies and individual states regarding nuclear.

The field of radiation chemistry presents us with desired chemical reactions induced by radiation processing. The object is to develop industrial applications of radiation and radiation technology, with the emphasis of processing indigenous products. Emphasis is given on the following:

- (i) vulcanization of natural rubber latex
- (ii) surface coating of wood panel or wood-plastic composite
- (iii) modification of plastics/polymers, and
- (iv) sterilization of medical products.

The vulcanization of natural rubber latex involves research on the mechanical and chemical properties of radiation vulcanized natural rubber (NR) in order to promote and encourage the manufacture of quality improved finished crosslinked polymer products for export.

In the area of surface coating of wood panel or wood-plastic composite, the upgrading of cheap, low quality timber such as rubber wood into quality products with improves physical and chemical properties are achieved. This process involves the impregnation coating of monomers into or on to wood panel followed by the polymerization process induced by irradiation (γ -irradiation or electron beam) resulting in wear-resisting wood.

Radiation can be used in the crosslinking of foam plastics, films and tubing.

Earth Science:

Work is being actively carried on RCA projects viz isotope hydrology and sedimentology. This on-going isotopes hydrology project which was started in Kelantan is being extended to areas in Kedah and Perlis. The project on sedimentology using environmental $C_s -137$ is being carried in the Lui River Catchment area, Kelantan. The main objective is to assess sediment redistribution in the catchment. A similar project will be carried out in the Air Itam Dam, Penang.

Projects which include the survey and evaluation of nuclear related materials, semiconductor materials and zeolite minerals will be emphasised. The exploration of uranium and thorium will be intensified.

Life Science:

Areas in radiation biology will be emphasised and will cover areas such as preservation and sterilization of food and the sterilization of medical products. The main objectives of this endeavour is to develop industrial applications of radiation and radiation technology. Ultimately, it is hoped to transfer pilot plants to commercial applications.

Other endeavours such as:

1. the use of radioimmunoassay technique,
2. the application of radiotracers involving agricultural problems and applications to animal food stuff,
3. genetic studies on effects of radiation, and
4. studies in microbiology.

Presently, food irradiation is an on-going project using a small cobalt-60 source available in one of the universities. The availability of an updated cobalt-60 source will facilitate better results.

Areas on instrumentation and control is essential to guarantee and sustain the future development of nuclear science.

Radioisotopes

It has been recognised radiation and radioisotope have found their way into patient care namely in radiopharmaceuticals. The field of industry is no exception in its usage of the above.

It is hope that facility is made available for:-

- (i) the production and supply of short and medium lived radioisotopes and radiopharmaceuticals.
- (ii) the encouragement and assisting of local industries, hospitals and reserach institutes in the use of radioisotopes wherever positive advantages can safely be obtained from their use.

PUSPATI will be producing the following radioisotopes.

The radioisotopes to be produced by PUSPATI

No.	Radioisotopes/Radiopharmaceuticals	Expected year of production	Expected Quantity produced/year (early production)
1.	Technetium-99m (For brain, bone, lung & liver scans)	1984	100 Ci
2.	Iodine-131	1985	10 Ci
3.	Phosphorus-32	1985	1200mCi
4.	Chromium-51	1985	1250mCi
5.	Sodium-24	1985	100mCi
6.	Potassium-42	1985	100mCi
7.	Copper-64	1986	100mCi
8.	Zinc-65	1986	100mCi
9.	Iron-59 (Fe-59)	1986	100mCi
10.	Rubidium-86	1986	100mCi
11.	Gold-198	1986	100mCi
12.	Bromine-82	1986	100mCi
13.	Radioimmunoassay-kits CEA, T3, T4 TSH	1986-1987	Not available

Nuclear Power

In the nineteenth century there were warnings that industrial expansion might be restricted by exhaustion of coal supplies and that diminishing supplies of fixed nitrogen might mean starvation; but alternative fuels have become available and chemistry has made it possible to fix atmospheric nitrogen.

Nuclear energy has now released us from dependence of fossil fuels; fast breeder reactors are likely to extend our stocks of fissionable fuels, and in the more distant future there is the prospect of vast quantities of energy from nuclear fusion.

This no doubt makes it more tantalizing for Malaysia to go nuclear power and efforts should be taken to study its feasibility, including the siting of nuclear power stations. Because of better communication methods, including publications, exposure to film, radio and television which constitute a new input of information and greater mobility will make the choice of sites problematic where it will be difficult to obtain cooperation of local communities even in the survey of siting feasibility.

This is because the Malaysian public is becoming increasingly aware of the so-called danger of nuclear science and prophets of doom are beginning to emerge. Their targets range from air pollution to the latest viz nuclear science.

I would imagine the same thing would have happened when man first discovered fire for fire has resulted in the production of equipments and machines for both human and nature destruction. They could have been the very first prophets of Doom. Yet civilizations survived and will survive.

As one of the long term objectives of the National Energy Policy, the Country must decide on alternative energy resources so as to reduce the national dependence on oil as a source of energy. The strategies adopted to realise the long term objectives should take into account economic, social and environmental considerations. It is indicated that depending on the availability of the various energy sources, namely natural gas, hydro and coal, the first nuclear power station with a capacity of 600 or 900 MW may be needed between 1992 and 1999.

The National Electricity Board (NEB) started consideration of the introduction of nuclear power into its electricity generating system since 1972, and a nuclear unit was established in 1973.

Site Selection

Nuclear power plants should only be constructed on a carefully selected site. Several factors such as population density, hydrology, meteorology, land usage and environmental considerations need to be examined and evaluated in detail during the site selection exercise.

A number of sites have been earmarked on Peninsular Malaysia and studies on them have been carried on by IAEA Siting Mission.

A number of sites have been found suitable on account of population hard granite foundation, and deep sea.

Steps to be taken to nuclear power are:-

1. Power Planning Studies

In the early stages of a nuclear power programme the long term power requirement of the country has to be reviewed. Nuclear power planning studies generally have the following as objectives:

- To review the electricity generating and distribution system in order to arrive at the possible size of nuclear plants that should be considered for economic competitiveness and the time when they could be introduced in the electric grid.
- To review present organisational structure and advise on future organisation and requirements for trained manpower.

- To review the possible area locations of nuclear power plants based on technical considerations.

The NEB, with IAEA assistance, has done preliminary studies on system expansion up to the year 2005. This study, including studies to determine the influence of factors such as load growth, Sarawak hydro, lower gas prices, etc., should be concluded. Subsequent studies should be carried out periodically to take into consideration any new developments in the national energy situation including new information on resources and production of oil, natural gas, coal and hydro. Load projections, plant investment and fuel cost data will also have to be updated as required. The objective of these studies would be to define more precisely the size and timing of the first nuclear plant.

2. Site Investigation and Selection

Information concerning the potential nuclear plant sites considered most promising should be firmed up as a basis for selecting the site for the nuclear project.

3. Characteristics of the Reactor Design

Considerations here should include the proposed use and maximum power level of the reactor, the extent to which generally accepted engineering standards are to be used in design and construction, and the engineering safeguards proposed to reduce the likelihood and consequence of reactor accidents.

4. Population Density

Here it is necessary to know the amount of land under the control of the reactor owner, distance to the site boundary and densely populated centres, densities of population between the reactor site and the population centres, and population activity.

5. Physical Characteristics of the Site

Some of the main factors that have to be evaluated include the following:-

- Ground and site preparation
- Circulating water system
- Plant foundation

- Site accessibility and power transmission
- Topography
- Geology
- Flooding
- Meteorology
- Tsunami
- Seismology
- Flora and fauna within site area
- Nearby agricultural activities
- Location of industrial, recreational and military establishments near the site.

The selection of suitable nuclear plant sites appears to be one of the most important considerations for the first and subsequent nuclear plants.

6. Training of Key Personnel

If a nuclear power planning study has indicated that work should be started towards the first nuclear power project, it will be necessary to start staffing both the regulatory authority and the project group which will be involved in the selection of a site and the feasibility study. Advantage should be taken of the various courses offered by the IAEA in the training of key personnel from NEB and other interested ministries/agencies in Malaysia. The area of training could include the following:-

- Nuclear Power Project Planning and Implementation
- Reactor Safety
- Nuclear Project Construction Management
- Generation Expansion Planning
- Manpower Development

7. Setting Up of Public Information Group

It is becoming increasingly apparent that the public must be kept fully informed during all stages of a nuclear project. Failure to involve the public might well jeopardize the success of the project. Particular attention should be given to the safety aspects of the plant and the advantages which might accrue to those living within the vicinity of the plant (increased local employment, possible income to a community

from local taxes, and increased business activities). The information programme should attempt to reach as wide a segment of the population as is possible, including government leaders and administrators, educators, other professionals and workers, etc.

8. Initiate a Manpower Training Programme

In addition to the training of key personnel mentioned above, numerous engineers, scientists and technicians will have to receive special training in order to implement a nuclear programme. This programme can be approached in several ways. First of all, engineers and scientists can be trained in the engineering departments of the main contractor dealing with nuclear as well as conventional systems. This can be followed up by delegating a large proportion of the trainees to the job site to assist contractor personnel and to gain an indepth knowledge of the systems and components of the plant. A second approach would be to carry out the basic training of nuclear project staff and operating personnel in Malaysia possibly in connection with the Nuclear Research Centre or with Universities. Finally, a special training centre might be set up within NEB staffed by outside experts as well as local personnel. The total training volume required for a nuclear project is of the order 300 man years. The IAEA is currently preparing a manual on manpower development which provides details of various courses of action.

Radioactive Waste Management in Malaysia

It is foolish to embark into the nuclear era without taking into account radiation protection and the question of radioactive waste management. The application of radioisotopes started with its introduction for medical purposes about twenty years ago. Since then, its use has been widely extended to other fields such as in agriculture, industry and research.

Radioactive waste in Malaysia originate from the various activities mentioned above which includes hospitals, universities, agricultural and medical research institutions and the industries. The waste from PUSPATI will be produced only once the centre is operational i.e. towards the second half of 1983.

At present, all users of radioactive substances are responsible for the handling and disposal of the waste they produce in whichever way they deem proper and safe. Besides the delay/decay process, no other treatment is currently being practiced. Waste containing short-lived radionuclides (e.g. Iodine, Technetium) such as those from the hospitals are disposed in the same way as other waste after the delay/decay process. However, most producers of radioactive waste in Malaysia are still storing their waste in their own places.

A decision was made recently at the meeting of the National Advisory Committee on Nuclear Energy to establish a National Radioactive Waste Treatment Centre in PUSPATI.

Waste Management

The facilities at this National Centre have been designed to accomodate all waste in the country arising during both normal and emergency situations.

Solid Waste:

Solid Waste is segregated at its source into compressible and non-compressible waste. A compactor will be installed for volume reduction of the compressible waste. The non-compressible waste will be kept either in drums only or fixed in concrete. After treatment, the waste will be temporarily stored in PUSPATI pending the establishment of a final waste repository. There is no provision for the combustion of solid waste, but this option will be considered in future planning.

Liquid Waste:

Liquid Waste is classified according to its activity level. Low-level waste from within PUSPATI will be collected by means of piping into sumps, delay tanks and finally to Liquid Effluent Treatment Plant. Waste from other agencies will be collected in containers and transferred into pumps at the Effluent Treatment Plant. This Plant which will be fully operational by 1983 is designed to treat liquid waste by chemical flocculation. The sludge produced from this treatment process will undergo settling followed by solar drying and finally fixation in concrete. The medium and high-level waste will be collected in appropriate containers and sent to the Waste Treatment Centre. Waste containing only short-lived radio-nuclides will be allowed to decay before it is transferred to the Liquid Effluent Treatment Plant for chemical treatment. Those with long-lived radio-nuclides will be insolubilised in concrete or treated by means of ion-exchange process. Other methods for the treatment of medium/high-level waste containing long-lived radio-nuclides will be developed in future as needed. The treated liquid effluent will be discharged into a river located about 2 Km from PUSPATI.

Gaseous Waste:

Gaseous effluent from active laboratories will be directed to a central active exhaust facility where the HEPA filters are

located. However, gaseous effluent from the iodine-production hot-cell will be filtered by means of a charcoal bed before it goes through the HEPA filters. The gaseous effluent will be discharged finally through a 40m stack. The reactor has a separate ventilation system which includes a pre filter and HEPA filter with eventual release of gaseous effluent through a 10ft. stack.

Other facilities

Besides the above-mentioned facilities, the waste management unit is also responsible for operating facilities for the decontamination of equipments and clothings.

Future Programme

Should the country opt for nuclear energy, then the Waste Treatment facility in PUSPATI will not be able to cope with waste arising from such activity. Thus, a new centre will have to be set up to handle all types of waste from the nuclear industry particularly high-level waste containing long-lived radionuclides. In addition, disposal options must be considered and siting of waste repositories have to be undertaken.

Opening Remarks for Panel Discussion on
"Development of Nuclear Energy Application and
International Cooperation in Asia and the Pacific"

by

Prof. H. Kakihana
June 16, 1982

It is my honour and pleasure to chair this panel discussion entitled "Development of nuclear energy applications and international cooperation in Asia and the Pacific" as the afternoon session of the 10th Anniversary Celebration of RCA.

First of all, I have the honour to introduce to you the participants of this panel discussion.

Before I ask the panelists to deliver their views, I would like to address some short remarks to the Panel. Today, we are celebrating the 10th anniversary of RCA and from tomorrow, we are schedule to work for the 4th RCA Working Group Meeting. The 1st Working Group Meeting was held in Tokyo in 1979, the second one in Manila in 1980, and the third one was held in 1981 in Jakarta. Before these three meetings, I, with the help of Dr. Fowler, had planned to have a meeting to stimulate RCA activities, to decide their future direction and to find the ways how to finance the expenses of those RCA activities. The meeting was originally planned to be held in Singapore, but was eventually held here in Kuala Lumpur in June of 1978.

Many Malaysian Governmental officers and scientists had worked so hard for the success of that meeting. Especially the Ambassador of Malaysia to IAEA, Mr. Khoh, who was at that time, from 1977 to 1978, also Chairman of the Board of Governors of IAEA in Vienna, worked with a kind mind and with remarkable efficiency to form channels between IAEA in Vienna and the Malaysian Government in Kuala Lumpur. I also cannot forget the remarkable performance in Kuala Lumpur, led by Prof. Noramly, who was at that time a very young Director of PUSPATI. Of course, Prof. Noramly is still young but in 1978 he was absolutely young, full of power and wisdom.

It was a bright and sparkling meeting, gave a real birth to RCA and provided the future prospect of RCA in a practical way in the spirit of cooperation and idealism. That Kuala Lumpur meeting may be called the Zeroth RCA Working Group Meeting.

Today we are celebrating the 10th anniversary of RCA, and even after the Zeroth Working Group Meeting of Kuala Lumpur, four years have passed. During these four years, each member country of RCA has planned and implemented many projects with good results. For example, here in Malaysia, four years ago PUSPATI kept only four rooms for planning the peaceful uses of atomic energy in Malaysia, and now Malaysia has nearly finalized the construction of a big and well-planned research reactor, which you will see on Saturday afternoon.

RCA activities themselves have developed quite a lot. As we will discuss the matters from tomorrow to next Monday, each programme within the framework of RCA has achieved good results, giving good contributions to the region with regard to its economic, educational and social developments. The UNDP industrial programme has now finalized its preparatory stage and is ready to take off as the biggest and best-prepared project under the auspices of UNDP and IAEA, with Dr. Fowler as Project Director and Chief Technical Advisor of an interim UNDP Project Office in Tokyo for the period June 14, 1982 to June 30, 1983.

Based on these facts, we can conclude that the RCA activities have been successful, with more results than had been expected 10 years ago and even more than we expected four years ago here in Kuala Lumpur.

Nevertheless, I believe that the day celebrating the 10th anniversary of RCA is a very good opportunity to reflect on our past and to plan our future in order to continue our present good status and even to accelerate and enlarge our activities to contribute much more to educational, social and economic development of the region.

Closing Remark for Panel Discussion
"Development of nuclear energy applications
and international co-operation in Asia and the Pacific"

by Professor H. Kakihana
16 June, 1982

I understand, each programme under framework of RCA can be performed by a system consisting of three steps:

1. Planning of programmes
2. Implementation of the programmes
3. Evaluation of the results

After the step of evaluation, coming back again to the first step, new programme will be planned based on the experiences.

At the first step, the needs and capabilities of the region are carefully studied and the programmes meeting the regional needs should be planned on the basis of recognition of capabilities of the region like man power, infrastructure and budgets etc. The programme, as the matter of course, should be strictly of peaceful uses.

At the second step, direct cooperation among scientists and engineers in the region based on the mutual understanding is absolutely necessary and in addition the spirit of fair competition will stimulate our activities. Effective implementation of the programmes with appreciable results will result in activating the spirit of selfreliance in the region.

At the third step, the results of the programmes can be analysed mainly by three directions:

- a) grade of economic contribution
- b) grade of educational contribution
- c) contribution to the social development of the region.

The results of evaluation of a certain programme can be used not only for the future of the programme itself, but also be informed to all the participants of the RCA to share the experiences. Exact evaluation of the results is as important as the successful implementation of the programme. Only based on exact evaluation, we can plan new programmes in a bigger scale on the basis of less-risk and more self-reliance.

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Philippines

Dr. K.G. Dharmawardena
Chairman
Sri Lanka Atomic Energy Authority
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Dr. S.P. Kasemsanta
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Tun Ismail Atomic Research Centre
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MESSAGE FROM MR. K. KANEKO, DIRECTOR,
NUCLEAR ENERGY DIVISION, MINISTRY OF FOREIGN AFFAIRS, JAPAN
ON THE OCCASION OF THE CELEBRATION OF THE
10TH ANNIVERSARY OF RCA

On the occasion of this Special Session commemorating the 10th anniversary of the RCA, I am sending my personal greetings to my friends as the Chairman of the first RCA Working Group Meeting held in Tokyo in October 1979. I regret very much that I am not able to join you personally in this memorable meeting due to my official responsibilities in Tokyo.

As we look back on the history of RCA over the past ten years, we are all satisfied to note steady and significant progress having been made in a wide range of cooperative activities within RCA. Needless to say, these remarkable achievements are entirely due to untiring efforts of all those concerned within the participating governments and the IAEA Secretariat. I hereby pay my personal tribute to all of them.

However, this is not the time to rest on our laurels. As we look toward the future, there is still a very long way to go. There are many new areas to be opened up for our regional cooperation in the peaceful uses of nuclear energy. There are also many new problems which have emerged or are about to emerge as we continue to widen the horizon of our cooperative activities in order to meet the ever increasing needs of Member Governments. Some of those problems will be addressed in the present Working Group Meeting, but most of them will require our careful consideration over months or years to come. Solutions to those new problems will require a great deal of our ingenuity as well as our hard work, because they are new not only to us in Asia but also to the rest of the world. In fact, we are pioneers in this type of regional cooperation in the field of the peaceful uses of nuclear energy for social and economic development. Other regions in the world, like Latin America, expect us to establish successful examples of regional cooperation for them to emulate. Therefore, we must continue our strenuous efforts in quest of better form and better framework for the regional cooperative activities we are going to undertake.

United, we shall continue to succeed.

On this memorable occasion, it is fitting and proper that we should all review our firm commitment to the further promotion of the peaceful uses of nuclear energy for the benefits of people in this part of the world. And let us hope that after another ten years from today, this session in Kuala Lumpur will be recalled as the session when we have taken an important step toward even more meaningful regional cooperation.

I, for one, intend to continue to make as much contribution as I can to such joint endeavours. In concluding, I wish to express my sincere hope for the successful conclusion of the present meeting. May I also wish every participant good luck!.

1983 RCA Cost Projection
(In US Dollars)

Title of Project	Research Contracts	1983 Project Meeting	Sub-Total
UNDP Project on Industrial Applications of Isotopes and Radiation Technology	-	-	2, 839,317
Regional Project on the Use of Induced Mutations for Improvement of Grain Legume Production	60,000	25,000	85,000
Regional Project on Food Irradiation	54,000	26,000	80,000
Regional Project for Improving Domestic Buffalo Production	24,000	25,000	49,000
Regional Project on Health-Related Environmental Research	55,000	19,000	74,000
Regional Project on Nuclear Instrument Maintenance	50,000	15,000	65,000
Regional Project on Isotope Applications in Hydrology and Sedimentology	55,000	-	55,000
Regional Project on Semi-dwarf Mutants for Rice Improvement	48,000	20,000	68,000
Regional Project on Radiation Sterilization of Biological Tissue Graft	25,000	14,000	39,000
Regional Project on Biogas from Agricultural Residues	45,000	20,000	65,000
Regional Project on Improvement of Cancer Therapy	50,000	15,000	65,000
Regional Project on Nuclear Medicine Methodology for Diagnosis and Treatment in Thyroid and Liver Diseases	45,000	15,000	60,000
Regional Project on Nuclear Techniques for Diagnosis of Parasitic Diseases	33,000	15,000	48,000
Regional Project on Development of Tc-99m General Systems	30,000	15,000	45,000
Working Group Meeting			4,000
			3,641,317

India's Special Contribution to RCA

India has always given strong support to RCA activities and has offered facilities for training in various areas of nuclear research and technology to scientists participating from the region. India is also actively participating in the various RCA programmes and is making significant contribution in kind to the Industrial project. In the tracer technology and radiation sterilisation sub-projects, Indian scientists accept a major share of the responsibility in organising the training programmes/demonstration workshops. This is also true for the demonstration programme of the nucleonic control system at the Bokaro Steel Plant.

In addition to the above, and in accordance with our interest in regional cooperation, and in the spirit with which we had earlier participated in the IPA programme, forerunner to the RCA, India will participate in well defined collaborative programmes with other RCA countries which aim to: -

- a) train manpower in basic sciences using nuclear techniques
- b) assist in the development of industrial or medical applications using radioisotopes and radiation.

As a measure of our keen support to RCA objectives, India is willing to contribute the equivalent of 50,000 dollars towards specific RCA activities as agreed upon. This contribution would be in addition to our voluntary contribution to the Agency and is intended to meet some of the expenditure towards

- a) exchange of personnel between participating countries
- b) supply of equipment required for collaborative programmes, training, irradiation charges, etc.

REVISED DRAFT

WORK PLAN FOR THE PROJECT ON
MEDICAL AND BIOLOGICAL APPLICATIONS OF NUCLEAR TECHNIQUES

The Project will be carried out in three phases:

- Phase I: Cooperative research projects to develop the most suitable techniques
1983-1985 for the region and general training for established techniques.
- Phase II: Training programmes to transfer the techniques established in Phase I.
1984-1987
- Phase III: Establishment of a demonstration training centre in the region
1986-1989 (subject to further assessment).

PHASE I (1983 - 1985)1. Radiation Therapy in Cancer

- a) Cooperative research project on the improvement of therapeutic gain using conventional machines by the study of irradiation schedules, combined treatments of radiation and chemical and/or physical means.

10 contracts over a 4-year term (1982 - 1985)	\$200,000
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4 coordination committees	<div style="border-top: 1px solid black; display: inline-block; width: 100%;">50,000</div>
	\$250,000

- b) Training workshop on "Radiation Therapy in Cancer". To be held in Japan in 1983, organized by JICA for RCA countries. The purpose will be to train medical doctors through lectures, visiting laboratories, information exchange, and discussions.

10-15 participants, 5 weeks 1983, Japan	<div style="border-top: 1px solid black; display: inline-block; width: 100%;">\$80,000</div>
	(JICA)

2. Nuclear Medicine for Liver and Thyroid Diseases

- a) Cooperative research project on the establishment of nuclear medicine methodologies for diagnosis and treatment of thyroid and liver diseases.

10 contracts over a 2-year term (1983-84)	\$100,000
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2 coordination committees	<div style="border-top: 1px solid black; display: inline-block; width: 100%;">30,000</div>
	\$130,000

b) Training workshop on "Nuclear Medicine". To be organized by JICA in 1984 for RCA to train medical doctors in nuclear medicine procedures.

10 - 15 participants, 5 weeks	\$ 80,000
(1984 Japan)	(JICA)

3. Nuclear Techniques for Tropical Parasitic Diseases

Cooperative research project to establish a final procedure for immunoradiometric assay for diagnostic tests in parasitic diseases, including schistosomiasis, filarias and malaria.

11 contracts for one year	\$33,000
Supply of antibody	5,000
Computer cost	3,000
Coordination meeting	15,000
Evaluation meeting	<u>15,000</u>
(1983 - 1984)	\$71,000

4. Preparation of radiopharmaceuticals

Cooperative research project on the development of a Tc-99m generator system using low specific activity (n, γ)-produced Mo-99 in low power reactors.

Research contracts over a 3-year term	\$ 105,000
Three coordination committees	45,000
Supply of two sets of prototype	20,000
(1983-1985)	<u>\$ 170,000</u>

PHASE II (1984-1987)

Training courses on sub-projects to transfer technology through training medical doctors and medical physicists who will be the core people in the respective countries.

1. Training workshops on radiation treatment of cancer of the uterus using remote and manual after-loading techniques

10 participants, four weeks	\$ 80,000 (1984)
Pakistan, where both manual and remote after-loading equipment is available	(including equipment)
(1984, Pakistan)	<u>\$ 80,000 (1986)</u>
(1986, Sri Lanka)	\$160,000

2. Training courses on diagnosis and cancer therapy by using CT and Linac for medical physicists and doctors

10 participants, 5 weeks	
(1985, Singapore)	\$ 80,000
(1987, Japan)	<u>80,000</u>
	\$160,000

3. Training courses on nuclear medicine for liver and thyroid diseases

15 participants, 6 weeks

(1984, Thailand)	\$ 90,000
(1985, Malaysia)	90,000
(1986 Indonesia)	90,000
(1987, Philippines)	90,000
	<hr/>
	360,000

4. Training courses on nuclear techniques for diagnosis of tropical parasitic diseases

15 participants, 2 weeks

(1985, Indonesia)	\$ 35,000
(1986,	35,000
	<hr/>
	\$ 70,000

5. Training courses on preparation, control, and utilization of ^{99m}Tc and ^{131}I labelled radiopharmaceuticals

15 participants, 5 weeks

(1985, Australia)	\$ 60,000
(1987, India)	60,000
	<hr/>
	\$120,000

6. Training courses on the preparation, control, and utilization of radioimmunoassay kits

15 participants, 5 weeks

(1984, Australia)	\$ 60,000
(1986, Malaysia)	60,000
(1987, Thailand)	60,000
	<hr/>
	\$180,000

PHASE III (1986-1989)

Establishment of a regional demonstration-training centre is the goal of Phase III. This centre will be used for systematic and continuous training of medical physicists, medical doctors and medical engineers in the fields of nuclear medicine, radiation therapy and radiopharmaceuticals.

The required equipment is listed below:

Linac	\$1,500,000
Y-camera	200,000
CT	900,000
Line for preparation of radioimmunoassay kits	150,000
Line for preparation of radiopharmaceuticals	100,000
	<hr/>
	\$2,950,000

Careful assessment of the centre should be made in terms of benefits, financial resources, location, maintenance capability and timing. A study mission planned by the Government of Japan to visit RCA countries in 1983 will provide useful information for this assessment. The experience gained in CRPs and training programmes should be reflected in the assessment. An experts team should be sent by IAEA to make a final assessment and to establish a project plan in 1986.

Experts mission for assessment and planning \$ 16,000

4 experts, 3 weeks

(1986)

SUB-PROJECT 1: RADIATION THERAPY FOR CANCER

	1982	1983	1984	1985	1986	1987	1988	1989	Project Cost (\$)
<u>PHASE I</u>									
			1						250,000
1. CRP on improvement of radiation therapy									
2. Training workshop on radiation therapy in cancer (JICA)		2							80,000 (JICA)
<u>PHASE II</u>									
			3		3				160,000
3. Training workshops on radiation treatment of cancer of the uterus									
4. Training courses on CT and Linac using existing facilities				4		4			160,000
5. Fellowships for 10 months training, 4 trainees per year					5				160,000
TOTAL									810,000

SUB-PROJECT 2: NUCLEAR MEDICINE, FOR LIVER AND THYROID DISEASES

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SUMMARY OF COMMENTS ON
THE DRAFT PROJECT PROPOSAL ON
"MEDICAL AND BIOLOGICAL APPLICATIONS OF NUCLEAR TECHNIQUES"

During the 4th RCA Working Group meeting, most representatives expressed the great interest of their respective countries in participating in this Project. Written confirmation of participation has been received from Indonesia, Japan, Republic of Korea, Malaysia, the Philippines, and Sri Lanka.

Regarding the Sub-project "Radiation Therapy in Cancer", it was pointed out that the timing for the establishment of a training-demonstration centre equipped with LINAC and CT should be carefully thought out in terms of financial resources for such a large investment and the capability of maintaining this sophisticated machine. The Governments of Indonesia and the Philippines have indicated that there might be a delay in their participation in this sub-project.

The necessity for longer training periods for medical doctors (10-month fellowships) in the area of radiation therapy and diagnosis by CT, was pointed out.

Meetings with officers of the Asian Development Bank (ADB) on
financial support of ADB to RCA activities

1. The objective of this one-day visit to ADB was to explore, on a preliminary basis, the possibility of ADB support to RCA activities, in particular the projects on medical and biological applications of nuclear techniques and on food irradiation.
2. I met with the following officials individually:
 - Mr. E. Watanabe, Co-Financing Manager
 - Dr. J. Madhab, Energy Advisor, Energy Planning Unit
 - Dr. A.I. Aminul Islam, Manager, Development Policy Office
(and two members of his staff)
 - Mr. G.H.P.B. Van Der Linden, Senior Project Economist
3. During all the above meetings, it was unanimously stated by ADB officials that the top priority in their loan and assistance policy is on subjects in the field of agriculture, such as the improvement of rice production. Starvation is still a very serious problem in developing countries in the region. The supply of electricity and water to the population is another important task.
4. The fields of medicine and health care are of comparatively low priority at ADB. ADB has provided some "soft loans" for very primary health care, for example the setting up of small house clinics, and the supply of primary pharmaceuticals.
5. It is the opinion of ADB officials that radiation cancer therapy and nuclear medicine are still too sophisticated to be considered for developing countries in the region. More than 50% of local patients still die of diarrhoea and pneumonia.

Mr. Watanabe stated that most of the patients in rural areas still cannot afford treatment in clinics or hospitals, so that nuclear medicine and radiation cancer therapy would benefit only a very limited number of (rich) people.
6. Great interest was expressed on the part of all ADB officials in food irradiation rather than medical applications of nuclear techniques.
7. Two kinds of loan are available from ADB:
 - i) a normal loan or "hard loan", with 7.4% interest p.a. and a pay-back period of 10 to 30 years;
 - ii) a soft loan, with 1.0% interest p.a. and a 40-year pay-back term. This type of loan is available only for Bangladesh, Pakistan, and Viet Nam among RCA countries, and much less is allocated to Indonesia, the Philippines and Thailand. This type of loan is not available to Malaysia, the Republic of Korea, and Singapore.

8. ADB has granted, from 1967 to 1980, \$60.8 million for technical assistance which is very little in comparison with the amount of loans. Technical assistance grants finance the preparation of activities for projects which may eventually receive bank loans. Preparatory activities include a feasibility study and planning of a project, and the grant is limited to less than \$350,000 per project.

9. ADB has also carried out technical assistance at a regional level in close cooperation with UNDP and other international agencies. Up to January 31, 1980, ADB had been involved in 60 regional technical assistance projects involving \$9.2 million, which is a very limited level.

10. Some of these technical assistance grants (up to 1978, \$1.8 million) have been used to support international research, mainly at the International Rice Research Institute (IRRI) in the Philippines and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT).

11. As can be seen from the above, technical assistance grants given by ADB are very limited and do not seem to be available for RCA. ADB officers pointed to UNDP as a more appropriate organization for RCA needs.

12. Dr. Islam mentioned that ADB is interested in a joint project with IAEA even if their technical assistance funds are limited.

13. It was requested that the revised project proposal on "Medical and Biological Applications of Nuclear Techniques" be forwarded to ADB for their consideration of possible support.

RCA SECOND EXTENSION AGREEMENT

Status as at 21 September 1982

1. The Agreement of 1 April 1982 to Extend the RCA of 1972 for a further five-year period with effect from 12 June 1982 (the RCA Second Extension Agreement, the text of which is attached) entered into force on 9 June 1982, pursuant to Article II, paragraph 2, upon receipt by the Director General of the IAEA of the notifications of acceptance from the following Governments Party to the RCA:

- Japan
- Singapore
- Sri Lanka.

2. Further notifications of acceptance of the RCA Second Extension Agreement were subsequently received by the Director General of the IAEA from other Governments Party to the RCA, on the dates indicated below:

- | | |
|-------------|--------------|
| - Australia | 16 July 1982 |
| - India | 20 July 1982 |
| - Indonesia | 10 June 1982 |
| - Malaysia | 15 June 1982 |
| - Pakistan | 29 July 1982 |
| - Thailand | 18 June 1982 |

3. It may be recalled that the original RCA of 1972 (reproduced in document INFCIRC/167) was in force between the IAEA and eleven Governments: Bangladesh, India, Indonesia, Republic of Korea, Malaysia, Pakistan, Philippines, Singapore, Sri Lanka, Thailand and Viet Nam.

4. The RCA First Extension Agreement of 1977 (reproduced in document INFCIRC/167/Add.8) was in force between the IAEA and the eleven original Parties listed above, plus Australia and Japan.

5. Thus, of the 13 Parties to the RCA as extended in 1977, four Governments have not yet notified their acceptance of the RCA Second Extension Agreement:

- Bangladesh
- Republic of Korea
- Philippines
- Viet Nam.

Annexes

SECOND AGREEMENT TO EXTEND THE REGIONAL CO-OPERATIVE AGREEMENT
FOR RESEARCH, DEVELOPMENT AND TRAINING RELATED TO
NUCLEAR SCIENCE AND TECHNOLOGY OF 1972

WHEREAS the International Atomic Energy Agency (hereinafter referred to as the "Agency") and the Governments parties to the Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology of 1972 (hereinafter respectively referred to as the "Governments" and the "Regional Co-operative Agreement") concluded an agreement to extend the Regional Co-operative Agreement for a period of five years with effect from 12 June 1977, which agreement entered into force on 23 September 1977 (hereinafter referred to as the "First Extension Agreement");

WHEREAS the First Extension Agreement is due to expire on 12 June 1982; and

WHEREAS the Agency and the Governments desire to extend the Regional Co-operative Agreement with effect from the date of its expiry for a further period of five years in view of its usefulness in providing a regional framework for co-operative projects and co-ordinated research programmes among interested Member States;

NOW, THEREFORE, the Agency and the Governments hereby agree as follows:

ARTICLE I

Extension of the Regional Co-operative Agreement

The Regional Co-operative Agreement shall continue in force for a further period of five years with effect from 12 June 1982. Unless otherwise agreed, all arrangements made in implementation of the Regional Co-operative Agreement shall continue in force during the extended period.

ARTICLE II

Entry into force

1. Any Government party to the Regional Co-operative Agreement may become a party to this Second Extension Agreement by notifying its acceptance thereof to the Director General of the Agency.

2. This Second Extension Agreement shall enter into force on the date of receipt by the Director General of the Agency of the second notification of acceptance. With respect to each Government accepting the Agreement thereafter, it shall enter into force on the date of receipt by the Director General of the Agency of the notification of such acceptance.

Done in Vienna, on 1 April 1982, in the English and French languages, both texts being equally authentic.

SECOND ACCORD PORTANT PROROGATION DE L'ACCORD REGIONAL
DE COOPERATION DE 1972 SUR LE DEVELOPPEMENT, LA RECHERCHE
ET LA FORMATION DANS LE DOMAINE DE LA SCIENCE ET DE LA
TECHNOLOGIE NUCLEAIRES

CONSIDERANT que l'Agence internationale de l'énergie atomique (ci-après dénommée "l'Agence") et les Gouvernements parties à l'Accord régional de coopération de 1972 sur le développement, la recherche et la formation dans le domaine de la science et de la technologie nucléaires (ci-après dénommés respectivement "les Gouvernements" et "l'Accord régional de coopération") ont conclu un accord portant prorogation de l'Accord régional de coopération pour une période de cinq ans à compter du 12 juin 1977, lequel est entré en vigueur le 23 septembre 1977 (ci-après dénommé "le Premier Accord de prorogation");

CONSIDERANT que le Premier Accord de prorogation vient à expiration le 12 juin 1982; et

CONSIDERANT que l'Agence et les Gouvernements souhaitent proroger l'Accord régional de coopération pour une nouvelle période de cinq ans à compter de sa date d'expiration, attendu qu'il offre un cadre régional utile pour des projets coopératifs et des programmes de recherche coordonnés entre les Etats Membres intéressés;

EN CONSEQUENCE, l'Agence et les Gouvernements conviennent de ce qui suit:

ARTICLE PREMIER

Prorogation de l'Accord régional de coopération

L'Accord régional de coopération demeure en vigueur pour une nouvelle période de cinq ans à compter du 12 juin 1982. A moins qu'il en soit convenu autrement, tous les arrangements pris en exécution de l'Accord régional de coopération demeurent en vigueur pendant la période de prorogation.

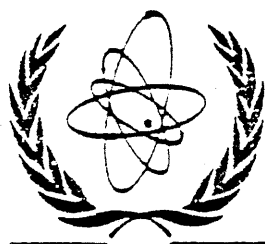
ARTICLE II

Entrée en vigueur

1. Tout Gouvernement partie à l'Accord régional de coopération peut devenir partie à ce Second Accord de prorogation en notifiant son acceptation au Directeur général de l'Agence.

2. Le présent Accord de prorogation entre en vigueur à la date de réception par le Directeur général de l'Agence de la seconde notification d'acceptation. Pour les Gouvernements qui acceptent ultérieurement l'Accord, celui-ci entre en vigueur à la date de réception par le Directeur général de l'Agence de la notification d'acceptation par chaque Gouvernement.

Fait à Vienne, le premier avril 1982, en anglais et en français, les deux versions faisant également foi.



International Atomic Energy Agency

Group of Experts on Nuclear Safety
Co-operation and Mutual Emergency
Assistance

Vienna, 28 June - 2 July 1982

N5-TC-478

2 July 1982

Original: ENGLISH

REPORT BY THE GROUP OF EXPERTS

I. INTRODUCTION

1. The Board of Governors of the International Atomic Energy Agency on 24 February 1982 adopted a resolution in which it requested the Director General:

- (a) To convene a group of experts designated by Governments, open to all Member States of the Agency, to study the most appropriate means of responding to the need for mutual assistance in connection with nuclear accidents and of facilitating appropriate international co-operation in the area of nuclear safety;
- (b) To arrange for the group of experts to begin its work as soon as possible; and
- (c) To report to the Board in February 1983.

2. The Group of Experts was convened at the Agency's Headquarters in Vienna from 28 June to 2 July 1982. It comprised experts from the following Member States: Argentina, Australia, Austria, Belgium, Brazil, Canada, Denmark, Egypt, Finland, France, Federal Republic of Germany, Hungary, India, Iraq, Italy, Japan, Republic of Korea, Mexico, Netherlands, Norway, Portugal, Saudi Arabia, South Africa, Spain, Sweden, Switzerland, Turkey, United States of America, Union of Soviet Socialist Republics and Yugoslavia. The meeting of the Group of Experts was also attended by observers from the Holy See, the United Nations Office of the Disaster Relief Co-ordinator (UNDRO) and the European Atomic Energy Community (EURATOM). The list of participants is attached to this report.

3. After the opening of the meeting on behalf of the Director General of the Agency by Mr. M. Rosen, Director of the Division of Nuclear Safety, the Group of Experts elected Mr. R. Rautiainen of Finland as Chairman of its meeting. Mr. H. Collins and Mr. Ha-Vinh Phuong of the Agency's Secretariat served as Co-Secretaries of the meeting.

4. The Group of Experts had before it working materials which included, inter alia, the following:

- A working paper presented by the United States of America;
- Document GOV/INF/392 to which were attached the drafts of four agreements reproduced from document GOV/1144 and presented to the Board of Governors in June 1966;

- The Nordic Mutual Emergency Assistance Agreement of 1963 in Connection with Radiation Accidents (INFCIRC/49);
- The Agency's Annual Report on Nuclear Safety covering the period 1980-1981 (GOV/INF/413).

The Group of Experts was also provided with a written statement of an expert from the United Kingdom of Great Britain and Northern Ireland.

5. In the course of the meeting, four Working Groups were established to consider respectively:

- Handling of on-site aspects of emergency;
- Handling of off-site aspects of emergency;
- Constraints and advance emergency planning; and
- Legal constraints and advance arrangements.

The Working Groups were respectively chaired by:

- Mr. F.C. Boyd, Canada;
- Mr. D. Beninson, Argentina;
- Mr. C.J. van Daatselaar, Netherlands; and
- Mr. R. Bettauer, USA.

6. On the basis of the reports prepared by the two Working Groups first mentioned above and in the light of discussion in plenary meetings, the two other Working Groups subsequently presented further reports for consideration by the Group of Experts. The contents of these reports as revised in plenary are reflected in parts II to IV below, followed by a Summary of the Recommendations by the Group of Experts in part V of this report.

II. THE NEED FOR ESTABLISHING MUTUAL EMERGENCY ASSISTANCE IN CONNECTION WITH NUCLEAR ACCIDENTS

A. Introduction

7. A nuclear accident which may have serious radiological consequences at one of the world's nuclear power stations, albeit of low probability, would require a substantial response effort to mitigate these consequences and to effect the recovery of both the plant and the off-site situation. This effort could tax the resources of a country experiencing such an accident. In many cases, such a response effort might well be beyond the capabilities of a country. Even highly developed countries with many nuclear power facilities and a large technical supporting infrastructure could find themselves hard-pressed to cope effectively with a nuclear accident, especially if it involves significant off-site radiological consequences. Some kind of external assistance enhancing the response capability would, therefore, appear to be desirable.

8. A nuclear accident in border areas could have serious radiological effects in the territories of neighbouring countries. Especially, in cases where the neighbouring country has no nuclear installation of its own, its capability of dealing with the situation would be limited.

9. All countries with major nuclear facilities should have a developed capability to respond to emergencies at their own facilities. The degree of development of the response capability should be adequate for the size of the nuclear programme. A country should, as a minimum, be able to mount a self-sufficient response during the early phase of an accident. Two to three days is about the minimum time that it would take to obtain substantial resources from outside the country requesting assistance. Small accident assessment teams should, however, be able to arrive sooner to help assess the situation and determine the needs. This could be done, for example, under the provisions of the Agency's existing Radiation Emergency Assistance Plan, initially established in 1959 and now in the process of being upgraded into a more comprehensive Nuclear Accident Assistance Plan (NAAP).

B. Timescale for Responding to an Emergency

10. The Agency's technical guidance publications identify three timescale phases associated with an accident at a nuclear facility. They are:

- The Early Phase: a period commencing with the onset of an accident or accident precursors, generally hours to one to two days;
- The Intermediate Phase: a period generally associated with recovery from the accident and extending from days to weeks after the early phase;
- The Late Phase: a period generally associated with recovery from the accident and extending from months to years.

11. The Group of Experts considers that the response to the early phase of an accident must depend upon the capability of the operating organization of the nuclear facility involved and the supporting national infrastructure for responding to emergencies. This assumes that the facility is operated by a competent organization and that adequate on-site and off-site emergency plans and preparedness are provided (such as are described in various IAEA documents).

12. Given the constraints of distance and communication, the Group of Experts considers that external emergency assistance can generally be provided only for the intermediate and late phases of the accident. Some external response, at the request of an affected country, might be possible during the early phase of an accident. The type of assistance

which might be rendered, however, would be limited to technical advice over existing communication links and, possibly, the sending of a small accident assessment team to assist in evaluating the situation and commencing the determination of needs.

C. The Needs and Sources of Assistance

(1) The Early Phase

13. Within the early phase of an accident, a number of short-term needs can be categorized in general terms. They are as follows:

- Technical advice (including advice on immediate protective measures which should be implemented both on-site and off-site)
- Special radiological monitoring (assessment of consequences both on-site and off-site)
- Special equipment and material
- Additional manpower
- Supplemental information processing and additional communication links
- Additional transportation
- Laboratory assistance (sample analyses)
- Additional security for control of access to the accident site and affected off-site areas
- Medical care.

14. Within the early phase of an accident, these needs must be met primarily from sources within the affected country. The ability to meet each of these specific needs is dependent upon the resources of the involved nuclear facility and its supporting governmental and private organizations. Examples of these organizations are:

- National laboratories
- Governmental agencies
- Nuclear facility operator organizations from other plants
- Industrial organizations
- Regulatory bodies
- Civil defence, police, fire brigades, military
- Universities and research facilities
- Local and central hospitals
- Vendors of nuclear steam supply systems (may be outside of the country)
- Commercial sources (may be outside of the country).

(2) The Intermediate Phase

15. Within the intermediate phase of an accident, the needs will be dependent upon the continuing course of the accident and the success in

mitigating its consequences during the early phase. The type of on-site intermediate needs, for a severe accident, will more than likely remain the same as the type of needs for the early phase. However, the amount or number of needs or requirements may be substantially higher during the intermediate phase.

16. With respect to off-site needs during the intermediate phase and depending upon the course of the accident in terms of the radioactive release and its distribution within the environment, substantial resources may be required. These may be mainly in the areas of monitoring equipment, radiological surveillance and sampling teams, assessment capability, implementation of protective measures, communications, temporary accommodation and provision of technical advice for recovery operations extending into the late phase.

17. Additional needs which may become important in the intermediate phase are in the areas of operations planning (extending into the late phase), computer assistance to process data, and waste management. These additional needs may be applicable to on-site recovery and possibly off-site recovery, extending into the late phase.

18. Within the intermediate phase of an accident, depending upon the internal resources available to the affected facility and country, some of these augmented needs may have to be met from external assistance. Potential sources of assistance for meeting these increased needs are:

- International organizations (such as IAEA, FAO, UNDRO, UNIDO, WHO, etc.)
- Foreign experts
- Foreign commercial and technical organizations.

Such sources could provide technical assistance, special radiological monitoring, special equipment or material, special laboratory facilities and special medical support facilities located in a few countries in the world.

(3) The Late Phase

19. If substantial resources are required during the intermediate phase of an accident, they are likely to continue to be required in the late phase of the accident as recovery from the accident proceeds. The needs in the late phase will depend upon the success achieved in mitigating accident consequences and effecting recovery operations during the intermediate phase. The resources that might be required in the late phase may be substantially the same as those in the intermediate phase, but may be of lesser order in such areas as implementation of certain immediate protective measures off-site which should have already been accomplished during the first two phases. On-site, needs are likely to be highly specialized during the late phase and to be oriented toward clean-up, equipment maintenance or replacement, specialized construction to effect long term recovery, and waste management considerations.

20. Additionally, during the late phase special confirmatory studies and assessments will undoubtedly have to be made, both on-site and off-site. Needs here will largely shift to the requirements for specialized experts to conduct such studies, possibly in rather esoteric fields. Desirably, the results of such studies should be shared with the international nuclear community in order to improve nuclear safety world-wide.

21. Finally, within the late phase of an accident, additional needs may develop to cope with the financial and legal aspects of the accident. It may be necessary for some of these additional needs to be met from sources outside of the affected country. The same potential external sources identified for the intermediate phase may also be able to provide assistance in the late phase. Assistance with financial and legal aspects may require special international considerations.

D. Constraints and Obstacles in Receiving or Providing External Assistance

22. The Group of Experts identified a number of constraints and obstacles in receiving or providing assistance. These constraints and obstacles comprise a spectrum of national, technical, social and political considerations. In considering these constraints and obstacles, the ways in which they might impact on both the potential recipient and the potential sources of assistance were considered and identified. Examples of potential sources of assistance that might be so affected are the vendors of nuclear steam supply systems, nuclear facility operator organizations, consultants, industrial organizations, international organizations, other governments and special medical centres and laboratories. The types of constraints and obstacles were listed by the Group of Experts. Some of these were identified as being fundamental obstacles which would preclude co-operation if not overcome through advance arrangements.

(a) Fundamental Constraints

- Financial (payment for services)
- Liability
- Commercial secrecy
- Political
- Unavailability of resources
- Lack of a national plan and organization for requesting and accepting assistance
- Lack of a qualified and knowledgeable source of assistance

(b) Other Constraints

- Logistics
- Customs/immigration
- Social differences
- Security
- National (local) laws and regulations
- Proper contacts
- Identification of who is able to help
- Bureaucracy
- Unavailability of technical information
- Unavailability of practical experience
- Vendors of nuclear facilities no longer in business
- Logistics and transportation
- Lack of clarity of responsibility or authority
- Lack of clarity of task definition
- Status of personnel/immunity

E. Means of Overcoming Constraints

23. The Group of Experts identified several mechanisms for overcoming these constraints. To be effective, these arrangements should be in place well before assistance might be needed. Most of the constraints identified as fundamental could probably be obviated by country to country or multinational arrangements. The nature of such arrangements is discussed in part IV of this report. Many of the other constraints could be minimized through advance planning on the part of both potential recipient and assisting countries. This should be supplemented by commercial arrangements between the operator of the facility and the vendor or other commercial technical organizations capable of providing the type of assistance likely to be required. Aspects of advance planning are discussed in part III of this report. A specific area where the Agency could take action is the identification and cataloguing of potential sources of assistance.

24. Although the Group of Experts considered it to be beyond its terms of reference, it concluded that it would be worthwhile to investigate some international and other cost-sharing mechanisms to help mitigate the severe financial consequences of a nuclear accident.

F. Receiving and Providing External Assistance

25. The Group of Experts agreed that any assistance provided from outside the country must be fully integrated into the recipient country's national emergency plan. This implies the need for prior planning and arrangements in both the potential recipient country and the potential assisting country. However, the way in which assistance will be received or provided may only have to be addressed in terms of organizational

considerations, that is to say, only as regards the manner in which the additional resources would be integrated into an already existing infrastructure.

26. These extra-territorial emergency plans should be subjected to tests and exercises at appropriate intervals. Otherwise, there would be many practical problems associated with co-ordination and interfacing the assistance into the national plans, arising from such factors as language, different basic philosophies and approaches to safety management, or non-compatible equipment such as in the areas of communication equipment and computers.

27. The Group of Experts also considered how the provision of assistance could be facilitated and organized. In addition to the considerations discussed in the following parts of this report, it was agreed that any external assistance received would need to be under the same chain of command and control that exists in the recipient country's emergency preparedness organization and programme, and that the assistance provided be integrated into this organization and programme.

III. ADVANCE EMERGENCY PLANNING REQUIREMENTS AND THE ROLE OF THE AGENCY

A. Assumption

28. Each reactor facility is licensed to operate by its national authority using codes and guides set forth in NUSS and other documents published by the Agency. This includes, e.g., that adequate on-site and off-site emergency planning and preparedness are provided and accepted by local or national authorities.

29. Each State and operator will apply resources to develop and maintain adequate emergency preparedness both off-site and on-site.

B. General Consideration

30. In principle, national authorities are expected to be prepared to deal with the effects of radiation accidents. However, where national resources may require reinforcement or are not available, it will be prudent to plan for obtaining adequate and timely external assistance.

31. Preparedness plans including communication facilities should be tested and exercised, and this includes the testing of arrangements for obtaining bilateral and/or multilateral external assistance.

C. General Considerations for Pre-Planning for External Assistance

32. (a) Pre-planning and testing are necessary for both potential requesting and assisting States.

- (b) Responders to requests for on-site assistance need to be familiar with the installation prior to arriving to assist during an emergency.
- (c) For responders to requests for off-site assistance some knowledge of the site area could be needed.
- (d) Talents required (professional qualifications) and materials needed to mitigate the consequences of an accident should be unambiguously defined by the requesting State. (For potentially impacted States, see section E below.)
- (e) Relevant standards in use by the requesting State, both on-site and off-site, should be clearly defined for use by the responding party.

33. The lines of authority and responsibility between the requesting and assisting parties should be defined. The assisting party should be subject to the direction of the requesting party in the performance of the tasks agreed upon.

34. The definition of each task to be performed by the assisting party should be as specific as possible in order to optimize the response effort and define when each task is completed. This degree of definition is necessary to decide when the assisting party has completed the tasks and is then able to recover from the assistance mode.

35. All States should establish specific modalities for requesting external assistance (for example, by designating the Department or Ministry of Foreign Affairs as the sole authorized channel for such requests) and make corresponding arrangements for focal points to deal with requests which may be received. External assistance in this context includes that which may be requested from IAEA and UNDRO (for technical and non-technical assistance respectively). The Memorandum of Understanding between IAEA and UNDRO covers inter-agency procedures.

D. Required Areas for Pre-Planning for External Assistance

36. It is anticipated that States and operators may need external assistance in order to cope with an accident at a nuclear facility. The assistance may be needed to:

- assess the possible in-plant development of the accident and mitigate its consequences;
- aid in performing the radiological surveillance of the environment as an input for decisions for protective measures; and
- aid in decontamination and recovery operations.

This may include some types of non-technical assistance.

(1) Operator/Industry Arrangements

37. The operating organization should include in its on-site emergency plans all pre-arrangements with vendors and any industry groups that would be required by the operator on-site in the event of an accident at the facility. These pre-arrangements should remain in effect for the operating life of the facility.

38. A concern was the role of the foreign reactor supplier, particularly in the situation where a foreign reactor vendor goes out of business. Thought needs to be given on how to assure the continued availability of technical advice to the customer in the event of a nuclear emergency.

(2) National Planning

39. The emergency plan for coping with an accident with off-site consequences should include pre-arrangements for any external support being supplied in response to a request.

(3) IAEA Planning

40. Generally, the role of the Agency should remain as advisory to Member States as well as being the repository of factual information regarding the availability of resources. Specifically, the Agency should consider the following roles or tasks, working where necessary in association with UNDRO as foreseen in their Memorandum of Understanding:

(a) Continue to provide assistance to Member States in planning, arranging for and evaluation of exercises;

(b) Offer assistance in the development of (and act as repository for) arrangements between or among Member States for assistance;

(c) Develop guidance for use by Member States in integrating external assistance into their preparedness planning;

(d) Maintain and update information on actual implementation of pre-arranged assistance between or among Member States.

E. Special Planning Considerations

41. In cases where serious accidents at nuclear power plants may have significant radiological impact in other States, special planning considerations need to be recognized and resolved. Issues such as establishing a threshold of reportable events, integrated planning and information exchange need prior arrangements.

Recommendation

The Group of Experts recommends that the Agency consider establishing an expert group to advise the Agency on this matter.

IV. LEGAL CONSTRAINTS AND ADVANCE ARRANGEMENTS

42. The Group of Experts reviewed the legal constraints that could impede the provision of foreign assistance to a State faced with a nuclear emergency and formulated recommendations that could be proposed to the Board of Governors on the most appropriate means for overcoming these impediments.

A. Multilateral Agreement or Less Formal Document

43. While the Group of Experts recognized that a multilateral agreement regulating in advance the legal framework to be applied in the event of emergency assistance might be more effective in removing impediments to the provision of emergency assistance, the Group believed negotiation of a multilateral agreement would take time.

44. Instead, the Group of Experts agreed to recommend that the Board of Governors consider the prompt development of a document setting forth terms and conditions that could be applied to emergency assistance. Such a document would be published as an IAEA/INFCIRC document. The provisions in the document (a) could serve as a model for the negotiation of bilateral or regional agreements, which are to be encouraged, and (b) could readily be agreed to by special agreement between a requesting and an assisting State at the time of a nuclear emergency. It was believed that the development of such a document would be simpler and more rapid than that of a multilateral agreement, particularly because of its lesser degree of formality. This effort was considered necessary, despite the existence of GOV/1144 and INFCIRC/49, in order to provide an updated model that could readily be drawn to the attention of States, and to develop a comprehensive single set of provisions available for use in emergencies by States not parties to other arrangements.

45. The Group of Experts believed that such a document could be of significant value in overcoming in advance the potential legal impediments to external nuclear emergency assistance and was the most appropriate means of responding to the need identified in this area. After this document is completed, it may be appropriate to consider negotiation of a multilateral agreement.

B. Provisions in Document

46. The Group of Experts agreed that the provisions in the document would apply to State conduct and not specifically to private entities, although they would affect private persons and entities. The Group

recognized that the States concerned would retain their freedom to agree where they deem it appropriate to vary any of the provisions or apply different provisions.^{1/} Further, the Group of Experts agreed that it should be made clear in the document that no State was required to request, provide or accept assistance.^{2/}

47. The Group of Experts agreed that the document should contain, inter alia, provisions on the following matters:

(a) Responsibility for costs ^{3/}

The Group of Experts agreed that the general rule should be that the requesting State is responsible for all costs involved in the assistance and should reimburse any assisting party for its costs, unless the assisting party waives reimbursement. However, it was noted that it may be desirable to provide that the assisting party would assume certain costs, e.g. costs within its territory and salaries of its government personnel. It was also noted that private entities might not provide assistance unless they were guaranteed payment and that some form of advance guarantee arrangement or fund might be considered.

(b) Liability ^{4/}

The Group of Experts agreed that a party providing assistance should be legally protected from liabilities that might arise out of the assistance.

(c) Information provided in confidence

The Group of Experts agreed that information provided in confidence in connection with the emergency assistance - such as commercial, proprietary, diplomatic or physical protection information - should be protected from disclosure by the recipient of the information and should not be misused. It was noted that appropriate regulatory use of such information would not be precluded.

^{1/} See GOV/1144, Annex I, Art.I.3.

^{2/} See Ibid. Art.I.2.

^{3/} See INFCIRC/49, Art.III, and GOV/1144, Annex I, Art.V.

^{4/} See INFCIRC/49, Art.IV.

(d) Public statements 5/

The Group of Experts supports the concept, expressed in earlier documents, that there should be only one point of release of information to the public on any serious nuclear accident, and that the source of such information should be designated by the authorities of the country in which the accident took place. It recognized, however, that assisting countries may have a need to make a public report, for example to their legislative body, and recommends that this be taken into account without deviating from the above principle.

(e) Facilities, privileges and immunities

The Group of Experts agreed that provisions on this subject should be developed, taking into account the Nordic Agreement 6/, GOV/1144 7/ and the Agreement on the Privileges and Immunities of the Agency (INFCIRC/9/Rev.2) 8/.

(f) Point of contact and competent authorities 9/

The Group of Experts agreed that there should be provisions for specification by participating States of the appropriate initial points of contact and, if different, of the appropriate channels for subsequent communications. There should also be provision for advance notification of competent national authorities.

(g) Direction and control of assistance 10/

The Group of Experts agreed that the overall control of and responsibility for the assistance should rest with the requesting State.

(h) Equipment

The Group of Experts agreed that a provision on the final disposition of equipment provided by an assisting party should be developed, taking into account the Nordic Agreement 11/ and GOV/1144. 12/

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- 5/ See INFCIRC/49, Art.VII, and GOV/1144, Annex I, Art.VII.
6/ INFCIRC/49, Art.VI.
7/ Annex I, Art.VI.
8/ See Art.VI and Art.VII.
9/ See INFCIRC/49, Art.V, and GOV/1144, Annex I, Art.IV.
10/ See INFCIRC/49, Art.I.1, and GOV/1144, Annex I, Art.II.1.
11/ INFCIRC/49, Art.I.2.
12/ Annex I, Art.II.4.

(i) Local facilities

The Group of Experts agreed that a provision specifying that the requesting party would provide local facilities was needed and should be developed, taking into account the Nordic Agreement 13/ and GOV/1144./14/

(j) Use of assistance

The Group of Experts agreed that a provision restricting the use of assistance to the purpose for which it was provided, along the lines of that in GOV/1144 15/, was appropriate.

(k) Role of the IAEA

In view of the Agency's statutory role in the field of nuclear safety, it was agreed that an appropriate provision identifying the Agency's possible functions should be developed. It was noted that in the event of bilateral political impediments, the Agency's good offices might be used to arrange assistance.

(l) Termination of assistance

The Group of Experts agreed that a provision on this subject should be developed, taking into account the Nordic Agreement 16/ and GOV/1144. 17/

48. It was suggested that if the provisions in the document were incorporated into a regional agreement, it would be useful to include a provision calling upon States to facilitate the movement through their territories of people and equipment involved in nuclear emergency assistance.

49. The Group of Experts recognized the importance of provisions on (a) exchanges of appropriate emergency planning information, and (b) notification by a State in which a nuclear accident occurs to other States which might be affected. The Group stressed the need for increased co-operation between States, particularly through the Agency, in the exchange of information and consultations on the design, maintenance and improvement of systems and equipment to enhance the safety of nuclear installations.

13/ INFCIRC/49, Art.I.3.
14/ Annex I, Art.II.2.
15/ Annex I, Art.II.3.
16/ INFCIRC/49, Art.X.
17/ Annex I, Art.IX.

Recommendation

50. The Group of Experts recommends that the Board of Governors consider the early preparation of a document of the type described in paragraph 44 above, with provisions as described in paragraphs 46 to 49 above.

V. SUMMARY OF RECOMMENDATIONS

51. The Group of Experts recommends that:

A. The IAEA, where necessary in co-operation with UNDRO -

1. Continue to provide assistance to Member States in emergency response planning and preparedness, arranging for and evaluation of exercises (see paragraph 40);
2. Offer assistance in the development of (and act as repository for) arrangements between or among Member States for mutual emergency assistance (see paragraph 40);
3. Maintain and up-date information on actual implementation of pre-arranged mutual emergency assistance between or among Member States (see paragraph 40);
4. Develop guidance for use by Member States on -
 - (a) General considerations for pre-planning by both potential requesting and assisting parties for external assistance (see paragraphs 32 to 35);
 - (b) Required areas for pre-planning by both potential requesting and assisting parties for external assistance, including the integration of external assistance into national preparedness planning (see paragraphs 25 to 27 and 36 to 39);
5. Identify and categorize potential sources of assistance (see paragraph 23);
6. Establish an expert group to advise the IAEA on the need for prior arrangements on issues such as establishing a threshold of reportable events, integrated planning and information exchange in cases where nuclear accidents may have significant radiological impact in other States (see paragraph 41);
7. Investigate international and other mechanisms to help mitigate the severe financial consequences of a nuclear accident (see paragraph 24).

B. The Board of Governors consider -

1. The prompt development of a single set of provisions setting forth the terms and conditions that could be applied to emergency assistance, that would include the provisions outlined in paragraphs 46 to 49 of this report and that could be in the form of an IAEA/INFCIRC document which could (see paragraph 44) -
 - (a) serve as a model for the negotiation of bilateral or regional agreements, which are to be encouraged; and
 - (b) be readily agreed to between a requesting and an assisting State at the time of a nuclear emergency;
2. The appropriateness of negotiating a multilateral agreement on mutual emergency assistance in connection with nuclear accidents, after completion of the document mentioned in paragraph B.1 above (see paragraph 45).

Attachment: List of Participants
(Issue No. 3, 2 July 1982)



INTERNATIONAL ATOMIC ENERGY AGENCY
AGENCE INTERNATIONALE DE L'ENERGIE ATOMIQUE
МЕЖДУНАРОДНОЕ АГЕНТСТВО ПО АТОМНОЙ ЭНЕРГИИ
ORGANISMO INTERNACIONAL DE ENERGIA ATOMICA

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IN REPLY PLEASE REFER TO:
PRIERE DE RAPPELER LA REFERENCE.

Department of Research and Isotopes
Department of Technical Co-operation

RCA Meeting

21 September 1982

Hofburg, Vienna

The attached draft report is being submitted for the information and comments of participating RCA States. The next draft, reflecting comments and suggestions for change received by the RCA Secretariat by 6 October 1982, will be issued as a status report for the information of the Technical Assistance and Co-operation Committee of the Board of Governors as part of the documentation being prepared for its meeting in November 1982.

DRAFT REPORT
TO THE
TECHNICAL ASSISTANCE AND CO-OPERATION COMMITTEE
OF THE
BOARD OF GOVERNORS

STATUS OF ACTIVITIES INITIATED UNDER THE REGIONAL CO-OPERATIVE AGREEMENT
FOR RESEARCH, DEVELOPMENT AND TRAINING RELATED TO NUCLEAR SCIENCE AND
TECHNOLOGY (RCA) IN THE ASIA AND PACIFIC REGION

Vienna, September 1982

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SUMMARY

In the nuclear field co-operation between countries in the Asia and Pacific region took place for the first time, in a regional context, under the IPA (India, Philippines and Agency) Agreement governing a programme of training and research in solid-state physics, 1964-1969. The success of this programme led to the formulation and acceptance of the Regional Co-operative Agreement (RCA) for Research, Development and Training Related to Nuclear Science and Technology. The Agreement came into force in June 1972 for a period of five years, and its validity has been extended twice. By March 1976 the following 11 States had become parties to the RCA Agreement: Bangladesh, India, Indonesia, Republic of Korea, Malaysia, Pakistan, Philippines, Singapore, Sri Lanka, Thailand and Viet Nam. Australia and Japan became RCA countries in 1977 and 1978, respectively.

Representatives of the participating countries make up the RCA Working Group which meets annually to review the progress of on-going, and proposals for new, co-operative projects in preparation for the RCA Meeting which is held each year during the Agency's General Conference. The Agency provides a scientist on its staff who serves as the RCA Co-ordinator; this person acts as the secretary for RCA organs and co-ordinates projects activities with the technical officers designated by the Agency to provide expertise in the implementation of individual projects. Beginning in 1978 the Agency has made funds available for RCA projects under its research contract and technical co-operation programmes. It has also helped in obtaining funds from other sources.

Any Member State in the region can become a party to the RCA Agreement, and any party can initiate a co-operative project. If at least two parties are interested in a proposal, they and the Agency meet to negotiate a project agreement. Other RCA countries may subsequently join a co-operative project, on the consent of the parties already participating in the project.

The first RCA co-operative project was initiated in 1975: "Research on the use of ionizing radiation for the preservation of fish and fishery products". No new co-operative project was initiated until 1978, when the first "RCA budget" was made available by the Agency. There are at present

nine active co-operative projects, including the industrial applications project supported by UNDP (United Nations Development Programme).

In 1978, \$98 000 was made available under the Agency's regular programme of technical co-operation, to finance a survey to determine the extent of interest on the part of RCA countries for a regional project to demonstrate isotope and radiation techniques in industry. Before this, the largest sum allocated to a RCA co-operative project under the Agency's research contract programme was \$30 000/year.

During the period 1979-1982 Australia and Japan contributed A\$425 000 and US\$491 000, respectively, in support of RCA co-operative projects. The survey of industrial applications, completed in 1980, led to a request to UNDP for large-scale assistance. UNDP provided funds for preparatory assistance, to formulate the project and to facilitate negotiations with participating countries concerning their financial commitments to the project. On 1 April 1982 the large-scale UNDP industrial applications project became operational in the areas of tracer technology, non-destructive testing, radiation technology, nucleonic control systems, and nuclear instrument maintenance, involving a composite budget of \$12 462 000.

The UNDP project is based on a "network system" approach, whereby a centre of excellence in one of the participating countries is designated as the "lead institute" in respect of a given activity; centres in the other participating countries are linked to individual sub-projects and second staff to take part in on-the-job and other training foreseen for a given sub-project, thereby making up the balance of the network of participating centres. The experience gained during the coming three years will reveal how effective the network system is in a regional context. One alternative would be the establishment of a regional centre that would specialize in advanced nuclear and other modern technologies of proven value. A decision on the direction RCA regional co-operation should take in the future, that is, concerning any change from present practice in the organization and implementation of co-operative activities, is not likely to be taken before 1985.

A. HISTORY

1. Regional co-operation can be likened to a young tree that has been planted in new ground; it takes time to take root and needs nourishment to thrive. A fore-runner of the Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (the Agreement and the States party to it are referred to as "RCA") was the IPA (India, Philippines and Agency) Agreement concluded in 1964, the text of which is reproduced in document INFCIRC/56, calling for intercountry co-operation in a five-year programme of training and research in solid-state physics using a neutron crystal spectrometer and expert services provided by the Government of India. This programme was hosted by the Philippines, and other RCA countries participating at one time or another were Indonesia, Republic of Korea and Thailand.

2. Upon the successful completion of the IPA Programme meetings were held to determine the extent of interest of countries engaging in other regional co-operative activities in the nuclear field. As a result of Agency-sponsored meetings held in Manila in March 1969 and in Bangkok in July 1970, the original RCA Agreement was formulated, the text of which is reproduced in document INFCIRC/167; it entered into force 12 June 1972 for a duration of five years. By March 1976 the following States had become RCA countries: Bangladesh, India, Indonesia, Republic of Korea, Malaysia, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, and Viet Nam.

3. The RCA required its first five years to take root. During this initial period various project proposals for regional co-operation were discussed. On the organizational side, the RCA countries decided to hold regular annual meetings scheduled to coincide with sessions of the Agency's General Conference, at which time on-going activities are reviewed, future plans are discussed and the work plan for the next year is agreed. On its part, the Agency designated a scientist in the Division of Research and Laboratories to serve as RCA Co-ordinator; this official's office has also functioned as the RCA secretariat. The validity of the RCA Agreement was extended for five more years as from 12 June 1977 (see document INFCIRC/167/Add.8).

4. Any Member State in the Asia and Pacific region can become a party to the Agreement, and any party can initiate a co-operative project by means of a

written proposal to the Agency; the IAEA can also initiate project proposals. If at least two parties are interested in participating in such a project the Governments and the Agency initiate negotiations with a view to establishing the project. Given the consent of the parties to an established project, any other State may also participate. The Agency's involvement - other than providing administrative support - has consisted of making funds available under its research contract and technical co-operation programmes.

5. Australia and Japan became RCA countries in 1977 and 1978, respectively.

6. Although the first regional co-operative project was initiated in 1975 (Research on the use of ionizing radiation for the preservation of fish and fishery products), it was only in 1978 when \$100 000 was made available for RCA activities in the Agency's regular budget, that the RCA began to grow. Funds ranging from \$20 000 to \$30 000 were provided for four co-operative research projects in 1978 plus \$98 000 under the Agency's regular programme of technical co-operation for a survey in RCA countries to determine the demand for a regional project to demonstrate isotope and radiation techniques in industry. The survey of industrial applications, completed in 1979, led to the submission of a request for assistance from the United Nations Development programme (UNDP); UNDP approved funds for preparatory assistance, commencing in 1980, to formulate a large-scale project and to allow opportunity for the negotiation of agreements with participating countries governing their financial commitments to the project. On 1 April 1982 the UNDP-supported industrial applications project became operational.

7. The validity of the RCA Agreement was extended for a further period of five years as from 12 June 1982. The present composition of RCA is as follows:

Australia	Republic of Korea	Singapore
Bangladesh	Malaysia	Sri Lanka
India	Pakistan	Thailand
Indonesia	Philippines	Viet Nam
Japan		

B. OBJECTIVES AND PRIORITIES*

8. The objectives of RCA are defined as increasing economic growth and social improvement through:

- Improvement of Member State infrastructure and development of trained manpower;
- Improved health care;
- Creation of new jobs;
- Improved industrial productivity through increasing use of modern technology;
- Increased rural development through improvement of agro-based industries; and
- Improved environmental quality.

9. Regional priorities were determined to be highest in the following areas:

- Manpower development;
- Increased acceptance of modern industrial technology;
- Increased food production;
- Increased development of natural resources;
- Energy and raw materials savings; and
- Social gains, including improved health care, increased employment and environmental quality.

10. The RCA is of particular value in facilitating co-operative projects on a regional basis, through co-ordinated collaboration among participating States in areas of common interest and the optimal utilization of resources with avoidance of duplication of effort.

C. CO-OPERATIVE ACTIVITIES

11. Major efforts of RCA are directed to promoting the transfer of modern nuclear technology in the areas of food and agriculture, health care, and industrial development. The titles of active co-operative projects and participating countries are listed in Table 1. The allocation of funds for RCA co-operative projects during 1978-1982 is given in Table 2, whereas the distribution of project funds in 1982 and estimated fund allocations for 1983-1986 can be found in Table 3.

*These were adopted at the RCA Meeting held in December 1979.

Table 1

RCA REGIONAL CO-OPERATIVE PROJECTS

Title of regional co-operative project	Participants												
	Australia	Bangladesh	India	Indonesia	Japan	Korea, Rep.	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	
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	
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	
7. Isotope applications in hydrology and sedimentology		X			X		X	X				X	
* 8. Semi-dwarf mutants for rice improvement			X	X	X	X	X	X	X		X	X	X
9. Industrial applications of isotopes and radiation technology (UNDP)		X	X	X	X	X	X	X	X	X	X	X	

* Agreement is under negotiation with participating countries.

Table 2

FUNDS ALLOCATED FOR RCA ACTIVITIES 1978-1982
(in US dollars)

Research projects	1978	1979	1980	1981	1982	Total
Use of induced mutations for the improvement of grain legume production	19 000	49 309	49 200	81 500	71 000	270 009
Food irradiation	8 000	27 400	76 000	80 000	80 000	271 400
Use of nuclear techniques in improving buffalo production	28 000	50 243	50 200	70 700	52 000	251 143
Radiation sterilization of medical supplies	-	30 000	51 000	35 000	39 000	155 000
Health-related environmental research	18 260	6 000	20 000	44 000	48 000	136 260
Maintenance of nuclear instruments	-	52 700	47 500	53 500	65 000	218 700
Neutron scattering	27 500	35 400	23 000	12 700	-	98 600
Isotope applications in hydrology and sedimentology	-	74 447	105 300	105 000	95 000	379 747
Semi-dwarf mutants for rice improvement	-	-	-	-	50 000	50 000
RCA Working Group meeting	-	-	-	3 600	4 000	7 600
Sub-Total	100 760	325 499	422 200	486 000	504 000	1 838 459
UNDP industrial project	-	13 535	123 798	2 294 032	2 886 279	5 317 635
TOTAL	100 760	339 034	545 998	2 780 032	3 390 279	7 156 094

Table 3

FUNDS ALLOCATED FOR 1982 AND SCHEDULED FOR RCA ACTIVITIES 1983-1986
(in US dollars)

Title of project/activity	Technical Project Officer or Co-ordinator	1982		1983-1986
		Operational activities	Co-ordination meeting	
Use of induced mutations for the improvement of grain legume production	A. Micke	46 000	25 000	140 000
Food irradiation	P. Loaharanu	54 000	26 000	400 000
Use of nuclear techniques in improving buffalo production	B. Young	32 000	20 000	260 000
Radiation sterilization of medical supplies	R. Mukherjee	25 000	14 000	39 000
Health-related environmental research	S. M'Baku	48 000	-	48 000
Maintenance of nuclear instruments	P. Vuister	50 000	15 000	65 000
Isotope applications in hydrology and sedimentology	B. Payne	77 500	17 500	95 000
Semi-dwarf mutants for rice improvement	T. Kawai	30 000	20 000	50 000
Biogas from agricultural residues	D. Lindquist	(no funds are available for this project)*		
RCA Working Group meeting	S. Machi	-	4 000	4 000
Industrial application of isotopes and radiation technology (UNDP)	E. Fowler	2 886 279	-	2 886 279
	TOTAL	3 248 779	141 500	3 390 279
				8 709 699

* \$65 000 was budgeted for project activities in 1982 and \$250 000 in respect of 1983-1986.

D. FINANCING

12. RCA activities have been and/or are being supported from various sources:

- a) Research contract funds from the Agency's regular budget for co-ordinated research programmes;
- b) Special cash contributions made by RCA countries. So far, Australia and Japan have made funds available for research projects and the UNDP-supported industrial project;
- c) Contributions in kind from RCA countries, consisting mainly of the services of lecturers and facilities for training courses as well as cost-free experts and fellowships;
- d) Assistance provided under the Agency's regular programme of technical co-operation; and
- e) UNDP funds for the industrial project.

13. Special cash contributions made by the Governments of Australia (in Australian dollars) and Japan (in US dollars) have been in support of the following projects:

Research projects*:

	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>Total</u>
Australia	80 000	100 000	100 000	65 000	345 000
Japan	46 000	76 000	80 000	80 000	282 100

UNDP industrial project:

Australia**	-	80 000	80 000
Japan***	85 000	118 000	203 000

*The major share of Australia's contribution is in support of isotope hydrology activities, whereas Japan's contribution is being used primarily for the food irradiation project.

** Australia is scheduled to contribute a total of A\$655 000 over the 6-year period 1982-87.

***Japan is expected to contribute a total of US\$1 838 195 in cash and in kind over the 5-year period 1981-86.

14. Of the total cost of RCA activities totalling \$7 156 094 from 1978 to 1982, approximately 55% was funded by Member States' contributions, 17% was funded by IAEA and 28% was funded by UNDP.

E. OPERATIONS

15. The timing of the annual RCA Meeting is mentioned in paragraph 3, and in paragraph 4 the modalities for initiating co-operative projects is outlined.

16. RCA Working Group meetings are also held annually on a rotating basis to review progress, discuss new proposals and formulate future work plans from administrative and scientific points of view. The results of the Working Group meeting are reported to the next RCA Meeting for consideration and acceptance.

17. The Scientific Co-ordination Committee is composed of senior scientists from RCA countries participating in co-operative projects. The work of this Committee includes information exchange on the scientific and technical results of projects and discussions of future work plans.

18. The RCA Co-ordinator is responsible for administrative and scientific co-ordination; he also directs the IAEA technical officers responsible for RCA projects and organizes RCA Meetings and Working Group meetings.

F. INFORMATION AND CURRENT CO-OPERATIVE RESEARCH PROJECTS

Research project on food irradiation (RPFI)

19. Background: Examples of the target food items of interest to countries in the region are fishery products, tropical fruits, onions and spices. It is hoped that pilot-scale studies will reveal the viability of introducing this technology on a commercial scale.

20. Fishery products provide the most important source of animal protein to the population of RCA countries. Through reduction of losses, especially of dried and cured fish which is widely consumed in tropical regions, food irradiation could assist in increasing the availability of fishery products to a larger segment, and at a price within reach of all sectors, of the

population. Through increasing shelf-life, the technology could assist in the wider distribution of fishery products in most countries.

21. Tropical fruits are normally infested by fruit flies which result in import restrictions in countries such as Australia, Japan, and the USA. Research conducted under the RPFI and elsewhere shows that irradiation provides a good alternative to the present practice of chemical fumigation to satisfy quarantine restrictions. In addition, the chemical fumigation of fruit is likely to be phased out in the near future owing to environmental and health considerations.

22. Food exports from RCA developing countries, such as spices and frozen seafood, are often rejected by authorities in advanced countries because of poor hygienic quality. Some of these problems could be solved by eliminating pathogenic micro-organisms and other undesirable organisms in the products by irradiation.

23. In most RCA countries there is only one onion crop per annum. Irradiation and proper storage have shown to be effective in ensuring a supply of this commodity for much of the year.

24. Achievements to date: results obtained under laboratory and pilot-scale research have shown that:

- a) irradiation (dose rate: 0.5 kGy) plus mild heat treatment is effective in killing various developments of fruit flies as well as destroying disease associated with the rotting of mangoes;
- b) insect infestation of dried fish can be effectively destroyed by low-dose irradiation (0.3 kGy); the shelf-life of semi-dried fish can be extended significantly by irradiation (2-3 kGy);
- c) irradiation at 10 kGy maximum resulted in improving hygienic properties of spices which comply with standards in importing countries; this dose level produces no chemical changes in the organoleptic properties of spices; and
- d) low-dose irradiation (0.1 kGy) of onions plus cool storage (10° C) resulted in a good quality product up to six months.

Research project on improving buffalo production

25. Background: The programme is multi-disciplinary with an overall goal of improving productivity of domestic buffalo. It incorporates studies on reproduction, nutrition and parasitic diseases of buffalo in relation to production of meat, milk and draught power. Among the initial goals of the programme was the encouragement of greater awareness among researchers of (i) the significance of each other's fields of research and (ii) the importance of integrated research in achieving progress in applied research.

26. The first research co-ordination meeting (RCM) was held in Sri Lanka in June 1979 and identified priority areas for the application of nuclear research techniques. The second RCM was held in March 1981 at the Chulalongkorn University Bangkok, Thailand; the third RCM was hosted by the University of Pertanian, Malaysia, in April 1982.

27. Achievements to date: Substantial progress has been made in all areas of the programme, particularly in reproduction, where working assays for different steroid hormones have been established in Sri Lanka, Malaysia, Thailand, India, the Philippines and Indonesia and are now being used for measurement of corpus luteum activity. Additionally, a quality control programme for various hormone assays which was initiated at the 1981 RCM in Bangkok is now running smoothly, with the result that it is now possible to ensure comparability of results between laboratories within as well as outside of the co-ordinated programme. Considerable information is now also available on the utilization of straw-based diets for buffalo, and on the beneficial effects on digestibility of treating the straw with urea. In addition, isotope-based studies have been implemented on the use of urea/molasses in straw-based diets; on the use of sweet potato, hay and fishmeal as supplements for straw-based diets; and on the feeding of agro-industrial by-products, e.g. rice bran, soybean meal and leucaena. Finally, studies on the pathogenesis, immunology and control of T. vitulorum infection have gone far in defining the nature and sequential development of the clinical disease, the nature of the host response to the parasite, and an effective chemotherapeutic strategy for the control of the infection in calves. The scope of the work to be conducted during the remainder of the programme (i.e. until the end of 1983) was defined at the 1982 RCM in Malaysia, and individual experimental protocols were drawn up for the research contractors.

28. Second phase of the project (1984-1989): At the 1982 RCM it was agreed that the buffalo programme has been highly successful, in terms of scientific achievement and in forming a strong basis for co-operation between participants. However, it was stressed that to achieve its goals, a follow-up programme should be initiated in 1984 to strengthen interdisciplinary studies, to fill important gaps which remain within some of the disciplinary studies, and to encourage other countries in the region to initiate applied isotope-aided research on the buffalo. Such a programme was likely to extend over the period 1984-1989 and include 12-15 research contract or agreement holders.

Research project for the improvement of grain legume production

29. Background: Grain legumes have traditionally afforded a considerable portion of the protein for the population of the region. Increased production of grain legumes, which is the aim of the project, would significantly improve the level of this essential dietary component.

30. Achievements to date: The second RCM was held 27 April - 1 May 1981, at Chiang Mai, Thailand and was hosted by the Department of Agriculture, Ministry of Agriculture, Food and Fisheries. The mutation breeding projects are in general making reasonable progress; the more recent ones benefit from the more advanced projects. For direct exchange of experience, the research co-ordination meetings here proved to be very useful. To make optimal use of this unique means of co-operation, it is planned to have a RCM each year. In addition to discussion of individual projects, RCMs have been used to call attention to specific aspects of legume improvement. In 1980 in Malaysia, the topic was disease resistance, in 1981 in Thailand it was nitrogen-2 fixation. For the 1982 RCM special discussions are planned on the relationship between plant architecture and yield. In 1983, the individual mutation breeding projects will continue, aiming at the development of improved cultivars of the various legume species. Advances in improved material will be exchanged among institutes within and outside the region.

Research project on health-related environmental research

31. Background: The project is specially aimed at (i) establishing and verifying analytical competence at participating laboratories with special reference to the assessment of heavy metal pollution, and (ii) applying this analytical competence to specific local health problems associated with environmental heavy metal pollution. Metals of primary interest are arsenic, cadmium, lead and mercury.

32. Developing country populations are particularly susceptible to health problems arising from environmental contamination with toxic substances, especially heavy metals. The reason for their susceptibility is (i) the rapid rate of their industrialization which has sometimes been carried out without due regard for the environment; (ii) the fact that they still largely subsist on locally produced food (in which case, if local contamination of food occurs its effect is not diluted by uncontaminated food from outside); (iii) inadequate nutrition of some which may accentuate the toxic effects of pollution; and (iv) the fact that large amounts of mineral ores are mined in some of these countries. Most of the known cases of large-scale health effects caused by heavy-metal pollution have occurred in countries undergoing rapid industrialization; they have led to pathological symptoms in thousands of subjects with hundreds of deaths. Thus, public health concern in developing countries about risks associated with environmental contamination with heavy metals is genuine.

33. Achievements to date: It is difficult to quantify the immediate economic and social benefits that may accrue to the countries concerned as a consequence of participation in this project. Pollution assessment cannot normally be expected to yield this kind of benefits. However, one should agree that the development locally of analytical capability for the assessment of toxic substances of environmental and occupational health importance, is of significant value to the countries concerned. Furthermore, the verification that pollution is absent (or below levels that give rise to concern) and the ability to investigate acute pollution incidents, should they arise, are also aims that merit support.

34. The primary objective of the project is the development and validation of useful analytical methodologies for the assessment of environmental heavy-metal contamination. One practical way to realise this objective is an active participation of the laboratories concerned in project-organized intercomparison studies of various reference materials. The results reported by participants as well as by other laboratories worldwide reveal discrepancies which cannot be fully explained and indicate that more research work is needed.

35. Parallel to the analytical quality-assurance activities described above, trace analysis of various bio-environmental matrices has been carried out to investigate specific environmental and occupational health problems of local significance. Data have been generated (through three completed individual projects) on toxic heavy metals such as arsenic, cadmium, lead and mercury in human subjects and in food. A study carried out in India showed that the presence of these heavy metals in the persons surveyed was a function of geographical location, and a higher exposure of the population to these elements was found in industrial areas. Similar results were obtained from a study conducted in the Philippines where a higher exposure to lead was observed in the population in areas previously involved with lead mining activities. A survey of rice and various kinds of common marine fish (two major export commodities) was conducted in Thailand. The study showed that there was no dangerous contamination of these items. Similar and related studies continue to be conducted; the results obtained thus far are preliminary and no meaningful conclusions can be drawn at present.

36. Participants in the project are active scientists; several research papers have been presented at symposia and/or published in journals.

Research project on the radiation sterilization of medical supplies

37. Background: necessary research and studies are being carried out to:

- a) develop and standardize methods for identifying microbial contamination levels of medical items and to up-grade hygiene standards;

- b) standardize sterilization dose-setting criteria to ensure product safety and meet national pharmacopoeal requirements;
- c) adapt radiation sterilization practices for specified categories of pharmaceutical substances for clinical use;
- d) generate necessary radiation chemical information pertaining to the constituents of the medical items in local clinical services; and
- e) promote accepted practices and technology through co-operation and information dissemination.

38. There has been a rapidly growing interest expressed by countries in the region for the introduction of radiation sterilization technology for medical supplies, as a mean of assisting in the up-grading of the quality and standard of existing health-care services.

39. The principle of effective radiation sterilization being dependent on the microbicidal (killing and/or inactivating) effects of penetrating radiation doses with little or no adverse effects on the clinically significant properties of the medical supplies concerned, it becomes essential to adapt such practices and the relevant technology as far as practicable to suit the constraints of local environmental conditions, contaminating microflora (with possible seasonal variations), radiation response characteristics of those microorganisms, hygiene standards as well as the physical/chemical composition of the medical supplies, including pharmaceuticals. Specific technical data and information on these aspects - to help develop appropriate practices - including regulatory standards and guidelines, must be generated through research.

40. Achievements to date:

- a) A standardized protocol has been formulated, through co-ordination of existing national practices, for the isolation and characterization of the microbial bioburden of medical items.

- b) Major discrepancies in the methodology for radiation sensitivity determination for microbial contaminants have been eliminated through intercomparison studies and the identification of error contributing factors. This has been particularly helpful for the centres which are new in the practices study.
- c) Appropriate techniques have been perfected to evaluate the safety criteria of the radiation sterilized items.
- d) Radiation chemical data have helped to characterize the bases for the definition of criteria and the choice of some packaging materials and other constituents of medical items from among local manufacturers.
- e) Practices have improved for the safe radiation sterilization of some locally manufactured pharmaceutical agents in the dry state, which seem adequate to meet the quality standards stipulated in leading pharmacopoeia.
- f) The investigators continue to collaborate with local manufacturers of medical supplies and provide guidance as well as transfer of expertise for the design of medical products to be sterilized by radiation.

Research project on the maintenance of nuclear instruments

41. Background: This project aims at higher efficiency, reliability and quality of work done in laboratories using nuclear instruments, through the introduction of effective maintenance procedures in Bangladesh, India, Indonesia, the Republic of Korea, Malaysia, Pakistan, the Philippines, Sri Lanka and Thailand. Project activities include: a) the introduction or improvement of laboratory maintenance plans, b) the improvement or establishment of the infrastructure for national and regional training in nuclear instrumentation and maintenance, and c) the search for, and implementation of, solutions to the many procedural and administrative

difficulties encountered in matters concerning the choice, procurement, maintenance and repair of instruments and the supply of spare and replacement parts.

42. Achievements to date:

- a) From a previous survey it became clear that the instrument environment (the humidity of the air and the instability of the mains supply) caused almost half of the instrument failures reported. Therefore, a survey was made on the stability of the mains supply, the temperature and the relative humidity in the pilot laboratories. Instructions were given on air conditioning. A paper was prepared on AC power-conditioning. Power-conditioners consisting of drop-out relays, varistors and constant-voltage transformers were planned on the basis of survey results and were installed in almost all the participating laboratories.
- b) A seminar on the maintenance of nuclear instruments was held in Manila in November 1980. Basic principles of maintenance were discussed and also maintenance experience in different laboratories. Guidelines based on information collected during a previous survey were developed for the introduction of improved maintenance procedures, in which special attention is paid to quality control, to the mechanical, electrical and electronic aspects of preventive maintenance and to safety checks of instruments.
- c) The improvement of national and regional training infrastructures started with the train-the-trainers workshop conducted in Kuala Lumpur in April-May 1981 in collaboration with the UNDP industrial project. This was followed by national training courses for instrument users and maintenance technicians in six countries, organized and conducted by workshop participants with Agency assistance. In the other three countries, courses were given without Agency assistance.

- d) A spare-part pilot project is in an advanced stage of preparation which aims at assisting participating laboratories in the formulation and execution of a spare-part policy. This project will encompass the pilot laboratories of this project and those of regional projects in Africa and Latin America.
- e) Within the framework of the IAEA interregional project, INT/4/054, which was initiated to support this project and similar ones in Africa and Latin America, itinerant experts visited the pilot laboratories in seven of the participating countries. The experts assisted in the preparation and implementation of power-conditioning and maintenance plans and in the conduct of local training courses. Their visits engendered a much better insight into the range of problems encountered in instrument maintenance and local training.

43. It is expected that the experience gained through this project will increase the self-reliance of the pilot laboratories in all aspects of maintenance and will lead to reduced instrument unavailability, more efficient use of instruments and higher quality work in the laboratories. As is the case in respect of power-conditioning, steps must be taken to ensure that the pilot laboratories share their experience and expertise in this area with other laboratories in the participating countries.

Research project on isotope hydrology and sedimentology

44. Background: The aim of this project is to introduce isotope hydrology techniques as an additional hydrological tool in participating countries and co-ordinate research on hydrological problems of common interest. The project was originally proposed by the Government of Australia, which has been providing the requisite funds.

45. Achievements to date: Project emphasis is on the application of environmental isotope techniques to groundwater problems. In addition, research has been initiated on the use of environmental caesium-137 measurements to estimate sedimentation rates in reservoirs and for the

study of soil erosion. Previously, environmental isotope techniques had not been used in the majority of the participating countries. Consequently the project has been concerned not only with the introduction of this technology, but also has assisted in the installation of the required analytical facilities in some countries. Environmental tritium facilities are already operational in Indonesia and in the Republic of Korea. Similar facilities are expected to become operational in Malaysia, Sri Lanka and Thailand. Carbon-14 analytical facilities for hydrological applications are already operational in Indonesia and are foreseen in Thailand. Scientists from these countries have been trained or will receive training at the Research Establishment of the Australian Atomic Energy Commission. Experts from the Research Establishment have co-operated in the preparation and installation of the analytical facilities. The laboratories of the Research Establishment and the Agency are providing the stable isotope data.

46. A co-ordinated research programme on the application of these techniques to groundwater problems includes studies in and in the vicinity of Bangkok, Jakarta and Seoul. The increase in population and industrial growth of these cities has resulted in increased demands on the water supply. The isotope studies are being directed to problems of source of groundwater recharge and potential deterioration of the quality of water by leakage of poor quality groundwater from below the horizons where water is pumped and from rivers, which may be subject to pollution by industrial waste. In Seoul, for example, the isotope investigations have demonstrated that groundwater in the metropolitan area is recharged from the Han River. Carbon-14 data from groundwater in Bangkok and Jakarta indicate that this water was recharged some thousands of years ago. This information is of importance in relation to future planning of water resources for these cities. Studies are in progress in two areas in Malaysia; e.g. the Kelantan area isotope data are being used to check a hydrological model. More recently investigations were begun in Sri Lanka to study questions concerning recharge and causes of salinity in groundwater. Most of the information obtained from the isotope data is of direct concern to the present and planned development of water resources of the countries concerned.

UNDP regional industrial project

47. Background: A major new initiative in industrial technology transfer involving nuclear applications was initiated 1 April 1982. The momentum for this large-scale effort has been generated by the participating Governments themselves. Representatives of States party to RCA assigned high priority to the increasing acceptance of modern technologies by their industries, for the period extending through the end of this century, where such technologies have demonstrated economic and social value. A resolution stressing the importance of modern technology transfer, using nuclear applications as one basis, was presented to UNDP in December 1979.

48. The IAEA, under its regular programme of technical co-operation, provided assistance in establishing the technical and economic justification for such a regional industrial technology transfer effort and in the design of the project proposal, work plan and budget to achieve desired economic and social benefits.

49. Twelve States (Table 1) are participating and financially contributing to the project (code number: RAS/79/061) along with UNDP and regional industries. The budget for the project over its term (6.75 years) is targeted at US\$12 462 413:

Financial plan for the project

1979-80	\$ 137 330	1984	\$1 802 759
1981	2 214 032	1985	1 394 606
1982	2 886 279	1986	764 064
1983	2 986 585	1987	196 755

50. Of this amount financial contributions are targeted as follows:

- Participating Governments	\$6 427 457 (52%)
- UNDP	4 381 516 (35%)
- Industry	1 653 440 (13%)

51. The project is broadly designed to:

- a) Create economic and social gains through the expanded use of modern nuclear technology in industries in the region;
- b) Improve the competitiveness of locally manufactured products in world markets through better quality control, higher productivity and lower costs; and
- c) Effect savings in raw materials and energy in high consumption industries.

52. Further, the project is expected to achieve social gains by:

- a) Assisting in increasing and improving the infrastructures of participating countries, and contributing to the development of trained manpower; and
- b) Helping to create new jobs.

53. The developing countries of the Asia and Pacific region are making continuous efforts to convert from agricultural to agro-industrial economies but have encountered obstacles in fully achieving this aim. These obstacles include a lack of adequate infrastructures and training manpower as well as insufficient management skills for the development of an indigenous technology base and for the smooth transfer of technology from advanced countries.

54. Compled with the increasing need for industrialization is the requirement to introduce modern technology in production and manufacturing operations to effect increased efficiency with concomitant benefits to the economies of developing countries in the region. The current energy situation, plus concerns about raw materials' availability and environmental pollution, are seriously impacting industrial operations worldwide. This situation can adversely affect newly emerging industries in developing countries in the region. Accordingly, the introduction of modern nuclear technology to obtain increased efficiency in production and

manufacturing operations, with concomitant savings in raw materials and energy along with protection of the environmental, is essential to continuing growth and productivity.

55. With regard to specific technology transfer initiatives, the project is directed to industries of major economic importance to the region; these include:

- Minerals;
- Paper;
- Rubber;
- Steel;
- Petrochemicals; and
- Fertilizer.

56. Near-commercial-scale pilot plants will be built and operated for:

- a) Radiation vulcanization of natural rubber (latex);
- b) Radiation curing of surface coatings for wood products; and
- c) Radiation modification of insulating materials for electric wire and cable.

57. In-plant production and manufacture using nucleonic control systems will be demonstrated for:

- a) Hot rolled steel plate production;
- b) Paper production; and
- c) Minerals recovery.

58. These in-plant demonstrations and near-commercial pilot plant operations will provide real production training and experience for industry-government persons and assist in establishing the basis for modern technology transfer.

59. A key to expanding the use of nuclear applications in industries in the region and to achieving full benefits is the requirement to create

a critical force, through regional co-operation, which is greater than that existing in countries individually. This is being achieved through a project "network system" which capitalizes on existing national capabilities in both developing and developed countries. The "network" includes national centres, institutions and selected industrial plants and factories for commercial-scale demonstrations and special training (see Appendix). The "network system" provides the necessary capability for significant progress toward the goal of integration of modern technology into industries of the region with important economic and social gains. As such this regional industrial effort is an example of technical co-operation among developing countries (TCDC), which is a major principle of UNDP and IAEA and a project goal.

60. Perspective: The UNDP regional industrial technology transfer project has evolved through a series of progressive steps in regional co-operation which had its first expression in the 1960's (see paragraph 1). This early attempt at regional co-operation was expanded and formalized through the RCA Agreement. The RCA can be described in three phases as follows:

- a) Phase I (1972-1977) was a period in which States party to the Agreement, with IAEA, were attempting to understand how they could use the Agreement to foster effective regional co-operation yielding economic and social benefits;
- b) Phase II, which began in 1978, is characterized by the allocation for RCA activities of \$100 000 under the IAEA's regular budget. The availability of this first "RCA budget" permitted the start-up of a number of regional co-operative research projects concerned with food, health and the environment, industry and applied research; and
- c) Phase III started in 1980 and is characterized by a new level of regional co-operation facilitated by means of external funding. The UNDP regional industry technology transfer project is the corner stone for Phase III. Governments participating in the

project are making major financial contributions, along with regional industries and the UNDP, as indicated in paragraph 50.

61. For the RCA network to advance to an even greater level of activity it will be necessary to articulate its requirements, objectives and priorities with increasing clarity. It is timely and necessary for objectives and priorities established in 1979 to be reassessed on a current basis. To secure additional funds for regional co-operation during the remainder of the 1980's and early 1990's will require the development of new strategies and the identification of resources over and above those now available.

62. The evolution of regional co-operation to Phase IV might make desirable the creation of a permanent regional institute or centre dedicated to the transfer of modern technology (including but not limited to nuclear science) encompassing the major sectors of regional interest and priority, including research and training programmes.

63. Such an institute, managed and financed from resources made available by the participating countries, would augment existing national capabilities in important ways. Its function would be to focus on modern technologies determined to have the potential to yield important economic and social benefits. Its first expression could be directed to establishing the capability for providing special training, research, development and the means for technology transfer in nuclear science. The concept of a regional centre for research and training was considered on a preliminary basis in 1979 and 1980. The experience gained through the UNDP project will be of value in any further consideration of this question in view of the existing network system of institutes. Reports on this experience will be transmitted to the RCA countries in the period 1983-85.

64. An alternative would be to strengthen the existing network system, that is, to continue to designate centres of excellence in individual participating countries as the "lead institute" for given co-operative projects and assist them in improving their infrastructures. It is assumed that certain centres, although involved in work in various

fields, would develop and maintain a high level of competence in one or more areas (for example, soil science, isotope hydrology and production of radioisotopes) that would qualify a given centre as a logical choice as "lead institute" for co-operative projects in one or more of its areas of specialization.

65. At present it is impossible to predict which alternative would yield the greater return in benefits to the participating countries until more is known about the likely level of financial contributions that can be counted upon from within the region and from external sources. In any event the creation of a regional centre would involve higher contributions from the participating countries, it being a known fact that neither UNDP nor Agency policy permits the use of technical co-operation resources to maintain a national or regional centre.

H. FUTURE PROSPECTS

66. Applications of nuclear technology in the field of food and agriculture have been receiving special attention in on-going research projects, most of which were started in 1978. Concerted efforts in this field will continue to improve food production in the region. A research project aiming at the improvement of rice production is being initiated, and the second phase project of food irradiation in pilot-scale experiments is under consideration.

67. The UNDP regional industrial project, which has just begun and will be conducted on a full scale over the next five years, has as its aim the transfer of modern nuclear technology to industries in the region. A centre for radiation technology will be completed in Indonesia. Trained manpower will be developed through a considerable number of training courses, workshops, on-the-job training, and fellowships.

68. In accordance with the great regional interest, enlargement of the programmes concerning health care is under consideration. A draft project proposal on "Medical and biological application of nuclear techniques" was discussed at the Fourth RCA Working Group Meeting, held in June 1982 in

Kuala Lumpur, Malaysia. The major objective of this project is the transfer of nuclear technology for cancer therapy, nuclear medicine and the production of radiopharmaceuticals.

69. The establishment of a regional emergency assistance centre in case of nuclear accidents, proposed by the Government of the Philippines in 1980, is considered to be a worthwhile idea; however, there are many obstacles and difficulties to overcome. The consensus of RCA countries on this proposal is to await the results of the assessment and conclusions on the USA-Netherlands-Swedish proposal on international co-operation in emergency assistance.

APPENDIX
NATIONAL CENTRES, INSTITUTIONS AND INDUSTRIAL PLANTS
REGIONAL "NETWORK SYSTEM"
for
TECHNOLOGY TRANSFER TO REGIONAL INDUSTRIES

Technology	National centres, institutes and industrial plants
1. Tracer technology in industry	<p>Bhabha Atomic Research Centre Bombay, India</p> <p>in collaboration with</p> <p>Singapore Institute of Standards and Industrial Research Singapore</p>
2. Non-destructive testing	<p>Japanese Society for Non-Destructive Inspection Tokyo, Japan</p> <p>Singapore Institute for Standards and Industrial Research Singapore</p>
3a. Radiation Processing	<p>Pasar Jumat Atomic Energy Research Centre Jakarta, Indonesia</p> <p>Japan Atomic Energy Research Institute</p> <p>Takasaki Radiation Chemistry Research Establishment</p> <p>Malaysian Rubber Research Institute</p> <p>India Rubber Research Institute</p> <p>and the</p> <p>Bhabha Atomic Research Centre Bombay, India</p> <p>Research Institute for Estate Crops Bogor, Indonesia</p> <p>Rubber Research Institute Sri Lanka</p> <p>Korean Advanced Energy Research Institute Seoul, Republic of Korea</p>

Technology	National centres, institutes and industrial plants
------------	--

- | | |
|---|--|
| 3b. Radiation sterilization of medical products | Korean Advanced Energy Research Institute
Seoul, Republic of Korea

Bhabha Atomic Research Centre
Bombay, India |
| 4. Nucleonic control systems | |
| a. Paper manufacture | Japan Atomic Industrial Forum
Tokyo, Japan

Office of Atomic Energy for Peace
Bangkok, Thailand

Siam Kraft Paper Company
Ban Pong, Thailand |
| b. Steel manufacture | Japan Atomic Industrial Forum
Tokyo, Japan

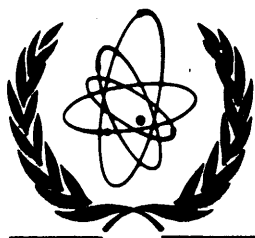
Bokaro Steel Plant
Bokaro, India

Steel Authority of India
Ranchi, India |
| c. Minerals beneficiation | Australian Atomic Energy Commission
Lucas Heights, Australia

Philippine Atomic Energy Commission
Quezon City, Philippines

Benguet Corporation
Dizon Mine Operation
San Marcelino
Yamabales, Philippines |
| 5. Maintenance of nuclear instruments | Japan Atomic Industrial Forum
Tokyo, Japan

Japanese Nucleonics Instrumentation Industry |



International Atomic Energy Agency

SUMMARY REPORT
OF
THE FOURTH WORKING GROUP MEETING OF RCA MEMBER STATES
JUNE 17 - JUNE 21, 1982
KUALA LUMPUR, MALAYSIA

SUMMARY REPORT OF THE FOURTH WORKING GROUP
OF RCA MEMBER STATES

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Summary Report of the Fourth Working Group Meeting

of

RCA Member States

June 17 - June 21, 1982

Kuala Lumpur, Malaysia

The Fourth RCA Working Group Meeting was held June 17-21, 1982 in Kuala Lumpur, Malaysia, in conjunction with the celebration of the 10th Anniversary of the Regional Cooperative Agreement for Research, Development and Training related to Nuclear Science and Technology. The meeting was hosted by the Government of Malaysia. A list of participants of the meeting is attached as Appendix 1.

Prof. Maurizio Zifferero, Deputy Director General, Department of Research and Isotopes (DDG-RI), IAEA, opened the meeting with a statement setting forth the significant progress in RCA activities during the past year as well as identifying important items of business to be considered during the course of the meeting. The statement is attached as Appendix 2.

Prof. Zifferero announced the Second Extension Agreement of RCA, effective June 9, 1982, for five years ending 1987.

Dato' Wan Sidek Hj. Wan Abdul Rahman, Secretary General, Ministry of Science, Technology and the Environment, Government of Malaysia, presented welcoming remarks on behalf of the Host Government, which are attached as Appendix 3.

The celebration of the 10th Anniversary of RCA was held one day before the Fourth RCA Working Group Meeting, including four invited lectures and a panel discussion. A copy of the programme is attached as Appendix 4.

Following the anniversary celebration and the opening of the meeting, Dato' Wan Sidek Hj. Wan Abdul Rahman was elected Chairman of the meeting by acclamation.

The tentative agenda for the Fourth Working Group Meeting was accepted with the addition of one item, "Other Business". A copy of the agenda is attached as Appendix 5.

.../

Agenda Item I - Current Status of Cooperative Research Projects

A summary of progress in RCA research projects was presented by the IAEA Secretariat. The summary, along with the progress reports of all research projects, is attached as Appendix 6.

The IAEA Secretariat reported that significant progress had been achieved in all projects. A new project on "Semi-Dwarf Mutants for Rice Improvement in Asia and the Pacific", which was recommended by RCA/9, has been approved and is now being implemented. The IAEA regular research programme budget is being used to fund the project.

A statement was presented by the Representative of Australia on the progress of the research project on Isotope Hydrology and Sedimentology, as described in Appendix 7.

The 1982 RCA Action Plan (Appendix 8) was explained by the IAEA Secretariat. The total budget for the RCA research projects in 1982 is US\$504,000. Of this total, US\$335,000 is from the Agency's regular research programme budget and US\$149,000 is from contributions of the Governments of Australia and Japan (US\$69,000 for Hydrology and US\$80,000 for Food Irradiation, respectively). The budget of the UNDP Regional Industrial Project (RCA) is estimated at US\$2,634,279, including UNDP funds and participating Government contributions.

Representatives of Governments party to RCA expressed satisfaction with the progress made to date on all projects.

The Representative of India expressed his concern about the implications of the termination of research projects such as "Neutron Scattering" which was agreed at the Third RCA Working Group Meeting, May 21-27, 1981, and accepted during RCA/10, September 22, 1981. He emphasized the importance of maintaining a proper balance between basic and applied research and stated that the current direction of RCA projects appears to focus on the latter.

.../

The DDG-RI, IAEA, stated that the Agency's regular budget for research programmes is levelling off and, consequently, funds for research projects are limited. Accordingly, it is necessary to use some system of priority as well as to begin and end projects after a set time period so that new projects can be initiated.

The IAEA Secretariat stated that currently emphasis is placed on the implementation and promotion of research projects in applied science which are expected to realize economic and social benefits in the RCA region over a shorter term.

The Representative of the Government of India reviewed the founding purposes of the RCA which importantly included creation of a framework permitting regional scientists to freely communicate with each other under the Regional Agreement as contrasted to formal diplomatic channels between Governments. This should not involve large expenditure on the part of IAEA.

Following the comments of the Representatives of the Member States, it was recommended that consideration be given to achieving some basic research activity within RCA such as neutron scattering.

The Representative of the Government of Australia announced that, subject to the agreement of IAEA, the second review meeting of the Isotope Hydrology and Sedimentology Project will be held November 1-5, 1982 at the AAEC Research Establishment, Sydney.

Agenda Item II - Current Status of the UNDP Industrial Project

A summary statement was given by the Project Director and Chief Technical Advisor, UNDP Regional Industrial Project RCA, on the current status and future plans as set forth in Appendix 9.

The Project Document Proposal, June 30, 1981, has been formally signed by the ten RCA Member States agreeing to their participation and financial contribution to the project. Separate "Letters of Understanding" have been exchanged between the Agency and the Governments of Australia and Japan providing for their participation and contributions. The estimated total expenditure over the 6-year term of the project is US\$12,462,413.

The full-scale project was initiated on April 1, 1982. As formally accounted by IAEA on May 28, 1981, a project office has been established in Tokyo, Japan for the period of June 14, 1982 to June 30, 1983, with Mr. E.E. Fowler being appointed Project Director for the same period. It was further announced that the permanent project office will be established in Jakarta, Indonesia, on July 1, 1983. The IAEA is continuing its search for a new Project Director to be appointed as of July 1, 1983 and to be based in Jakarta. IAEA expects to reach a decision on the new Project Director by December 31, 1982.

The Malaysian Representative urged that for smooth transfer from the current UNDP Project Director to his successor on July 1, 1983, sufficient time should be allowed for purposes of familiarizing the new Director. The UNDP Project Director stated that it was for this precise reason that IAEA wishes to complete its consideration of a successor by December 31, 1982. This action will allow sufficient time for transfer of responsibilities.

The UNDP Project Director continued to emphasize that the goal of the Project is the transfer to regional industries of established technologies having proved to bring economic and social benefits, rather than research and development. He urged that strong efforts be made to achieve required projects.

Negotiations are expected to be completed in June 1982 concerning the implementation of the Sub-project on "Mineral Exploration, Mining and Processing" with the Government of Australia and the Government of the Philippines, and the industrial partner, Benguet Corporation.

A statement was made by the Representative of Australia on the implementation of the above-mentioned sub-project as set forth in Appendix 10.

The Representative of Japan stated that his Government will make every effort to support the UNDP Industrial Project, through financial contributions and technical assistance, with emphasis on the sub-projects Radiation Processing, Non-destructive Testing, Nucleonic Control Systems and Nuclear Instrument Maintenance in particular. The Japanese Representative stated that:

.../

- 1) An electron beam accelerator with wire handling equipment planned for the Sub-project on Radiation Processing and which the Government of Japan is requested to donate, should be negotiated on a bilateral basis, with cooperation between the Governments of Indonesia and Japan. The request from the Government of Indonesia with top priority is necessary for the initiation of negotiations.
- 2) Early notification by IAEA of its decision to fund a training course on radiation processing, recommended by RCA countries and scheduled to be held in Japan in 1983, is requested.
- 3) The Government of Japan will make every effort to host three ultrasonic and two radiographic inspection training courses as well as planned workshops on paper and steel gauging.
- 4) The First Workshop on Maintenance of Nuclear Instruments was held in Tokyo, November 1981 and the Second Workshop will be held in Japan in November 1982. The Government of Japan will make every effort to obtain the necessary funds for the Workshops after 1983.
- 5) An expert will be made available for the UNDP Special Panel, scheduled for June 28-30, 1982, to select a nucleonic system for installation at the Bokharo Steel Plant, India, for use in Sub-project 4a, "Steel Manufacturing".

Agenda Item III - Cost Projection for RCA Activities in 1983

A draft of cost projections for RCA activities in 1983 was explained by the IAEA Secretariat, as set forth in Appendix 11.

Total estimated research project cost is US\$666,000 for 1983, exceeding the 1982 level by about 15%.

.../

The Representatives expressed their great appreciation of the IAEA's efforts to increase financial support of RCA, and urged the IAEA to continue its strong support for the activities planned for 1983. The proposed activities for 1983, outlined in Appendix 11, were accepted.

The DDG-RI, IAEA, stated that he would make every effort to achieve the required support for RCA activities, but cautioned that the IAEA regular budget for research contracts is not expected to increase. Therefore, he emphasized the continuing need for the required assistance from participating Governments, and especially urged Australia and Japan to consider increasing their financial contribution.

Agenda Item IV - Future Programmes and New Proposals

1. Medical and Biological Applications of Nuclear Techniques

A draft project proposal on "Medical and Biological Applications of Nuclear Techniques" was outlined by the IAEA Secretariat (Appendix 12). The draft proposal was prepared at the request of the Governments of Malaysia, Indonesia, Japan and Thailand. This request was based on the country requirements and on the conclusions of the Japan Expert Survey Team to RCA countries, as well as the findings of the Workshop on this topic held in Tokyo in August 1981 (Appendix 13 and 14, respectively).

The draft proposal includes four major sub-projects:

- i) Improvement of conventional radiation therapy in cancer;
- ii) Nuclear medicine in liver and thyroid diseases;
- iii) Nuclear techniques for diagnosis of parasitic diseases;
- iv) Preparation of radiopharmaceuticals.

The proposed project will provide activities including cooperative research programmes, training programmes, and the setting up of demonstration centres leading to manpower development in the field of medical science.

A draft working paper on "Medical and Biological Applications of Nuclear Technology of Interest to Thailand and the RCA Region" was presented by the Government of Thailand through its Representative to the meeting (Appendix 15). The working paper is mainly concerned with manpower development for nuclear medicine and supporting areas.

The Representative of Malaysia also presented a proposal on the "Medical and Biological Application of Nuclear Techniques" (Appendix 16). Emphasis is placed on the development of radioimmunoassay kits and radio-pharmaceuticals labelled with Tc-99m and I-125.

It was recognized that the draft proposal prepared by the IAEA Secretariat includes the interests expressed above.

The Representative of India wondered how far projects of this nature fall under the responsibility of the WHO and suggested close coordination between IAEA and WHO to avoid duplication.

In response, the DDG-RI, IAEA stated that good coordination is now being maintained between IAEA and WHO and that development of nuclear technology and nuclear medicine and biological sciences are within the scope and responsibility of IAEA.

The Representative of Australia expressed concern regarding the large proportion of funds allocated to Sub-project (i) and cautioned against allowing this factor to dominate the project implementation.

Most Representatives expressed their strong interest in implementation of the proposed project, and the draft proposal was, in principle, accepted. It was also pointed out that further elaboration of the proposal should be made in terms of location of activities and work plans which would take into account the comments of relevant experts of the Member States. A revised proposal should be prepared for discussion at RCA/11 in September 1982.

Accordingly, all Representatives were requested by the IAEA Secretariat to send their comments for changes or additions to the proposal at their earliest convenience, but not later than August 31, 1982.

In this connection, it was also agreed that the new coordinated research programme on "Improvement of Cancer Therapy in Asian Countries by the Combination Treatment of Conventional Radiation and Physical or Chemical Means" (Appendix 17) should be included in the RCA projects.

.../

It was agreed by the Representatives that action on the research programmes of the proposal should be completed at the earliest time possible so that the proposed project could be included in the RCA Cooperative Research Projects for 1983.

The Representative of Japan stated that his Government will make every effort to support the implementation of the proposed projects with emphasis on nuclear medicine and radiation therapy. The Representative stated that his Government will assess the proposal in terms of projects scale and inform the IAEA Secretariat of any comments. In this connection, the Government of Japan will hold a Study Group Meeting on Environmental Aspects of Radiation and Related Subjects, from August 16 to September 10, 1982 in Tokyo, with the participation of invited experts from RCA Member States.

2. Nuclear Safety and Preparing for Emergencies

(Emergency Assistance Centre proposed by the Government of the Philippines)

The IAEA Secretariat explained the background for the proposal, procedures taken for its review and the opinion of IAEA on the proposal as set forth in Appendices 18, 19, 20, and 21.

The Representative of the Philippines briefly explained the draft proposal (Appendix 18) and its background.

The DDG-RI, IAEA reported that a proposal from the USA, the Netherlands and Sweden on international cooperation in mutual emergency assistance and nuclear safety in case of nuclear accidents will be assessed by an Experts Group this year, and their findings and recommendations will be reported to the IAEA Board of Governors in February 1983 for a decision on future actions.

It was stated by the Representative of India that mutual emergency assistance is extremely important, but it may be too large for RCA to accommodate and should be considered on a global level as now under consideration by the Board.

The Representative of Indonesia underlined the importance for all countries operating nuclear power plants of having emergency preparedness of their own capability.

The Representative of Japan pointed out that there are great differences in the status of nuclear energy development and its utilization within RCA Member States, and that, therefore, information exchange on current and future problems relating to regulatory matters and to nuclear safety are important. He also pointed out that the Philippine proposal should be considered in close connection with the proposal mentioned by the DDG-RI.

The meeting concluded that the consensus of the Representatives on the Philippine Proposal is to await the results of assessment and discussions on the USA-Netherlands-Swedish proposal on international cooperation in emergency assistance and nuclear safety.

3. Food Irradiation

It was reported by the IAEA Secretariat that the first phase of the project on Food Irradiation will be terminated in 1983, and the Representatives were requested to make comments on the second phase plans as set forth in Appendix 22. The second phase plans will provide pilot-scale studies to accelerate practical application of food irradiation in RCA countries on fishery products, mangoes, spices, and onions.

The IAEA Secretariat explained that the joint IAEA/FAO/WHO Expert Panel recommended in 1980 that all food items irradiated up to 10 KGy (1 Mrad) are wholesome and safe for human consumption. A table was also presented on the current status of commercial application of food irradiation (Appendix 22).

Representatives of all countries participating in the current project expressed their strong interest in the second phase programme proposal and urged continuous financial and technical support of the programme by the Government of Japan.

The Representative of Malaysia stated that there might be some delay in implementing the second phase of the project in his country.

It was stated by the Representative of Japan that an assessment of progress in the current project, the merit and justification for the second phase plans as well as the current regional technological level in the field are required before the Government of Japan can reach a decision on continuing financial support. He also said that an Experts Meeting and/or study tour should be scheduled for the above evaluation in 1983 using IAEA funds. The Representative of Japan concluded by saying that his Government will consider submitting a budget in 1983 requesting some tens of thousands of US dollars to support food irradiation activities.

It was noted by the IAEA Secretariat that the 2nd Cooperative Research Project Meeting on Food Irradiation will be held November 22-26, 1982 in Bangkok, Thailand, to evaluate latest results.

4. Radiation Sterilization

The IAEA Secretariat provided background and justification to change the emphasis on radiation sterilization from medical supplies to tissue grafts, and the proposal was accepted by the Representatives. The new title of the project will be "Radiation Sterilization of Biological Tissue Grafts".

5. Radioactive Waste Management

The IAEA Secretariat quoted the statement of the Government of the Philippines at the 25th IAEA General Conference on the possible use of RCA as a forerunner for regional monitoring of sea dumping of radioactive waste like NEA. He also mentioned that the purpose of this agenda item is only to exchange views and information on radioactive waste treatment and disposal in RCA countries.

The Representatives of Australia, Indonesia, Japan, the Republic of South Korea, Malaysia, the Philippines, Sri Lanka and Thailand reported on the current status of waste management activities in their respective countries.

The Representative of Australia stated that the exchange of information on this topic is useful but setting up of a special study group is premature because of wide differences in the amounts and level of radioactive wastes being handled by RCA countries.

The Representative of Sri Lanka pointed out the importance of manpower training in his country in this field as well as information exchange.

The Representative of Japan commented that the amounts of radioactive wastes in RCA countries will increase in the future so that his Government will cooperate in the exchange of information and in discussions of possible future regional cooperation in this field.

The DDG-RI, IAEA stated that the IAEA is operating the Monaco Laboratory which is devoted to the study of radioactivity in the marine environment. He identified that IAEA can accept trainees from RCA countries in this field.

6. Potential Financial Resources

The IAEA Secretariat pointed out that RCA research projects are facing the problem of shortage of funds. For example, it was cited that the Biogas Project is awaiting funds; a new medical and biological applications proposal required major expenditures and the second phase of the Food Irradiation Project must find new resources. The Representatives were asked for their comments.

The Representative of Australia stated that his Government will contribute 655,000 Australian dollars over the 6-year term (1982 - 1987) of the UNDP Industrial Project and 60,000 Australian dollars for the Hydrology Project in 1982-1983. However, he cautioned that additional cash contributions from his Government are unlikely.

The Japanese Representative indicated that his Government would make every effort to increase its contribution, in cash and in kind, with emphasis on the UNDP Industrial Project, Food Irradiation and the Medical and Biological Applications proposal. However, at the same time it was stated that RCA activities should be kept within a reasonable budget limit.

The Representative of Sri Lanka pointed out that each RCA Member State should make every effort to increase their own national budget for RCA projects. He also mentioned that some of the projects of his Government are supported by IAEA under Footnote/a projects.

The DDG-RI, IAEA, commenting on resources made available under the Technical Cooperation programme of the Agency, said that the funding of Footnote/a projects by donor countries is steadily increasing; for example, more than 70% of requests for 1982 were funded in this way.

The Representative of Thailand emphasized that Member States should make every effort to reduce the cost of projects. He also suggested that IAEA should consider looking for contributions from private companies.

Prof. Kakihana suggested that New Zealand should be invited to become a member of RCA and to establish its interest in financially contributing to RCA. The Malaysian Representative supported this comment.

The Malaysian Representative further suggested that continued effort should be made with WHO to contribute to the Medical and Biological Project proposal.

The DDG-RI, IAEA was of the opinion that WHO has no financial resources for projects such as those of RCA.

It was pointed out by the IAEA Secretariat that it may be worthwhile to seek funds from ADB (Asian Development Bank) to support the Medical and Biological project proposal and the Food Project. The Japanese Representative supported this idea.

The Chairman concluded that it was the consensus of the Meeting that the IAEA Secretariat should explore the above mentioned funding possibility and the Member States should make strong efforts to increase their own budget to support RCA programmes. The Chairman further requested that RCA Member States, particularly Australia and Japan, continue to increase their contributions for the further development of RCA activities.

Agenda Item V - Country Statements

All Representatives gave country statements on the current status, progress and future prospects of RCA activities, as attached as Appendix 23.

Agenda Item VI - Other Business

The IAEA Secretariat noted that the offer of the Government of Bangladesh at RCA/10 to host the 5th RCA Working Group Meeting in 1983 in Dacca, was to be discussed at the present meeting. The Secretariat suggested postponing discussion of this offer to RCA/11 in September 1982 because Bangladesh was not represented at the Fourth RCA Working Group Meeting. This suggestion was accepted by the Representatives. In this connection, the Representatives of India and Thailand proposed to host the 5th RCA Working Group Meeting if the Government of Bangladesh is not in a position to do so. The Representative of India also offered to host the 6th RCA Working Group Meeting (1984) if the 5th RCA Working Group is not held in India.

Agenda Item VII - Confirmation and Acceptance of Meeting Report

The Representatives accepted the draft Summary Report of the 4th RCA Working Group Meeting and closing remarks were made by the Chairman.

The meeting was adjourned at 12:30 hours, on June 21, 1982.

FOURTH RCA WORKING GROUP MEETING

June 17 - June 21, 1982

Kuala Lumpur , Malaysia

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4th WORKING GROUP MEETING OF RCA
17-21 June 1982
Kuala Lumpur, Malaysia

Opening Remarks
Prof. M. Zifferero

Distinguished delegates and guests from RCA Member States, Ladies and Gentlemen.

It is my great honour to open the 4th RCA Working Group Meeting following the celebration of the 10th anniversary of RCA.

First, I would like to cordially welcome all the representatives and guests from Member States. I would also like to extend my appreciation to the Government of Malaysia for hosting this important meeting.

The Working Group meetings were started four years ago in order to review progress in RCA activities and to discuss future programmes. They have been recognized as preparatory meetings for the annual RCA meetings held during the IAEA General Conference.

Allow me to briefly review the progress of RCA programmes during the past year since the 3rd Working Group meeting was held in May 1981 in Jakarta.

The RCA budget for 1982 earmarked for research projects is in the amount of US\$ 504,000, including the Agency's regular research programme funds and special contributions from the Governments of Australia and Japan. Allocation from the IAEA budget is US\$ 355,000, representing an increase of 25% over the budget for 1981, which reflects the importance the IAEA is giving to RCA.

It is evident from the Status Reports submitted by the Scientific Officers, that the ongoing projects have achieved their respective goals through cooperative research activities and coordination meetings. I am delighted to report that a new project on "Radiation mutation of rice" which has been pending subject to the availability of funds, has now been approved and is now in effect. Further, the project on "Medical and biological applications of nuclear techniques" has been approved, placing emphasis on cancer therapy. This will be the precursor of another new RCA programme.

The UNDP Industrial Project for RCA Member States has greatly progressed through the Preparatory Assistance Project, particularly in the Sub-projects on nucleonic control systems, radiation processing and nuclear instrument maintenance. A nucleonic control system for paper manufacture has been installed in Thailand and a demonstration training has taken place in Japan and Thailand. A large-scale demonstration plant for radiation vulcanization of natural rubber including Co-60 irradiation is being manufactured and will be commissioned in early 1983 in Indonesia.

I am very pleased to announce that, on 1 April 1982, the UNDP Project started with the formal agreement of all RCA Governments, and the first Project Office in the Region will be opened in Tokyo in June of this year, managed by Mr. Eugene Fowler to whom I wish to extend my warmest wishes.

I should like to express my special appreciation to the Government of Japan for hosting this office at their expense and take this occasion to underline the generous contributions, both in cash and in kind, made by the Governments of Australia and Japan to the RCA activities.

In addition to the review of the current status of RCA activities, another important item related to future programmes is on the agenda. I refer to preparedness, at the Regional level, in case of nuclear emergencies. A draft proposal for the establishment of a regional emergency assistance Centre was prepared by the Philippine Atomic Energy Commission and submitted to the last RCA meeting, held in Vienna in September 1981 in conjunction with the IAEA General Conference. At that time the Agency expressed the opinion that further thought should be given to such aspects as cost-benefit analysis, identification of possible alternatives, choice of the location, funding.

Meanwhile a proposal for an international convention on nuclear safety cooperation and mutual emergency assistance in connection with nuclear accidents has been submitted at the Agency's Board of Governors meeting in February 1982 by a group of countries.

Following this proposal a group of experts, designated by Governments of the Agency's Member States will analyse means to respond to the need for emergency mutual assistance and to facilitate appropriate international cooperation in the area of nuclear safety. Since these matters undoubtedly relate with

the RCA proposal it would probably be wise to withhold any decision on the regional emergency assistance center until the outcome of this larger initiative is known.

Another important area of future RCA activities is the medical and biological application of nuclear techniques. The relevance of this subject to the improvement of health care in RCA countries was pointed out in the report prepared by a team of experts which undertook a planning mission in 1981 to RCA countries. Your comments on the implementation of this project should be reflected in the future programme.

During the 10th. meeting of RCA representatives, all RCA Member States expressed their wish to extend the RCA for a further period of five years, starting from 13 June 1982. The formal procedure for the extension has, accordingly, been started.

Ladies and gentlemen, distinguished guests, in concluding my remarks, I would like to pledge the Agency's continued efforts to promote, under the formula of an effective Regional Cooperation, those activities that Member States themselves have indicated to be most beneficial to them, and would like, at the same time, to urge your Governments to continue and foster their contributions and active participation in the projects on the basis of friendship and self-reliance.

Thank you.

OPENING REMARKS
BY
YB DATO' WAN SIDEK BIN HJ WAN ABD. RAHMAN
SECRETARY-GENERAL
MINISTRY OF SCIENCE, TECHNOLOGY & ENVIRONMENT
AT THE
FOURTH RCA WORKING GROUP MEETING
KUALA LUMPUR, MALAYSIA
16TH JUNE, 1982

Prof. Zifferero,

YB Datuk (Prof.) Mohd. Ghazali bin Hj Abd. Rahman,

Honourable Delegates,

Distinguished Guests,

Ladies and Gentlemen.

I consider it a privilege and honour for me to be given this opportunity to say a few words on this occasion of the 4th RCA Working Group Meeting here this morning. On behalf of the Malaysian Government, I would like to express a warm welcome to all the distinguished delegates to Kuala Lumpur and hope that they will find the next few days fruitful in their discussions on the need to establish a more effective regional cooperation in nuclear science and technology in this part of the world.

For us in Malaysia, the meeting of the 4th RCA Working Group is both timely and significant in that it coincides not only with the 10th Anniversary of the RCA but also with the present stage of Malaysia's direct involvement in nuclear technology where our research reactor at PUSPATI is about to become critical. Our success in bringing about this development is due to a large extent to the efforts of the International Atomic Energy Agency (IAEA), whose officials had given us from time to time their invaluable assistance by way of advice to our Scientists on the ground. Members of the RCA had also shown positive response to our requests for technical expertise, and for training facilities for our officials in nuclear technology so as to ensure that the objectives of PUSPATI would be fully achieved.

Ladies and Gentlemen,

The field of nuclear science and technology is relatively new in this country. This is perhaps a blessing in that we are able to learn from the experience of others who had preceded us, to gain from their successes and to avoid the mistakes they might have made in the course of their own development. In this country, we have come to regard nuclear technology as an essential ingredient in the development process of the country. Nuclear technology is necessary in order to supplement development efforts in the field of industrialisation, agricultural development, public health and medical care and such other activities that will contribute to a better quality of life for the people of this country. However, nuclear technology, as a new field, has attracted a great deal of public attention not only in its potential to contribute to socio-economic growth but also in the need for a proper management framework that will ensure not only the optimum use of available resources but also to ensure minimum risks in terms of its effects on environment and public safety. Towards this end, I feel it is important that a proper system of information dissemination be developed within the management framework of nuclear technology which will enable the public to acquire correct and an unbiased information on what is going on within the four walls of the nuclear reactor. A lack of correct information or lack of ability on the part of the authorities to make available such information may result in unnecessary public controversy over the safety or relevance of nuclear technology in the development process. One of the most adverse reaction of the public with regard to nuclear industry is the potential release of radiation to the environment that could harm public health and safety. I am aware that there is sufficient technology in the world today that can minimize or prevent such incidence.

Despite the fact that the safety record of the nuclear industry so far is particularly encouraging it is our responsibility as people directly involved in the development and growth of nuclear technology to ensure that there will be a diligent control of the nuclear industry in

order to re-assure the public of the potential risks, however small they may be. We in the Ministry of Science, Technology and the Environment, with the assistance of IAEA and others who are keen to help us have undertaken several preparatory steps to look into various legal and administrative actions towards evolving an adequate legal framework and infra-structure within which nuclear science and technology can be developed. The administrative and legal framework essentially covers such aspects as appropriate authorisation, coordination, control and supervision of activities in the field of nuclear research and application. It is hoped that in the near future a new legislation will be introduced in Parliament that will provide among others, a regulatory basis for ensuring that nuclear installations will be operated without undue risk to public health and safety and without harm to the environment and at the same time provide a proper mechanism that can aid the Government in promoting further development of nuclear science and technology in this country.

In conclusion, I would like once again to thank the IAEA for giving us this rare honour to host the 4th RCA Working Group in Kuala Lumpur in conjunction with its tenth anniversary celebration. This meeting will no doubt provide our local scientists the opportunity to meet and discuss with their counterparts in the region subjects of mutual interest.

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CELEBRATION OF THE 10TH ANNIVERSARY OF RCA

16 JUNE 1982

Kuala Lumpur, Malaysia

PROGRAMME

9:30	Opening Remarks	Prof. M. Zifferero Deputy Director General Department of Research and Isotopes International Atomic Energy Agency
	Welcoming Remarks	Minister of Science, Technology and Environment, Malaysia
	Coffee Break	
10:30	Invited Lecture "Japan's Experience in Nuclear Science and Technology"	Prof. T. Mukaibo Acting Chairman Japan Atomic Energy Commission
	Invited Lecture "Development of Nuclear Science and Technology in Australia"	Dr. D.G. Walker Acting Director Australian Atomic Energy Commission Research Establishment
	Invited Lecture "Development of Nuclear Science and Technology in India"	Dr. R. Ramanna, Director Secretary to the Government of India Bhabha Atomic Research Centre
	Invited Lecture "Development of Nuclear Energy in Malaysia"	Minister of Science, Technology and Environment, Malaysia
12:30	Lunch	
14:30	Panel Discussion	Chairman: Prof. H. Kakihana
	Development of Nuclear Energy Applications and International Cooperation in Asia and the Pacific	Members: Dr. R. Ramanna, India Dr. D.G. Walker, Australia Minister of Science, Technology and the Environment, Malaysia
		Chief Delegates from all other RCA Member States Prof. M. Zifferero, IAEA

FOURTH RCA WORKING GROUP MEETING

June 17 - June 21, 1982

Kuala Lumpur, Malaysia

PROGRAMMEJune 17, 1982

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|-------|---|--|
| 9:00 | Opening of the Meeting | Prof. M. Zifferero
Deputy Director General
Department of Research and Isotopes
IAEA |
| | Welcoming Remarks | Deputy Minister
Science, Technology and Environment
Malaysia |
| | Election of Chairman | |
| | Adoption of Agenda | |
| | Break | |
| 10:30 | I. Current status of regional cooperative research projects | |
| | II. Current status of UNDP Industrial Project | |
| | III. Cost projection for RCA activities in 1983. | |
| | Lunch | |
| 13:30 | Continued | |
| | Break | |
| 14:30 | IV. Future programmes and new proposals | |
| | - Medical and biological applications of nuclear techniques | |
| | - Nuclear safety and preparing for emergencies
(Emergency Assistance Centre) | |

June 18, 1982

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|------|---|--|
| 9:30 | IV. Future programmes and new proposals (continued) | |
| | - Food Irradiation | |
| | Break | |

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- Radioactive wastes management (exchange of information)
 - Potential financial resources

Lunch

14:45 V. Country statements on RCA

June 19, 1982 (Saturday)

9:30 Visit to PUSPATI and National University of Malaysia

Afternoon free

June 21, 1982

10:00 VI. Other Business

VII. Confirmation and acceptance of meeting report

Break

Closing remarks

12:00 Adjournment

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1. PROGRESS REPORTS OF
REGIONAL COOPERATIVE RESEARCH PROJECTS

June 1982

SUMMARY OF RCA PROJECTS
PROGRESS IN 1981 - 1982 and 1982 ACTION PLAN

OUTLINE

The Third RCA Working Group (Jakarta, May 1981) reviewed and evaluated on-going Cooperative Research Projects on the basis of the Status Reports prepared by IAEA Scientific Secretaries. It was then recommended that all projects except "Neutron Scattering" should be continued. Remarkable progress has been achieved in every project, as set forth in the attached respective reports, through research programmes and project meetings.

A new project on "Semi-dwarf Mutants for Rive Improvement in Asia and the Pacific", recommended by RCA/9 for prompt initiation, has been approved under the IAEA Regular Budget and is being implemented. The first project meeting is planned to be held this year. The goal of this project is the improvement of rice production.

The RCA Action Plan for 1982 is shown in Table I. Eight research projects and one UNDP project are in progress. the Member States participating in each project are listed in Table II. The total budget of RCA Research Projects for 1982 is in the amount of US\$504,000, including the Agency's regular research programme funds of US\$355,000 and contributions from the Governments of Australia and Japan at a level of US\$149,000 for the Hydrology and Food Irradiation Projects. The total amount of US\$504,000 compares to the 1981 level of US\$486,000.

Regarding the RCA/UNDP Industrial Project, Sub-projects on Nucleonic Control Systems, Radiation Processing, NDT, and Nuclear Instrument Maintenance have been fully implemented under the Preparatory Assistance Project (PAP). On-line tickness and moisture control systems have been installed in a paper plant in Thailand and have proved to bring large economic benefits. A pilot-scale plant of radiation vulcanization of natural rubber has been designed and is being manufactured to be commissioned in February of 1983. Several workshops, training courses, and working group meetings have been held in variuos RCA countries. Details are described in the status report of the Project. The full project started on April 1, 1982, with the acceptance of the Revised Proposal by all participating RCA countries. The Regional Project Office will begin its operation on June 14, 1982 for a duration of about one year, with Mr. E.E. Fowler as Project Director.

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For possible future programmes of RCA, "Medical and Biological Applications of Nuclear Techniques" has been assessed by the Government of Japan to be an important and useful subject, based on the information provided by a Japanese Experts Survey Mission. Bangladesh, Indonesia, Malaysia, Thailand, and the Republic of Korea have already expressed their interest in the implementation of these applications under RCA to improve medical care in the Region. The Agency has already approved a new coordinated research programme on "Improvement of Cancer Therapy in Asian Countries by the Combination Treatment of Conventional Radiation and Physical Means", which will be a new RCA Research Project if the Member States express their wish to this effect. This matter or a larger plan on a similar basis will be discussed during the meeting.

According to the recommendation of the 3rd Working Group Meeting, the Government of the Philippines prepared and presented the Draft Proposal on "The Establishment of a Regional Nuclear Emergency Assistance Centre" to RCA/10 in September 1981. The Agency's opinion is that further elaboration is necessary in terms of i) need for such a centre, ii) cost and cost-benefit analysis, iii) possible alternative arrangements and existing facilities, and iv) location of such a centre. It was concluded that the Proposal should be further discussed at the 3rd Working Group Meeting.

Regional Cooperative Research Projects

1. Use of Induced Mutations for Improvement of Grain Legume Production

The major objective is to develop mutant lines with improved characteristics for a higher yield, better quality, lower susceptibility to pathogens, etc. Remarkable progress has been achieved, i.e.:

- i) high yielding mutant of chickpea in Bangladesh which will be released to farmers for cultivation with the name "Hyprosola";
- ii) high-yield pea variety "Hans" in India;
- iii) mutant of ground nut released as a variety in India;
- iv) advances in methodology to improve Cercospora leaf spot resistance of mung beans in Korea;

It is expected that the major objective will be achieved in 2 - 3 years.

2. Food Irradiation

Results of studies on dried fish and spices in Indonesia, onion in India and Korea, and mango in Thailand have shown benefits of irradiation in increasing the storage life or improving the hygiene of the products.

Further studies include irradiation of fishery products with emphasis on packaging aspects; intra- and inter-country shipment studies of irradiated onions, mangoes and spices; market testing and consumer acceptance studies of these treated commodities.

3. Use of Nuclear Techniques to Improve Domestic Buffalo Production

The buffalo is an important animal in the economy of many RCA countries. The project is proving to be highly successful.

Substantial progress has been made over the past year, particularly in reproduction where working assays for different steroid hormones have been established in Sri Lanka, Malaysia, Thailand, India, the Philippines and Indonesia and are now being used for measurement of corpus luteum activity.

4. Radiation Sterilization Practices for Local Supplies

To develop effective methods and practices for radiation sterilization of indigenously manufactured medical products, standardization of the dose-setting methodology has been carried out through intercomparison of radiation-inactivation data, and provided most valuable help for the development of reliable practice.

5. Health Related Environmental Research

This project aims to assist the Member States in developing their analytical capability with regard to environmental health research.

An inter-laboratory comparison study of a number of reference materials was initiated in 1982. The study involves the analysis by all the participants of five reference materials for some selected trace and other elements of bio-environmental significance. A proposal is under study to hold a training course on nuclear methods for environmental health studies (1984).

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6. Nuclear Instrument Maintenance

All research contracts have been renewed. During the past year, this project placed emphasis on power conditioning, training and preventive maintenance planning. Recordings of the AC mains voltage were made which led to repairs of the mains distribution grid. Several kinds of device to improve power conditioning were installed in the Member States. Local training courses were held in six countries with the assistance of Agency experts.

7. Isotope Application to Hydrology and Sedimentology

The study in the Seoul area has been extended to an examination of the water in the crystalline rock. Initial data indicate that this aquifer is recharged by the overlying shallow aquifer. Sampling of groundwater in the Jakarta basin has been extended and carbon-14 data show a sharp break between estimated groundwater ages of 9,000 and 19,999 years. An investigation of the cause of salinity of groundwater in the southern part of Sri Lanka has recently commenced.

In some countries studies have commenced on the use of Cs-137 for investigating sediment erosion and deposition.

21 May 1982

RCA SUMMARY REPORT

FAO/IAEA Co-ordinated Research programme on the Use of Induced Mutations for Improvement of Grain Legume Production in South East Asia

The co-ordinated research programme was initiated by the Agency stepwise since 1976. The scientists participating are now as follows:

since 1976	S.H. Patil, Bombay (india)	groundnut
since 1977	M.A.Q. Shaikh, Mymensingh (Bangladesh)	mungbean, black gram
	B. Sharma, New Delhi (India)	chickpea, lentil, pea, cowpea
since 1978	J.H. Oh, Seoul (Rep. of Korea)	mungbean
	A.A. Baradjanegara, Bandung (Indonesia)	soybean
since 1979	A. Nalampang, Bangkok (Thailand)	mungbean, black gram
	B.S. Jalani, Kuala Lumpur (Malaysia)	soybean
	S. Bala Ravi, Hyderabad (India)	pigeon pea
	K. Hendratno, Jakarta (Indonesia)	soybean
since 1980	H.C. Cheah, Serdang (Malaysia)	Phaseolus bean
	M.A. Rajput, Tandojam (Pakistan)	soybean
	R. Pathirana, Angunukolapelessa (Sri Lanka)	groundnut

The Second Research Co-ordination Meeting was held from 27 April to 1 May 1981 at Chiang Mai (Thailand) hosted by the Department of Agriculture, Ministry of Agriculture, Food and Fisheries. The mutation breeding projects make, in general, reasonable progress, the more recent ones benefit from the more advanced projects. For direct exchange of experiences the research co-ordination meetings proved to be very useful. To make optimal use of this unique means of co-operation, we plan to have meetings every year. In addition to discussion of individual projects, the research co-ordination meetings have been used to call attention to specific aspects of legume improvement. 1980 in Malaysia, the topic was disease resistance, 1981 in Thailand N_2 -fixation. For 1982 the third meeting is planned and special discussions are planned on the relationship between plant architecture and yield.

Work plan for 1983

The individual mutation breeding projects will continue, aiming at the development of improved cultivars of the various legume species. Advanced improved material will be exchanged among institutes within and outside the region.

Budget projection 1983

a)	12 contracts with support of ca. \$5000 each	\$60 000
b)	4th Research Co-ordination Meeting December 1983 India	\$25 000

PROGRESS REPORT ON FOOD IRRADIATION UNDER THE RCA

(MAY 1981 - MAY 1982)

1. Important Events in the Past Year

A. FAO/IAEA Research Coordination Meeting (RCM) on the Asian Regional Cooperative Project on Food Irradiation (RPFI)

The first RCM under the RPFI was held in conjunction with the FAO/IAEA Seminar on Food Irradiation for Developing Countries in Asia and the Pacific at the Ministry of Foreign Affairs, Tokyo, from 9 to 13 November 1981. Thirteen participants of the programme from nine participating countries in the Project attended the meeting. Among the reports presented, it was clear that several research projects under the RPFI are being carried out in close collaboration with the local industries, especially the work on dried fish and spices in Indonesia, the onion studies in India and Korea, and the mango study in Thailand. Results of these studies have shown benefits of irradiation treatment either in increasing the storage life or improving the hygiene of the products. Further studies under this programme include pilot-scale irradiation of fishery products with emphasis on packaging aspects; intra- and inter-country shipment studies of irradiated onions; mangoes and spices; market testing and consumer acceptance studies of these treated commodities.

B. Second Meeting of Government Representatives to the RPFI (RPFI Project Committee)

The second RPFI Project Committee meeting was held following the conclusion of the seminar and RCM mentioned above, also at the Ministry of Foreign Affairs, Tokyo, from 16 to 18 November 1981. The meeting was attended by representatives of nine out of ten Governments party to the RPFI, i.e., Bangladesh, India, Indonesia, Japan, Republic of Korea, Malaysia, the Philippines, Sri Lanka, and Thailand. This meeting was more administrative in nature with emphasis on cooperation among Governments in participating countries in studies on food irradiation in the region. Among the discussions on future collaborative plans of

the RPFI, it emerged that most representatives were anxious to continue studies on a larger scale to facilitate practical application in their countries. This incentive came from recent developments in food irradiation, both on national and international basis, discussed at the seminar and the RCM mentioned above.

It was concluded that the Secretariat of the RPFI will take views of various Government representatives into consideration and will approach all Governments party to the RPFI for concrete plans of contribution to accelerate application in the region in the near future. The Secretariat will compile such contributions and will present them at the next session of the RPFI Project Committee which is planned to be held in conjunction with the second RCM on the RPFI in Bangkok in late November 1982. It was also agreed that the detailed discussion on a possible phase II of the RPFI, including the necessary level of financial support from participating and donor Governments, will be discussed at that meeting when an additional year of experience and results will become available.

2. Estimated Budget for 1983

A. Research Contracts

C.S.I. (Country)	RC No.	Proposed Allocation* (US\$)
M. Hossain (Bangladesh)	2835/JN	4,500.00
M. Ahmed (Bangladesh)	2271/RB/JN	4,500.00
M. Maha (Indonesia)	2506/RB/JN	4,500.00
T. Saputra (Indonesia)	2630/JN	4,500.00
H. Cho (Republic of Korea)	2834/JN	4,500.00
B. Ismail (Malaysia)	2938/JN	4,500.00
A. Hossain (Pakistan)	2392/RB/JN	4,500.00
G. Guevara (Philippines)	2256/RB/JN	4,500.00
J. Manalo (Philippines)	2833/JN	4,500.00
K. Theivendirarajah (Sri Lanka)	2840/JN	4,500.00
P. Vibulsresth (Thailand)	2244/RB/JN	4,500.00
D. Buangsuwon (Thailand)	2864/JN	4,500.00
	TOTAL	54,000.00 =====

* contributed by the Government of Japan

B. Research Agreements

<u>C.S.I. (Country)</u>	<u>RA No.</u>	<u>Proposed Allocation*</u> <u>(US\$)</u>
P. Thomas (India)	2705	cost free
K. Kawashima (Japan)	2790	cost free

C. Research Coordination Meeting

22,000.00

Bangkok, 22 to 26 November 1982

D. Contingency

4,000.00

TOTAL 80,000.00

*contributed by the Government of Japan

Title of Programme: The Use of Nuclear Techniques to Improve Domestic Buffalo Production in Asia.

Progress to date:

Substantial progress has been made over the past year in all areas of study, but particularly perhaps in reproduction where working assays for different steroid hormones have been established in Sri Lanka, Malaysia, Thailand, India, Philippines and Indonesia and are now being used for measurement of corpus luteum activity. Additionally, a quality control programme for various hormone assays which was initiated at the last meeting in Bangkok is now running smoothly with the result that it is now possible to ensure comparability of results between laboratories within as well as outwith the coordinated programme. Considerable information is also now available on the utilization of straw-based diets for buffalo, and on the beneficial effects on digestibility of treatment with urea. In addition, isotope-based studies have been implemented on the use of urea/molasses in straw-based diets; on the use of sweet-potatoe hay and fishmeal as supplements for straw-based diets; and on the feeding of agro-industrial by-products, e.g. rice bran, soyabean meal and leucaena. Finally, studies on the pathogenesis, immunology and control of T. vitulorum infection have gone far in defining the nature and sequential development of the clinical disease, the nature of the host response to the parasite, and an effective chemotherapeutic strategy for the control of the infection in calves.

The scope of the work to be conducted during the remainder of the programme (i.e. until the end of 1983) has been defined and individual experimental protocols drawn up for each Research Contractor.

Work Plan for 1983:

The work planned for 1983 is essentially a continuation of that specified at the first and second research coordination meetings, with greater emphasis being placed on the interactions between the various constraints on buffalo productivity, e.g. the interaction between nutrition and disease on reproductive performance. Appropriate contracts and agreements will be renewed up to the end of 1983 when the Final Research Coordination Meeting will be held. At this meeting, final reports will be presented by members of the programme and these should form the basis for a high quality Agency publication.

Funds required for 1983:

Research Contracts	\$ 24,000
Coordination Meeting	\$ 25,000

(likely venue: Philippines)

Future Plans:

At the Third Research Coordination Meeting of the programme (Malaysia, 19-23 April 1982) it was agreed that this programme has been highly successful both in terms of scientific achievement and in forming a strong base for cooperation between scientists working in Asia. However, it was stressed that to achieve its goals a follow-up programme should be initiated in 1984 to strengthen inter-disciplinary studies, to fill in the important gaps which remain within some of the disciplinary studies and to encourage other countries in the Region to initiate applied isotope-aided research on the buffalo. Such a programme would extend over the period 1984-1989 and would include 12-15 Research Contract/Agreement holders with approximately 3 Coordination Meetings. The appropriate cost would be \$ 60,000 per annum for Contracts and \$ 25,000 for each Coordination Meeting.

STATUS REPORT ON THE RCA CO-OPERATIVE RESEARCH PROJECT

"Radiation Sterilization Practices for Local Medical Supplies in Asia and the Pacific Region"

Introduction

The IAEA Co-ordinated Programme of Research (CPR) on "Radiation Sterilization Practices Significant to Local Medical Supplies and Conditions for Asia and the Pacific Region" has recently concluded upon the attainment of its objective goals (detailed in the earlier reports) during the past five years' of operation (1977-1982). The CPR has formed a part within the frame of the Regional Co-operative Agreement (RCA) of the IAEA with the Member States concerned. The participating investigators in this RCA programme are from Australia, Bangladesh, India, Indonesia, Korea (Republic of), Pakistan, Philippines and Thailand, respectively.

The present report deals primarily with the work carried out during the past project year (1981-1982) to be treated as a continuation of the previous reports. Besides, the report includes major recommendations/outlook for the future that might have emerged from the developments. For the ease of discussions the report details will be treated under the following topics:

- (1) The inter-laboratory dosimetric comparisons for standardization of methods and dose determination
- (2) Pre-sterilization bioburden levels of locally manufactured medical products
- (3) Radiation sterilization of pharmaceutical products
- (4) Continuation of the co-operative links in the technical and/operational matters pertinent to the promotion of the radiation sterilization practices.

1) The Inter-Laboratory Dosimetric Comparisons

The biological end-objective of the practices for radiation sterilization of medical supplies being the "elimination"(killing) of the contaminant microorganisms to the accepted standard of safety (adopted by the national health regulatory authorities) the microbicidal efficacy of the delivered radiation dose and the radiation response characteristics of the contaminants are among the crucial determining factors in the dose-setting criteria and the overall practice. Data presented by the various institutes on the estimated radiation dose (D_{10} in rads) needed to inactivate/eliminate 90% of the microbial contaminant population in an inter-laboratory intercomparison study revealed major variabilities (significantly higher than the variations to be expected due to chance probabilities). This situation necessitated a standardization of the methods followed for D_{10} value determination as well as an identification and control of responsible technical and environmental factors applicable for the region.

The dosimetric standardization involved intercomparison of data on radiation-inactivation of indicator microbiological preparations from Bacillus pumilus strain E 601 (spore suspensions) and radiochemical assay of a Cerium/Cerous (Ce^{4+}/Ce^{3+}) chemical dosimeter. Preparation of these dosimeters, their postal dispatch to the participating institutes of the RCA programme for irradiation and the parallel control study of the duplicate sets were all

carried out by the Isotopes and Microbiology Laboratories of the Australian Atomic Energy Commission in Lucas Heights.

The results showed that the different irradiation techniques followed, culture media used and radiation dose rates applied by the institutes at the participating countries had measurable but little effects on the estimated D_{10} values and hence could be adjusted. Comparisons of absorbed doses based on Ceric-cerous dosimeters, however, showed that some centres deviated to a greater extent from the acceptable values, with one being off by 25%. This could be ascribed to the use of two different measuring techniques such as potentiometry and spectrophotometry. Potential sources of variation were identified and a standardized procedure for D_{10} value determination was formulated for further use by the group. The radiation sterilization dose determined for several products is based on D_{10} values assessed using different suspending fluids. It is still necessary to relate in vitro D_{10} values with in vivo D_{10} values. More research is required to generate data on this aspect, particularly for the interest of all countries in the tropics (including the RCA Member countries concerned) with high ambient temperature and humidity. Regarding the choice and adaptation of the dosimeter systems for stable and reliable performance in the mega-rad dose levels the interesting findings of the IAEA Dosimetry Expert Group were reviewed and recommended for introduction as appropriate.

2) Pre-Sterile Bioburden of Local Medical Supplies and the Standard of Production Hygiene

Pre-sterilization bioburden levels of several medical products manufactured in Bangladesh, India, Indonesia, the Philippines and Thailand are now available from recent surveys resulting from this regional co-operative effort and the associated research project. In most of these above enumerated countries the status of pre-sterilization count (ranging between 10^4 to 10^6 per gram) indicate the pressing need for further improvement of the standard of their production hygiene. In all these countries, bioburden levels of cotton products (gauzes, dressings, cotton balls for clinical practices) show very high figures (sometimes as much as 10^5 to 10^7 per gram). With periodic alterations of hot humid and dry seasons there are gross fluctuations noticed in both the qualitative and quantitative aspects of bioburden of the cotton products.

The group referred to the recent incident of discovery in the UK and Europe of anaerobic spore-formers, such as Clostridium perfringens and C. tetani, in such products leading to very expensive recalls and destruction. Besides being the causes of health hazard to patient populations, such undesirable incidents tend to become counterproductive and hinder the prospect of the beneficial potentials of this technology. The group unanimously considered that more attention should be paid to testing for anaerobes and to persuading local manufacturers to improve the standard of hygiene in their factories. Films on good manufacturing practice could have much of a role to play for this purpose.

3) Radiation Sterilization of Pharmaceutical Products

In the clinical practice many pharmaceutical formulations are frequently needed in sterile condition. The potential of using ionizing radiation as the sterilizing agent of choice for such pharmaceutical substances has centred considerable attention in research and applications. Thermolability of most

of the active principles in pharmaceuticals preclude the use of heat sterilization. Retention of ethylene oxide in hazardous toxic levels often contra-indicates its use for the sterilization process.

The sterilizing radiation doses are liable to cause some radiochemical alterations/degradations of the pharmaceutical agents. The difficulties are, however, elucidated through appropriate research on the role(s) of environmental factors and the preventive steps against radiochemical degradations. Extensive studies have been undertaken on the irradiation of pharmaceutical substances in non-aqueous and/or dry states and with or without the presence of some additives/excipients to help scavenge the radicals/ions. A considerable amount of insight has generated with the applications of current multi-disciplinary research information in these regards. The availability of precision analytical tools (HPLC chromatography; Potentiometry, Spectrophotometry, GC and MS tools) have helped to identify and characterize the possible degradation products ^{in trace quantities and} to evaluate in terms of clinical safety and the Pharmacopoeal stipulations.

The research of the RCA programme has successfully completed the analysis of the following pharmaceutical groups after exposure to radiation doses (3-4 Mrads) higher than that recommended for sterilization practices (2.5 Mrads):

- (a) Antibiotics, such as chloramphenicol Na-succinate; gentamycin sulphate; oxytetracycline HCl; benzyl penicillin Na; ampicillin; tricarcilin Na; cefoxitin Na.
- (b) Antibiotic-hydrocortisone eye ointment formulations, such as chloramphenicol-hydrocortisone acetate; gentamycin sulphate-steroid eye ointment.
- (c) Steroids, such as hydrocortisone acetate ointment in paraffin base; prednisolone hydrate; betamethosone-17-valerate; prednisone; testosterone propionate in oil.
- (d) Crude drugs, such as leaves of digitalis, belladonna, Jemu (in Indonesia); paraffin based ointments, topical ointments, powders.
- (e) Pharmaceutical containers and applicators, such as polyethylene containers, plugs, eye droppers, aluminium tubes.
- (f) Medical devices such as vasectomy kits; maternity kits and to a limited extent tissue graft implants for corrective/rehabilitative surgery.

The above radiation sterilized products have successfully stood the tests of major pharmacopoeal specifications to be considered as clinically safe.

4) Co-operative Links within the Members of the Group in the RCA Programme

The CPR group comprises of members/institutes with various levels of advancement in the implementation of the radiation sterilization technology and practices to help up-grade the national health-care services. The spirit of expertise-sharing between the members through dissemination of technical information, as manifested during the past years, has been recognized as beneficial and in keeping with the RCA objectives and hence should continue.

To-date all the countries have operating large irradiator facilities, either in the semi-commercial or pilot-scale demonstration levels. These are in use to practices development, manufacturers' instruction, testing of packaging materials, on-site training of technicians and test-marketing of local medical products.

The experiences continue to be shared between the individual members in terms of hygienic control, dosimetry monitoring, product designing and packaging as well as the format for applications in seeking health authority's clearances for radiation sterilized pharmaceuticals. Instructions of the national good manufacturing practices (GMP) and the layout of the facilities and the adaptation of the IAEA recommended code of practice were discussed and reviewed by the group in the context of specific national requirements.

Future RCA Programme Activity in the Field of Applications

The Technical feasibilities of using radiation and chemical sterilization practices for biological tissue grafts (such as bone, nerve, fascia lata, dura mater, cartilages, tendon, "skin dressings", heart valves) have facilitated their large scale availability to the surgeons for safe clinical use in corrective/reconstructive surgery to help alleviate health disorders/disabilities of human patients. Large numbers of such cases of physical/physiological disorders are thus corrected in the technologically advanced countries of the West by using such sterile tissue grafts processed and preserved in tissue banks. The technical know-how and practices for medical products' sterilization developed in the countries of Asia, Far East and the Pacific could therefore be extended to encompass the fields of tissue grafts sterilization and the establishment of Tissue Banking facilities to ensure a sustained supply to the surgeons for safe clinical use. Preliminary surveys in the health centres of the countries in the regions have met with unanimous support and this lack of tissue banks is regarded as a major gap in the indigenous health care system.

The already well-developed technical know-how from the Tissue Banks in the countries of Europe, North America and Australia could be extended with necessary research to adopt the practices to the local conditions of socio-economic and cultural aspects. Some countries in the region have already initiated preliminary steps towards this objective goal. The existing facilities could be strengthened through research on the suitable factors in sterilization practices with none or minimal alterations in the physical/chemical/antigenic properties of the tissue grafts to ensure safe clinical usage. WHO co-operation in this venture should be desirable and helpful.

If sufficient interests are shown by the member countries in Asia/Far East and Pacific in this field of medical applications the effort could justify the initiation of a new RCA programme on this subject.

RCA PROJECT ON HEALTH-RELATED ENVIRONMENTAL RESEARCH

Project Current Status and Proposed Action Plan and Budget for 1983

I. Introduction

The work scope of this RCA Project is to assist the participating institutes in developing their analytical capability with reference to environmental health research, and in applying this competence to specific environmental and/or occupational health problems of local significance.

This brief report reviews the Project's current status and outlines the action plan and budget for 1983.

II. Project's Status for 1981-1982

1. Investigators from the following countries are currently participating in the Project: Bangladesh, India, Indonesia, Japan, Malaysia, Pakistan, Singapore and New Zealand. Two contracts were completed in 1982 (Thailand and Republic of Korea), while another one was completed in 1981 (Philippines).

2. An inter-laboratory comparison study of a number of reference materials was initiated in 1982. The study involves the analysis by all the participants (current and past contractors), of 5 reference materials for some selected trace and other elements of bio-environmental significance.

3. A proposal is under study to hold in 1984 a training course on nuclear methods for environmental health studies.

4. The Project's Newsletter was revived. It was edited in 1982 with the help of the participant from India and circulated among the participants and other interested investigators from the RCA region.

III. Action Plan for 1983

5. The existing research contracts and research agreements will continue to be supported.

6. Intercomparison studies of trace and other elements of bio-environmental interest will continue to be carried out within the Project's analytical quality control activities.

7. The second research co-ordination meeting (RCM) of the Project will be held during 1983 at one of the participating institutes. It is planned to hold this RCM conjointly with the RCM of a related CRP, which involves participants from non-RCA member countries.

8. The current Project is expected to be phased out in 1984 and it is planned to explore the possibility of initiating a new project on the assessment of mercury and a few selected toxic elements in food, especially in fish. The new project could be implemented in 1984.

IV. Estimated Budget for 1983

The budget for the proposed Project's activities for 1983 is summarised as follows:

(a) Contracts	\$ 47,000
(b) Research Co-ordination Meeting	\$ 19,000
(c) Reference Materials	\$ 5,000
(d) Distribution of Reference Materials	\$ <u>3,000</u>
T O T A L	\$ 74,000

RCA project on the Maintenance of Nuclear Instruments

Status report May 1982

- 1.) All contracts under this project have been renewed during the past year.
- 2.) In the past year the project concentrated on powerconditioning, training and preventive maintenance planning.
- 3.) In the field of powerconditioning:
 - a) Very informative recordings of the AC mains voltage were made in eight of the nine participating countries. The recordings led in several laboratories to repairs of the mains distribution grid.
 - b) In almost all pilot laboratories drop-out relays and varistors were installed.
 - c) More than 40 voltage stabilizers (constant voltage transformers) were installed.
 - d) In a few pilot laboratories dedicated earthlines were installed.
 - e) A paper on powerconditioning was prepared.
- 4.) In the field of training:
 - a) The Train-the-Trainers Workshop was held in Kuala Lumpur, attended by 24 participants.
 - b) Local training courses were given by mainly local teachers, participants of the Workshop with some assistance of Agency experts in Bangladesh, Indonesia, Malaysia, the Philippines, Sri Lanka and Thailand. In India, Korea, Pakistan courses were given without Agency assistance.
- 5.) In the field of preventive maintenance a start was made with the introduction of logbooks and maintenance and quality-control plans.
- 6.) In the framework of the Interregional Technical Assistance Project, which was initiated in support of this RCA project and similar ones in Africa and Latin America, itinerant experts visited the pilot laboratories in seven of the participating countries. The experts paid attention to all three above mentioned subjects. Their visits allowed also for a much better insight in the real existing problems in the field of instrument maintenance.

- 7.) A project review meeting was held in Yogyakarta, Indonesia, during which for the first time all nine National Supervisors were together. During this meeting it became clear how much work has been done already in this project.
- 8.) In 1983 the activities of the project will continue. The main activities will gradually more concentrate on local training and maintenance planning. It is also planned to continue the Train-the-Trainers activities and to conduct regional training workshops on selected topics such as microprocessors in nuclear instruments and use and maintenance of liquid scintillation equipment.
- 9.) A Project Review Meeting will be held in November 1982 during which a detailed evaluation will be made of the results of the project.
- 10.) The funds necessary for the project in 1983 will be of the same magnitude as in previous years: US\$ 50,000 for the contracts and US\$ 15,000 for the meeting.

ISOTOPE APPLICATIONS TO HYDROLOGY AND SEDIMENTOLOGY

Progress

The coordinated programme of research applying environmental isotope techniques to hydrological problems in Indonesia, Malaysia, Republic of Korea and Thailand has continued. The study in the Seoul area has been extended to an examination of the water in the crystalline rock. Initial data indicate that this aquifer is recharged by the overlying shallow aquifer. Sampling of groundwater in the Jakarta basin has been extended and carbon-14 data show a sharp break between estimated groundwater ages of 9,000 and 19,000 years. In connection with the latter project the analytical systems for tritium and carbon-14, which were installed last summer, are being used for the required analyses. An investigation of the cause of salinity of groundwater in the southern part of Sri Lanka has recently commenced.

In some countries participating in this project studies have commenced on the use of ^{137}Cs for investigating sediment erosion and deposition. An expert from the Australian Atomic Energy Commission has visited a number of countries to demonstrate techniques and advise on the performance of detector systems.

Programme and budget for 1983

The general lines of the project will be maintained. A review of the project and the coordinated programme of research is foreseen in November 1982.

Consideration is being given to the organisation of a roving seminar to visit the participating countries with the aim of informing hydrologists of the potential of isotope techniques.

The estimated budget foreseen for 1983 is US\$ 72,000.

STATUS REPORT OF RCA PROGRAMME

Title of Programme: Semi-dwarf Mutants for Rice Improvement in Asia and the Pacific

Summary Progress Report

Invitations to join the programme were sent to 16 scientists in 9 RCA countries.

Research contracts have been concluded so far with the following institutions and scientists:

Indian Agricultural Research Institute, New Delhi, India, E.A. Siddiq;
Osmania University, Hyderabad, India, T.P. Reddy;
Centre for the Application of Isotopes and Radiation, Jakarta, Indonesia, R. Sumanggono;
Nuclear Institute for Agriculture and Biology, Faisalabad, Pakistan, M.A. Awan;
Atomic Energy Agricultural Research Centre, Tandojam, Pakistan, G. Bari.

Research proposals have been received from the following institutes and scientists:

Bangladesh Rice Research Institute, Dacca, Bangladesh, N.M. Miah;
Institute of Nuclear Agriculture, Mymensingh, Bangladesh, A.J. Miah;
Maligaya Rice Research and Training Centre, Philippines, T.S. Eugenio

These are under processing for approval.

It is expected that the programme will reach its full size by the end of this year.

Activities in 1983 and Budget

The first research co-ordinated meeting will be held in early 1983, where the results obtained up to that time will be reported and the research plan will be discussed in depth. Emphasis will be placed on practical aspects which may lead to evolving promising semi-dwarf genotypes adapted to local conditions.

The following budget is proposed:

12 potential research contractors	US\$ 48,000
3 potential research agreement holders	—
Research Co-ordination Meeting	20,000
Total	\$ 68,000

IAEA: 4th RCA WORKING GROUP MEETING
SESSION 17 JUNE

TOPIC I - CURRENT STATUS OF REGIONAL COOPERATION RESEARCH PROJECTS

IAEA REGIONAL COOPERATIVE AGREEMENT

PROJECT 13 ISOTOPE HYDROLOGY AND SEDIMENTOLOGY

PROGRESS REPORT

1. INTRODUCTION

The specific aim of the project is the application of environmental isotope techniques in support of investigations of water resources and soil erosion. It is hoped thereby that local practising hydrologists and soil scientists will become familiar with the procedures and that eventually self-sustaining activities based on national needs will evolve.

The program is managed jointly by the IAEA and the AAEC. The Project Officer is Dr. B. R. Payne, Head of the Agency's Section of Isotope Hydrology. The key element in the implementation of the project is the letting of IAEA research contracts.

2. PROJECT IMPLEMENTATION

The project is implemented through the design and support of investigations of national significance. The strength of the RCA concept as interpreted through the Hydrology Project is that support can be provided not only by the letting of research contracts and the arranging of periodic meetings of projects leaders, but also by the

- . provision of capital equipment, and
- . training of key personnel.

Thus it is possible to combine the best elements of the Agency's technical assistance and research contract programs.

Major activities include the following:

2.1 Investigation of Water Resources

- . Interaction between the surface water and groundwater of the Han River Valley (Republic of Korea).
- . Groundwater hydrology of the Jakarta Basin (Indonesia)
- . Groundwater hydrology of the Bangkok Basin (Thailand)
- . Isotope hydrology of the lower Kelantan Catchment (Malaysia).

A number of projects have been approved and preliminary measurements undertaken. These include:

- . the hydrology of the Karst areas of Northern Thailand,
- . the hydrology of nominated aquifers in the states of Kedah and Perlis (north-western Malaysia)
- . the hydrology of the crystalline rock aquifers in the dry areas of Sri Lanka.

The location of many of the study areas is shown in Figure 1.

2.2 Investigation of Soil Erosion and Sedement Accumulation

Environmental caesium-137 techniques are to be used to study the cumulative effects of sediment erosion and redistribution in post-nuclear times. Investigations in the following areas have commenced:

- . Sg Lui catchment near Kuala Lumpur (Malaysia)
- . Song Khla lagoon region of south-east Thailand.

2.3 Provision of Capital Equipment

The following major capital equipment items have already been provided:

- . Republic of Korea - Tritium enrichment facilities, liquid scintillation facilities,
- . Indonesia - tritium enrichment facilities, carbon-14 conversion equipment
- . Thailand - liquid scintillation spectrometer
- . Malaysia - tritium enrichment facilities (to be installed)

2.4 Training of Key Personnel

Scientists from Korea and Indonesia have been trained in isotope hydrology techniques and a Malaysian scientist has commenced an attachment with the AAEC's Nuclear Hydrology Group under the RCA program. A scientist from Sri Lanka has been trained under the IAEA's regular Fellowship scheme.

2.5 Project Review Meetings

The initial meeting establishing the project was held at Lucas Heights in June 1979; the first review meeting was hosted by the Korean Advanced Energy Research Institute in Seoul in October 1981. The second review meeting will be held at the AAEC Research Establishment at Lucas Heights, Sydney from 1-5 November 1982.

3. IMPACT OF THE PROJECT

3.1 Potential Impact of the Scientific Results

As a direct result of isotope measurements in the Han River Valley (ROK), it was shown that the mechanism of recharge to the groundwater appears to depend on the degree of urbanisation. In metropolitan Seoul recharge is by seepage from the Han River; in country areas from rainfall infiltration. Interesting results from the study of the groundwater in the urban regions of Jakarta and from the Bangkok Basin are emerging. An extensive survey has also been carried out in the Lower Kelantan Catchment. Isotopic data have been important in establishing a water balance within the region.

Two points need to be made:

- (i) In general these insights could only have been obtained with isotopic techniques as much of the necessary hydraulic data was unavailable;
- (ii) More importantly, the isotopic indicators of the recharge water in metropolitan areas will almost certainly move through the ground more rapidly than many of the chemical and biological pollutants and may therefore provide an early warning signal

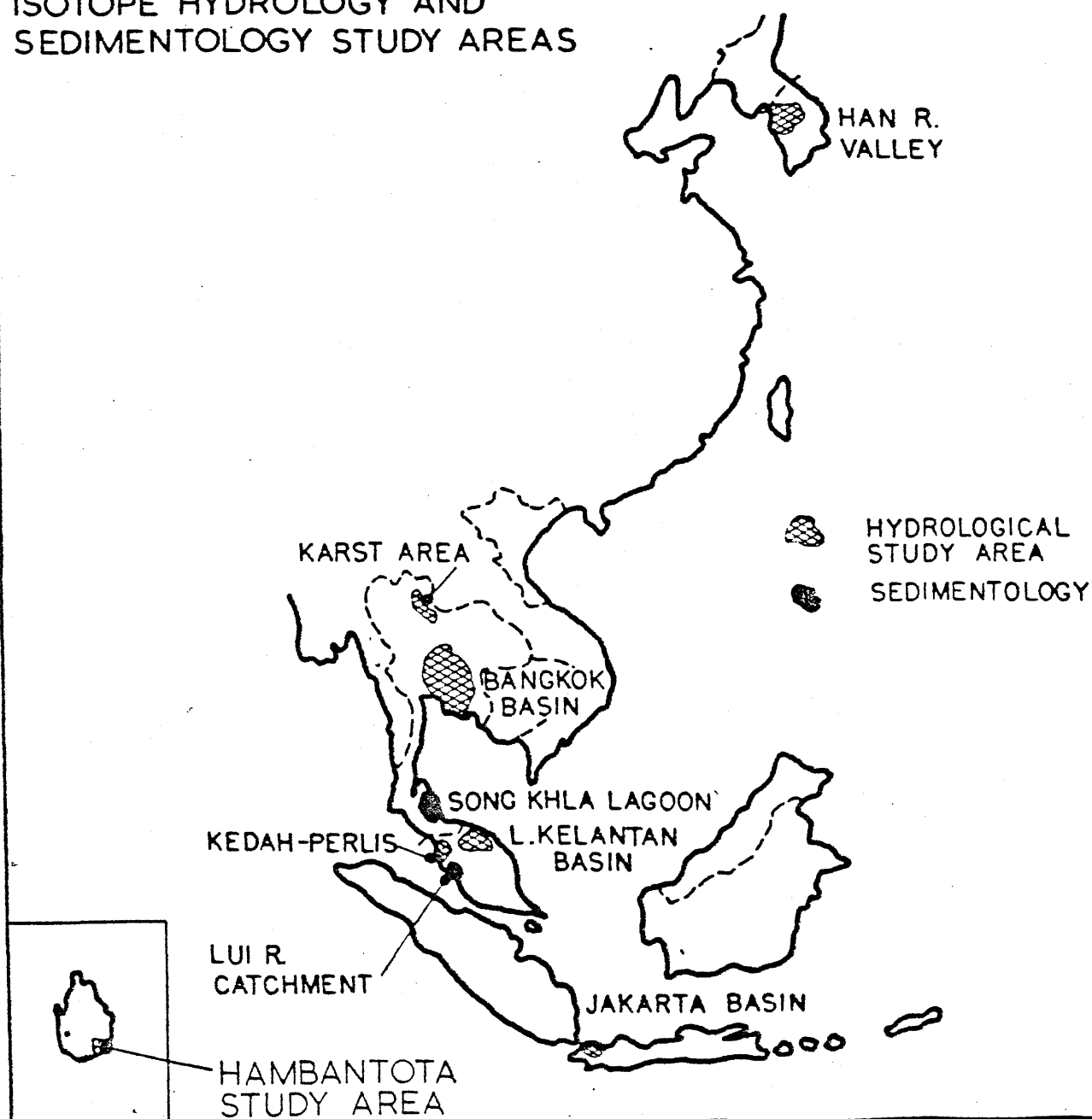
3.2 Interactions between Atomic Energy Establishments and other Authorities

The hydrology project has contributed to a process of interaction between atomic energy establishments and other authorities to the benefit of local communities. Some of the authorities involved in the project include:

- | | |
|------------|--|
| Indonesia: | Geological Directorate, Bandung
Water Supply Enterprise, City of Jakarta. |
| Thailand: | Department of Mineral Resources,
Royal Irrigation Department. |
| Malaysia: | Geological Survey,
Department of Irrigation and Drainage. |
| Sri Lanka: | Water Resources Board |

RCA PROJECT

ISOTOPE HYDROLOGY AND SEDIMENTOLOGY STUDY AREAS



1982 RCA ACTION PLAN

Table I

ESTIMATED COSTS

TITLE	Technical Proj. Officer	1981		1982		Sub-Total	1983-1986
		Total Costs	Res. Contracts	Proj. Mtg.	Proj. Mtg.		
UNDP Proj. on Industrial Applications of Isotopes and Radiation Technology	E. Fowler	\$2,289,299	-	-	\$2,634,279 ¹⁾		\$7,176,699
Reg. Proj. on the Use of Induced Mutations for Improvement of Grain Legume Production	A. Micke	81,500	\$ 46,000	\$ 25,000	71,000		140,000
Reg. Proj. on Food Irradiation	P. Loaharanu	80,000	54,000	26,000	80,000 ²⁾		400,000 ³⁾
Reg. Proj. for Improving Domestic Buffalo Production	B. Young	70,700	32,000	20,000	52,000		260,000
Reg. Proj. on Sterilization of Medical Supplies	R. Mukherjee	35,000	25,000	14,000	39,000		-
Reg. Proj. on Health Related Environmental Research	S. M'Baku	44,000	48,000	-	48,000		140,000
Reg. Proj. on Nuclear Instrument Maintenance	P. Vuister	53,500	50,000	15,000	65,000		230,000 ⁶¹
Reg. Proj. on Neutron Scattering	R. Muranaka	12,700	-	-	-		-
Reg. Proj. on Isotope Applications in Hydrology and Sedimentology	B. Payne	105,000	77,500	17,500	95,000 ⁴⁾		151,000
Reg. Proj. on Semi-Dwarf Mutants for Rice Improvement	T. Kawai	-	30,000	20,000	50,000		200,000
Regional Proj. on Biogas from Agricultural Residues	D. Lindquist	-	(45,000)	(20,000)	(65,000)		(250,000)
Working Group Meeting		3,600			4,000 ⁵⁾		12,000

Appendix 8

TOTAL

\$2,775,299\$362,500\$137,500\$3,138,279\$8,709,699

(407,500)

(157,500)

(3,203,279)

(3,959,699)

- 1) The Project on Industrial Applications of Isotopes and Radiation Technology is funded by UNDP at a level of US\$800,000, by RCA Governments at a level of US\$1,716,279 and by industries at a level of US\$118,000. The Government of Japan has made a cash contribution of US\$85,000 in 1981 and is expected to make a contribution of US\$614,050 in cash and in kind in 1982. The Government of Australia is expected to make a cash contribution of US\$45,000 in 1982.
- 2) The Government of Japan has made a cash contribution of US\$76,000 in 1980 and US\$80,000 in 1981, and is expected to make a contribution of US\$80,000 in 1982.
- 3) The phase II of the Project concerning pilot-scale research and development will be initiated in 1983 subject to availability of funds and contributions from RCA Governments.
- 4) The Government of Australia has made a contribution in the years 1979-1981 totalling US\$317,000 and is expected to make a contribution of US\$65,000 in 1982.
- 5) The meeting will be partially funded at a level of US\$ 4,000 through the contribution of the Australian Government.

TABLE II

RCA REGIONAL CO-OPERATIVE RESEARCH PROJECTS

1. Regional UNDP Project on Industrial Applications of Isotopes and Radiation Technology

Australia*	Pakistan
Bangladesh	Philippines
India	Republic of Korea
Indonesia	Singapore
Japan*	Sri Lanka
Malaysia	Thailand
2. Regional Co-operative Research Project on the Use of Induced Mutations for the Improvement of Grain Legume Production

Bangladesh	Pakistan
India	Philippines
Indonesia	Sri Lanka
Republic of Korea	Thailand
Malaysia	
3. Regional Co-operative Research Project on Food Irradiation

Bangladesh	Malaysia
India	Pakistan
Indonesia	Philippines
Japan*	Sri Lanka
Republic of Korea	Thailand
4. Regional Co-operative Research Project on the Use of Nuclear Techniques in Improving Buffalo Production

Australia	Malaysia
Bangladesh	Philippines
India	Sri Lanka
Indonesia	Thailand
5. Regional Co-operative Research Project on Radiation Sterilization Practices significant to Local Medical Supplies and Conditions

Australia	Republic of Korea
Bangladesh	Pakistan
India	Philippines
Indonesia	Thailand

6. Regional Co-operative Research Project on Health Related
Environmental Research

Bangladesh	Malaysia
India	Pakistan
Indonesia	Philippines
Japan	Singapore
Republic of Korea	Thailand

7. Regional Co-operative Research Project on Maintenance of
Nuclear Instruments

Bangladesh	Pakistan
India	Philippines
Indonesia	Sri Lanka
Republic of Korea	Thailand
Malaysia	

8. Regional Co-operative Research Project on Isotope Applications
to Hydrology and Sedimentology

Australia*	Malaysia
Indonesia	Thailand
Republic of Korea	

9. Regional Co-operative Research Project on Semi-Dwarf Mutants for
Rice Improvement

Bangladesh	Philippines
India	Republic of Korea
Indonesia	Sri Lanka
Japan	Thailand
Malaysia	Viet Nam
Pakistan	

* Donor Government

STATUS REPORT

UNDP Regional (RCA) Industrial Project

The following activities are reported for the period ending 1 June 1982:

1. The UNDP Preparatory Assistance Project was completed on 31 March 1982. A total expenditure for the period 16 August 1980 through 31 March 1982 of \$ 1,584,833 was made. A final report on the Preparatory Assistance phase will be issued on or before 15 July 1982.
2. The Project Document proposal (30 June 1981) has been formally signed by the 10 Participating Governments party to RCA, agreeing to their participation and financial contributions to the Project. Letters of Understanding have been exchanged between the IAEA and the donor Governments of Australia and Japan providing for their contributions. A Project expenditure of \$12,462,413 is planned over its 6.7 year term.
3. The full scale UNDP Regional (RCA) Industrial Project was initiated on 1 April 1982. As required by UNDP a Project Plan was prepared and issued on 1 April 1982 incorporating all required elements of the Project Document Proposal and signed by UNDP, New York and IAEA.
4. Governments party to RCA were formally advised by IAEA on 28 May 1982 of its decisions to:
 - a) Accept the proposal of the Government of Japan and establish an interim UNDP Project Office in Tokyo for the period 14 June 1982 to 30 June 1983.
 - b) Appoint Mr. E.E. Fowler, Project Director and Chief Technical Advisor of the office for the above period.
 - c) Establish a permanent UNDP Project Office, 1 July 1983 in Jakarta, Indonesia; and
 - d) Complete its search for a new Project Director for the Jakarta Office by 31 December 1982.
4. All negotiations have been completed and agreements signed for initiation of the large-scale demonstration Sub-Project using a nucleonic control system for paper manufacture at the Siam Kraft Paper Company, Ban Pong, Thailand. The first special training, large-scale demonstration, took place 8-26 February 1982 in Tokyo, Japan and Ban Pong, Thailand.

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5. Final negotiations have been completed for initiation of a large-scale demonstration Sub-Project using a nucleonic control system for steel manufacture at the Bokaro Steel Plant, Bokaro, India. A competitive selection to supply the nucleonic control system for 1982 installation in the Plant will be made in June 1982. The first special training - in plant demonstration will occur in October 1983.
6. Negotiations have been completed for installation of a 1,000 ton per year Pilot Plant for radiation vulcanization of natural rubber latex at the Centre for Application of Isotopes and Radiation, Jakarta, Indonesia. A competitive selection of a 150,000 curie cobalt-60 radiation source and the chemical reactor for the Pilot Plant was completed and equipment ordered in November 1981 for installation and commissioning during 1982. Pilot Plant start-up is scheduled for January 1983.
7. Final negotiations are targeted to be completed in June 1982 leading to implementation of the Sub-Project on Mineral Exploration, Mining and Processing which includes advanced training and in-plant demonstration at the Benguet Corporation, Dizon Mine, San Marcelino, Bambales, Phillippines of a nucleonic control system for copper beneficiation. Training demonstration activities will be initiated in September 1983.
8. A UNDP Expert Working Group held its 4th meeting in Bombay, India, 3-5 March 1982 to finalize the design of a Regional Certification Plan for NDT Practice according to International Standards. The Plan will be presented to RCA Governments in September 1982 for final review and acceptance. Implementation of the Regional Plan is targeted for early 1983 coupled with special training courses in Advanced NDT methods in Singapore and Japan.
9. A UNDP sponsored Train-the-Trainer Workshop on Nuclear Instruments Maintenance was held on 13 April - 23 May 1981, at the University of Technology, Kuala Lumpur, Malaysia, Twenty-one participants from 10 RCA countries participated.
10. A "Pilot" Workshop on Maintenance of Nuclear Instruments for Industrial Application was held 5-25 November 1981, Tokyo in co-operation with the Government of Japan and the Japan Atomic Industrial Forum. Twelve participants from 9 RCA countries attended.
11. The first Technical Review Meeting on the Sub-Project 3.a. "Radiation Processing" was held 15-19 February 1982 in Kuala Lumpur, Malaysia.

4th RCA WORKING GROUP MEETING,
SESSION JUNE 17, 1982
TOPIC II CURRENT STATUS OF UNDP INDUSTRIAL PROJECT

IAEA: RCA REGIONAL PROJECT ON INDUSTRIAL APPLICATIONS OF ISOTOPES
AND RADIATION TECHNOLOGY - MINERALS SUB-PROJECT
PROJECT ON "ON STREAM ANALYSIS AND CONTROL OF MINERAL CONCENTRATORS"

The Australian Government in consultation with the Government of the Philippines and the International Atomic Energy Agency is at present finalising planning for a Regional Sub-Project on "On-Stream Analysis and Control of Mineral Concentrators". Detailed plans were drawn up at a series of meetings held in the Philippines from 21-23 April 1982 and project documentation will be finalised at a meeting to be held at the Lucas Heights Research Establishment, 23-25 June 1982.

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; plant studies to improve control of this concentrator; and 'in plant' training on nucleonic techniques and control. The project, of five years duration will involve the Commonwealth Scientific and Industrial Research Organisation (CSIRO), the Australian Atomic Energy Commission (AAEC), the Julius Kruttschnitt Mineral Research Centre (JKMRC), University of Queensland, the Australian Mineral Development Laboratories (AMDEL), the Philippines Atomic Energy Commission (PAEC), and the Benguet Corporation, Dizon Operation, Kaline Concentrator, San Marcelino, Zambales, Philippines.

It is anticipated that the following countries will participate in the project:-

Bangladesh, India, Indonesia, Republic of Korea, Malaysia, Pakistan, Philippines, Sri Lanka and Thailand.

The objectives of sub-project are:-

- (a) To train selected metallurgists in nucleonic techniques and their application to mineral processing operations.
- (b) To demonstrate the development and use of an automatic control system for a mineral concentrator based on the use of a nucleonic method for continuous analysis of ore streams.
- (c) To train the metallurgists in all the techniques associated with the application of the total control system, with particular emphasis on nucleonic techniques.

- (d) To transfer Australian technology related to the highly specialised field of nucleonic on-stream analysis to the Philippines Atomic Energy Commission so that it can undertake regional training in this field at completion of the sub-project.

This program of training and control work has been designed for metallurgists and control engineers who have had at least two years post graduate experience working in the area of control of mineral concentrators. They should be currently working in this field. This background and experience is required so that, at the end of the course, the participants will have sufficient training to ensure that they can improve control of concentrators in their own countries.

The sub-project 4C consists of two main parts:-

- (a) Training courses in Australia and in the Philippines to give participants a background in nucleonic techniques and their application to mineral processing, and a background in control of mineral concentrators, and
- (b) development of better control of Benguet Corporation's Kaline copper concentrator based on information from the nucleonic on-stream analysis system and other sensors, and 'in plant' training of participants who will take part in these control developments.

PROGRAM AND TIMETABLE

It is envisaged that AMDEL will install an on-stream analysis system at the Benguet Kaline copper concentrator in January 1983. Benguet staff will be trained in its operation. The Julius Kruttschnitt Mineral Research Centre (JKMRC) will initiate a logging program to obtain data required for control of the concentration. Control equipment will be installed in August 1983. A two week training course on the application of nuclear techniques to mineral processing will be held in August 1983 in Australia. This will be followed by a week of visits to Australian mineral concentrators and to AMDEL, and a one week course on control of mineral concentrators at the JKMRC.

Half of the twelve trainees from the Australian course will travel directly to the Philippines to undertake a one week course on nuclear techniques at the PAEC's training centre in Quezon City followed by three months at the Kaline copper concentrator, being trained by JKMRC staff in on-stream analysis and control. The trainees will be directly involved in improving control of the concentrator under supervision of JKMRC staff. This expertise gained is generally applicable to any type of (froth flotation) concentrator, large or small, not only for copper minerals, but also for lead, zinc, nickel, etc. minerals.

The second half of the trainees will return to their own countries after completion of the Australian course. Two months later, they will go to the Philippines to undertake the one week course by the PAEC, followed by three months' training at the concentrator.

A second cycle of training, similar to the first, will be held in 1985-86.

During the sub-project, JKMRC staff will spend two six month periods at the concentrator improving its control. Records will be kept during the whole sub-project period of 1982-86, of metal recovery, ore tonnage treated in the concentrator, and (where possible) flotation characteristics of the ore. These records will be used to establish improvements in concentrator performance resulting from on-stream analysis and control. The trainees will thus have access to data on improved economies of operation of the concentrator.

3. 1983 RCA Cost Projection

(In US Dollars)

Title of Project	Research Contracts	1983 Project Meeting	Sub-Total
UNDP Project on Industrial Applications of Isotopes and Radiation Technology	-	-	2,839,317
Regional Project on the Use of Induced Mutations for Improvement of Grain Legume Production	60,000	25,000	85,000
Regional Project on Food Irradiation	54,000	26,000	80,000
Regional Project for Improving Domestic Buffalo Production	24,000	25,000	49,000
Regional Project on Health Related Environmental Research	55,000	19,000	74,000
Regional Project on Nuclear Instrument Maintenance	50,000	15,000	65,000
Regional Project on Neutron Scattering	-	-	-
Regional Project on Isotope Applications in Hydrology and Sedimentology	57,000	15,000	72,000
Regional Project on Semi-Dwarf Mutants for Rice Improvement	48,000	20,000	68,000
Regional Project on Radiation Sterilization of Biological Tissue Graft	25,000	14,000	39,000
Regional Project on Biogas from Agricultural Residues	45,000	20,000	65,000
Regional Project on Medical and Biological Applications	50,000	15,000	65,000
Working Group Meeting			4,000

 US\$ 3,505,317

OUTLINE OF DRAFT PROPOSAL
REGIONAL RCA PROJECT FOR ASIA AND THE PACIFIC ON
MEDICAL AND BIOLOGICAL APPLICATIONS OF NUCLEAR TECHNIQUES

PURPOSE

The purpose of this Project is to expand and accelerate the use of nuclear techniques in medical and biological applications in RCA countries to improve health and medical care.

The project is designed to promote scientific and technical cooperation among the developing and developed countries in the region through the use of established facilities and capability in individual Member States.

BACKGROUND AND JUSTIFICATION

It has been fully recognized and proved that nuclear techniques are extremely useful and beneficial in various fields of medical science in improving health and medical care, both in developed and developing countries.

In the developing Member States in the region, the following findings have been pointed out by the Japanese expert team on the status in RCA countries of medical and biological applications of radiation and isotopes (February 1981) and the workshop on the same topic (August 1981):

1. In the field of nuclear medicine, the availability of medical practice is still very limited because of the insufficient nuclear equipment available, radioisotopes, equipment maintenance and trained manpower. The study of liver and thyroid diseases is a common need and interest of the region.
2. Radiation therapy plays a role of considerable importance among the various modalities for cancer treatment. However, there is an obvious shortage of qualified radiotherapists, technicians and therapy equipment. In the combination of radiation with chemotherapy, which is used in many countries, the availability of drugs is limited due to the high cost. The most common cancers are those of the stomach, lung, naso-pharynx, oral cavity, breast and uterine cervix.

3. Labelled compounds for nuclear medicine are mostly imported in most countries at a very high cost, with the exception of India, Indonesia, and Thailand.

Upon receipt of the report of the Japanese Expert Team, including observations and recommendations for future activities under RCA, the Governments of Bangladesh, Indonesia, Republic of Korea, Malaysia and Thailand have already expressed their interest in initiating the Project. The IAEA Secretariat was informally asked to prepare a Draft Project Proposal for discussion at the 4th Working Group Meeting.

Recognizing the importance of this field, the Agency has approved a Coordinated Research Programme on "Improvement of Cancer Therapy in Asian Countries by a Combination Treatment of Conventional Radiation and Physical and Chemical Means". This programme will form part of the new RCA Project after the acceptance by Member States.

ACTIVITIES

The activities of the Project consist of four components in related important fields:

- i. Improvement of conventional radiation therapy in cancer
- ii. Nuclear medicine in liver and thyroid diseases
- iii. Nuclear technique for diagnosis of parasitic diseases
- iv. Preparation of radiopharmaceuticals

1. Improvement of conventional radiation therapy in cancer

Sub-Project duration: 5 years

The major objectives of this sub-project are to train manpower in modern radiation therapy techniques and to improve the therapeutic gain using conventional machines available in the Region.

This sub-project provides over its five year term:

- i) Ten special training courses for medical physicists engaged in radiation therapy ;
- ii) Establishment of training and demonstration centre in the Region equipped with computer tomography and LINAC of 20 MeV;
- iii) Co-operative research programme on improvement of therapeutic gain using conventional machines by the study of irradiation schedule, combination treatments of radiation and chemicals and/or physical means, and introduction of computers for collection and evaluation of clinical data.

Sub-Project Cost

i. Group training-demonstration activities, 2 courses per year over 5 years (4 weeks, 20 participants per course)	\$ 600,000
ii. Equipments	
Whole body computed tomography	\$ 1,000,000
Linear accelerator, 20 MeV	\$ 1,500,000
iii. Co-operative research programme	
10 contracts over 5 year term	\$ 250,000
5 coordination committees	\$ 75,000
<u>Total</u>	<u>\$ 3,425,000</u>

2. Nuclear medicine for liver and thyroid diseases

Sub-Project duration ; 3 years

Nuclear medicine technique play a predominant role in diagnosis and treatment of thyroid and liver diseases which have high incidence in RCA countries.

This sub-project provides:

- i) Co-operative research programme on establishment of nuclear medicine methodology for diagnosis and treatment in thyroid diseases, such as endemic goiter and Graves' disease;
- ii) Co-operative research programme on nuclear medicine in diagnosis of liver diseases to establish the best methodology;
- iii) Training activities for technicians and medical doctors on nuclear medicine procedures placing emphasis on thyroid and liver diseases;
- iv) Installation of Gamma Cameras at medical centres where training courses will be held.

Sub-Project Cost

i. Two co-operative research programmes	
18 contracts over 2 year term	\$ 180,000
4 co-ordination committees	\$ 60,000
ii. Group training activities	\$ 240,000
2 courses per year over 2 year term	
(6 weeks, 20 participants per course)	
iii. Equipments	
Gamma Camera, 2 sets	\$ 400,000
<u>Total</u>	\$ <u>880,000</u>

3. Nuclear technique for diagnosis of parasitic diseases

Sub-Project duration: 2 years

Estimated numbers of infections of malaria and filariasis in the region of Asia and the Pacific are 15 million and 6 million per year, respectively. The need for effective diagnostic methods for tropical parasitic infections is great.

The objectives of this sub-project are to evaluate the potential of the existing immunoradiometric assay to detect parasite antigens in sera and urine of patients with malaria, filariasis or schistosomiasis, and to train technicians on these techniques.

Input from this sub-project is provision of:

- i) Co-operative research programme to establish final procedure for diagnostic tests in the parasitic diseases;
- ii) Training programme for technicians on the technique established in the above co-operative research.

Sub-Project Cost

i. Co-operative research programme	
11 contracts for one year	\$ 33,000
2 co-ordination committees	\$ 30,000
Supply of antibody	\$ 5,000
Computer cost	\$ 3,000
ii. Training courses, two for one year	\$ 72,000
(2 weeks, 15 participants per course)	
<u>Total</u>	\$ <u>143,000</u>

4. Preparation of radiopharmaceuticals

Sub-Project duration; 3 years

A bottleneck in the promotion of nuclear medicine in the developing countries in the Region is the high cost of imported radiopharmaceuticals. The establishment of technology for the production of ^{99m}Tc generator, radiopharmaceuticals labelled with ^{99m}Tc , and preparation of radioimmunoassay kit is highly valuable.

This sub-project provides:

- i) Co-operative research programme on development of a ^{99m}Tc generator system using low specific activity ^{99}Mo produced in low power research reactor;
- ii) Practical training for junior staff in preparation and use of ^{99m}Tc labelled radiopharmaceuticals;
- iii) Practical training for junior staff in preparation and use of radioimmunoassay kit.

Sub-Project Cost

i. Co-operative research programme	
10 contracts over 3 year term	\$ 150,000
3 co-ordination committees	\$ 45,000
supply of prototype, 2 sets	\$ 20,000
ii. Training activities on preparation, control and utilization of radiopharmaceuticals	
1 course per year over 3 year term (3 weeks, 15 participants)	\$ 150,000
iii. Training courses on preparation, control, and utilization of radioimmunoassay kit	
1 course per year over 3 year term (3 weeks, 15 participants)	\$ 150,000
<u>Total</u>	\$ <u>515,000</u>

TOTAL PROJECT COST

<u>Sub-Project</u>	<u>Cost</u>
1. Improvement of conventional radiation therapy in cancer	\$ 3,425,000
2. Nuclear medicine in liver and thyroid diseases	\$ 850,000
3. Nuclear technique for diagnosis of parasitic diseases	\$ 143,000
4. Preparation of radiopharmaceuticals	\$ 515,000
TOTAL	\$ <u>4,933,000</u>

1. Title of the Project: Improvement of Cancer Therapy by the Application of Recent Radiobiological Research
2. Scientific Background:

Cancer incidence throughout the world is increasing. In almost all the countries in southeast Asia the incidence of cancer is increasing with some differences in the order of the primary organs affected. Radiation therapy, together with the surgery, is one of the major modalities of cancer treatment, and about half of all patients need radiation therapy. Nowadays in cancer therapy by conventional radiations, radiation treatment by daily fractionation methods lasting for several weeks has been the general procedure. Many patients are obliged to stay in the hospital far from their families for a long time and they face a serious problem because well-equipped hospitals are located for the most part in large cities and rarely in rural areas. Therefore, a reduction in the number and/or overall time of fractionated treatment is an economically important problem for patients in Asian countries.

On the other hand, the cure rate in cancer radiotherapy is at present approximately only 50% in industrial countries, and it might be even lower in developing countries. Of course new methods are being developed to improve this figure, especially by the use of high energy particle. Nevertheless, the giant accelerators and generators for producing high LET radiation may be too expensive and too sophisticated technically for the developing countries, especially the Asian countries. As pointed out at the IAEA Seminar on "Prospective Methods of Radiation Therapy in Developing Countries" held in Kyoto, Japan in 1981, the combination modalities of radiation and hypoxic cell radiosensitizers and/or hyperthermia as well as the choice of the well qualified scheme in fractionated irradiation will be the most useful practically on economic and technical grounds for improvement of conventional radiation therapy, such as X-rays or γ -rays, in developing countries.

The following observations were also made by a team of Japanese experts who made a study tour of six Asian countries in 1981 and by experts who attended the Workshop on Medical and Biological Application of Radiation and Isotopes in the RCA Countries (1981, Tokyo): (1) Although linear accelerators are available in a few countries, orthovoltage X-ray and telecobalt machines are the mainly used equipment items for radiation therapy of cancer in most countries; (2) Maintenance service of the therapy equipment appears to be unsatisfactory; (3) There is a shortage of qualified radiotherapists, physicists and technicians; (4) Chemotherapy is used in many countries but the use is limited due to the high cost of the drugs.

Certain recommendations were made which are given in the reports of the above-mentioned Study Tour and Workshop: (1) Exchange of radiotherapists for encouragement in their work, and training of physicists and technicians; (2) Effective maintenance and service of the equipment; (3) Clinical co-operative work through the co-ordinated research programme.

3. Objectives:

- (1) To improve the therapeutic gain using conventional machines which are available in Asian countries.
- (2) To train the medical physicists engaged in radiation therapy.

4. Work Plan:

- (1) Coordination research programme on improvement of cancer therapy in Asian countries by the combination treatment of conventional radiation and physical or chemical means: Cooperative work of basic and clinical research in cancer therapy, and exchange of radiotherapists will be possible through this programme. The following subjects will be taken into account:
 - (i) Irradiation schedules of conventional treatment: The increased knowledge of radiobiology will lead radiotherapists to try new modalities in fractionation and changes in the fraction size. That is, an increase in the interval between fractionations may favour repopulation of tumor and normal tissues but it is also important for the reoxygenation of anoxic cells. The study of the fractionation scheme should be of the first importance - length of time between fractionation, the total number of fractionation, and irradiation dose.
 - (ii) The combination treatments of radiation and chemicals and/or physical means (hyperthermia): These agents will be expected to show an increase of the therapeutic gain from the results of radiobiological studies and could be of consequence in the reduction of the period of radiotherapy.
 - (iii) Epidemiological study analysis of data obtained: Collection and evaluation of the clinical data including follow-up data of the patients are necessary for the future optimization of cancer treatment through the correct use of the various modalities. The introduction of computers would be very useful. If the equipment was not available then the collaboration of experts from developed countries will of course be expected. These data will be very helpful for further study on geographical pathology or oncology in Asian countries in relation to the region, race or habitat.

(2) Training Course for Medical Physicists:

The training of practical techniques for radiation diagnosis and radiation therapy as well as of an essential knowledge of radiobiology and biophysics for medical physicists engaged in radiotherapy should be taken up.

In the treatment planning of radiotherapy, it is very important to acquire the information of body counter and internal structure. Introduction of the X-ray transmission Computer Tomography made it possible to obtain the precise information concerning the localization of tumor and the surrounding normal tissue. Furthermore, by computerization of radiotherapy in cancer more precise treatment will be possible. This method is being routinely carried out by medical physicists in many hospitals in industrial countries. In order to train these new techniques the following instruments are requested.

5. Budget:

(1) Coordinated Research Programme US\$ 175,000

Research Contracts - $\text{US\$ } 5,000 \times 10 \times 5 \text{ years} = \text{US\$ } 250,000$

RCM - $\text{US\$ } 15,000 \times 5 = \text{US\$ } 75,000$

(2) Equipment US\$ 2,500,000

(i) Whole body computed tomography including computer and X-ray units, - $\text{US\$ } 1,000,000$

(ii) Linear accelerator (20 MeV) - $\text{US\$ } 1,500,000$

(3) Training courses, (two times per year x 5 years) US\$ 600,000

Trainee (20 x 4 weeks) Travel: $\text{US\$ } 1,000 \times 20 = \text{US\$ } 20,000$

Per diem: $\text{US\$ } 40 \times 20 \times 28 \text{ days} = \text{US\$ } 22,400$

Lecturer (8 x 1 week) Travel: $\text{US\$ } 1,000 \times 8 = \text{US\$ } 8,000$

Per diem: $\text{US\$ } 60 \times 7 \text{ days} \times 8 = \text{US\$ } 3,360$

Local cost: $\text{US\$ } 6,240$

Total cost: $\text{US\$ } 60,000 \times 2 \text{ times} \times 5 \text{ years} = \text{US\$ } 600,000$

TOTAL: US\$ 3,425,000



INTERNATIONAL ATOMIC ENERGY AGENCY
INTEROFFICE MEMORANDUM

TO: Mr. S. Machi
Ind. Appl. and Ch., RIRL

DATE 1982-06-09

OUR REF.:

FROM: B. Vavrejn *B. Vavrejn*
Medical Applications Section, RILS

YOUR REF.:

SUBJECT: Notes concerning possible contribution of nuclear medicine in solving some health problems in RCA countries. (These notes have been requested by Mr. S. Machi)

Actually there are two sets of problems:

- A) Professional
- B) Organizational

- A -

a) The role of both in vitro and in vivo nuclear medicine procedures in the screening, diagnosis, prognosis, treatment and follow-up of diseases covers a wide range. The few areas listed below should not be considered as a complete list; they have been chosen as examples of what could be achieved using radionuclides in the medicine. It is only fair to mention in this connection that newer diagnostic procedures as e.g. ultrasonography, computerized axial tomography, thermography and nuclear magnetic resonance are undergoing continuing development and evaluation and might compete with some of nuclear medicine procedures.

Thyroid diseases

Undoubtedly radionuclide tests of thyroid function and anatomy play a predominant role in the assessment of thyroid diseases. Measurement of the kinetics of iodine metabolism by various radionuclide techniques cannot be replaced by any conventional measurement. Recently in vitro radioassays are replacing some in vivo tests because they are thought to be more specific, they eliminate radiation exposure and can be done on serum samples

(rather than demanding two trips of the patient to the nuclear medicine facility). Yet the introduction of these radioassay procedures is rather difficult (if not impossible) in some developing countries at present, because of the economic and organizational problems.

A new Coordinated Research Programme is being prepared by the Agency's Medical Applications Section (RILS) with the intention to help in solving some of those problems. The main goal of the programme:

1. To identify a set of the most useful and promising tests for radionuclide thyroid function studies bearing in mind

- the professional part (information content, reliability, technical feasibility - particularly in developing countries etc.)
- the organizational part (simple and reliable procedures which could be performed mostly by technicians in a great number of patients frequently using samples posted from remote areas)
- the economic part (reasonable cost, benefit for the individual, public health impact)

2. To test the identified set of procedures (which could be at present considered as "optimal") in different areas of the world. The question should be answered whether these procedures are really the most suitable (and to what extent) in particular conditions of the area in question.

Liver diseases:

The principal value of radionuclide procedures in liver diseases is not so much that it provides a specific diagnosis but that it is a sensitive indicator of hepatic pathology, which may lead to a more complex evaluation. Thus early discovery of the presence and extent of hepatic disorder may greatly influence treatment and prognosis of the patient's disease.

New radiopharmaceuticals improved the possibilities also in the pathology of the hepatobiliary system. Generally new development in radiopharmacology is perhaps one of the most important contributions to be expected in the future in this field.

The main interest particularly in many developing countries concentrates to the diagnosis of different forms of hepatitis and space occupying lesions.

Because of the great importance of this area of nuclear medicine, corresponding Coordinated Research Programme is under consideration in the IAEA-RILS, its basic strategy being in some way similar to the thyroid programme i.e. to identify and to test procedures which should be considered as optimal for the particular conditions of the developing countries. Critical evaluation of the impact of these radionuclide procedures on clinical decision making and cost-effectiveness considerations (both also as compared with non-radioactive tests) should be taken into account for the corresponding standard (=recommended) procedures. At the same time the necessary quality assurance methodology should be prepared.

Lung:

The urgency of the introduction of pulmonary perfusion and inhalation studies for the detection of pulmonary embolism depends on the frequency of this pathology in the area of question. It is a well known fact that the clinical diagnosis of pulmonary embolism can be difficult because the clinical symptoms and signs are not specific - as well as the biochemical tests, and the conventional X-ray techniques can be expected to give positive results in approx. 20% of the cases.

On the other hand perfusion scans accompanied by studies of regional ventilation are both sensitive (true positive rate over 90%) and specific (true negative approx. 90%). It must be admitted that the perfusion scans themselves are of course less sensitive (true positive approx. 75%) and less specific (true negative rate about 65%) but still they can substantially contribute to the correct diagnosis.

Kidney:

Radionuclide renography can help in assessment of the renal function in normal conditions and in pathology. The important advantage of this procedure is, that it makes possible to get information on the right and left kidney separately in a non-invasive way. Also in patient allergic to contrast media, determination of renal function can be readily performed with nuclear medicine procedures. Similarly in patient with raised blood urea, investigation of renal function can frequently be accomplished by radionuclide imaging in spite of non-visualization or poor visualization by X-ray methods.

Therefore although non specific diagnosis is provided by radionuclide techniques in kidney pathology, valuable clinical information can be obtained.

Bone:

Bone imaging using radionuclides is nowadays one of the most frequently performed nuclear medicine imaging procedures. Almost any bone lesion can on occasion produce a positive bone scan. Areas of increased and decreased accumulation of radiopharmaceutical can signalize rather early the presence of pathological focus or foci; early diagnosis followed by proper treatment can greatly improve the prognosis e.g. in patients with bone tumors.

In-vitro procedures - generally:

they are mentioned here separately in order to stress their still growing importance. Undoubtedly the in-vitro procedures have made in the last years significant contributions to the effective diagnosis of a number of diseases and the quantitative assessment of their various parameters. Investigations of hormone profiles have e.g. aided to understanding, diagnosis and assessment of a number of endocrine diseases (e.g. diabetes mellitus, dwarfism, thyroid dysfunction, sexual disorders, hypertension). In drug addiction, drug toxicity (e.g. digoxin), assessment of nutritional status (e.g. vitamin B₁₂, folic acid) metabolic disorders (e.g. cyclic adenosine monophosphate) immunopathology and

malignancy these in-vitro procedures have also proved invaluable.

However, it is important to realize that their widespread use and the rapid assay of large number of samples are possible only if good facilities for standardization and automation are available. The quality control is a very important part of these procedures. As already mentioned above the situation in many developing countries is complicated and far from satisfactory in this area of nuclear medicine.

B.

Organizational part should always be based upon the analysis of the health situation of the area or country in question. Diseases most important from the point of view of health and economic situation of the area or country should thus be identified. The priority should be decided concerning the solution of particular problems bearing in mind all particulars of importance.

As soon as the priority of the main health problems has been identified the possibilities of radionuclide methods in solving them should be evaluated in a complex way (including cost-benefit considerations).

On the basis of this evaluation the most appropriate organization and structure of the nuclear medicine service is to be recommended for the area or country in question. The recommendation must cover (among others) the following particulars:

- Level of the services to be provided (nucleus, unit, department) including the main tasks, studies and techniques to be performed, the link with other health institutions (hospital, university, research institute).

- Requirements of the particular nuclear medicine service as regard premises.

- Requirements as regard staff (medical specialists, medical physicists, radiopharmaceutists or radiochemists, specialists in maintenance and repair of nuclear medicine equipment, technicians, nursing and auxiliary staff - in proportions appropriate to the given nuclear medicine service). In this connection the need of the proper training of specialists should be stressed; it is of paramount importance.

- Requirements of the particular nuclear medicine service as regards equipment and also maintenance tools.

- The radionuclide and radiopharmaceuticals supply.

These are just some headlines: the IAEA - RILS - Medical Applications Section is prepared to provide detailed information and/or recommendation if it is felt, that this could help in solving problems in particular countries or regions.

PROPOSAL OF A CO-ORDINATED RESEARCH PROGRAMME
UNDER THE REGIONAL CO-OPERATIVE AGREEMENT

1. Proposed title of programme

Co-ordinated Research Programme on Nuclear Techniques for the Detection of Parasite Antigens in Host Body Fluids (CRP-DPA)

2. Summary of proposal

The new programme will provide the framework for collaboration between advanced facilities institutes in Australia and Japan and institutes in the endemic regions of S.E.Asia for the evaluation of immunoradiometric methods for detecting parasite antigens in blood and urine of patients with filariasis, malaria or schistosomiasis. The new immunoradiometric assays combine the sensitivity of radioimmunoassays with the specificity of monoclonal antibodies to give assays capable of detecting under experimental situations the minute quantities of antigens and their products in body fluids. The programme will test the reliability of these methods for predicting the level and stage of infection under endemic conditions .

3. Scientific background

The need for effective diagnostic methods for tropical parasitic infections is great. The distinction between the presence of the infection and the clinical manifestation is often difficult to interpret because of the phenomenon of the host parasite relationship. Thus the clinician and the epidemiologist must rely heavily on laboratory diagnostic methods to support a clinical diagnosis. Classically this support has taken the form of direct identification of parasites and their ova in faeces, urine, blood and biopsy material but for both diagnosis and epidemiology this approach is viewed increasingly as an impractical proposition. In some diseases such parasitological diagnosis is unattainable, whilst in others the long prepatent period, the different stages of disease, the periodicity of the parasite or the low intensity of infection makes the direct parasitological identification a difficult and unreliable method. In such cases serology has been looked upon as the more attractive option.

The focus of classical parasite serology over the past 20 years has been on antibody detection systems of which immunoassays using radio-tracers have been shown to be very sensitive techniques capable of measuring antibody levels to pico and nanograms. Despite this, radioimmunoassays like all other methods based on antibody detection, have inherent disadvantages of fundamental importance. Thus, early in infection the delay before detectable levels of circulating antibody are reached will give a false negative result, whereas the persistence of antibody levels after infection has ceased, will give a false positive one, with its implications on costly chemotherapy. Moreover, such tests often lack specificity. In contrast, the immunological demonstration of parasite specific antigens or products in the host minimizes the possibility of such errors and would by definition, constitute an unequivocal basis for a diagnosis analogous to that of the classical parasitological diagnosis.

The recent development of hybridoma technology had enabled the combination of the sensitivity of radioimmunoassay techniques with the specificity of monoclonal antibodies to produce assays which can detect parasite antigens in blood and urine from patients with filariasis and schistosomiasis; and a single infected cell in a hundred thousand erythrocytes from patients with malaria. Such methods are of special importance in endemic regions where the high level of homologous antibody in resident populations make the diagnosis of disease on the basis of detected antibody an impractical proposition. Radiometric methods for detecting antigens are being developed in Advanced Facilities Institutes and the programme provides a basis for the collaboration of these with institutes in endemic regions for the evaluation of these methods in terms of their reliability to predict the level and state of infection.

4. Objectives of the programme

1. To evaluate the potential of the existing immunoradiometric assays, used in combination with monoclonal or defined polyclonal antibodies, to detect parasite antigens in sera and urine of patients with schistosomiasis, filariasis or malaria.
2. To assess the variability in the results obtained from performing the immunoradiometric assays at different institutes but using aliquots of the same serum and monoclonal antibodies.

5. Participants

Three institutes with advanced facilities and hybridoma technology (A.F.I.), seven institutes from endemic regions (E.R.I.). (See appendix 1 for list of proposed participants).

6. Work Plan for First Year

The ERIs will collect serum and urine samples from 20 patients with known clinical records. These specimens will be obtained at least twice from each patient i.e. during the pretreatment acute clinical phase and again at 2, 4 or 12 weeks following completion of therapy. Similar specimens will also be collected from 5 normal healthy persons who have been free of parasitic and other infections during the preceding 12 months. The specimens obtained from at least 2 of the patients at each ERI will be of sufficient volume to enable the distribution of aliquots of at least 1.0 ml serum and 5.0 ml urine to all AFI's and ERI's participating in the programme. Specimens from the other patients and from the health controls will be divided to enable aliquots of 0.5 - 2.0 ml serum and 5.0 - 10.0 ml urine to be sent to each of the 3 AFIs whilst retaining an aliquot at the collection ERI. (In place of the serum plasma may be collected in EDTA, but NOT in Heparin).

The serum and urine specimens will be prepared, stored, and shipped as indicated in Appendix 2.

The AFIs will provide all institutes with control negative serum and with monoclonal or defined polyclonal antibodies which will be used to analyse the various serum and urine specimens for the presence of parasite antigens using the Sandwich RIA and/or the Radioimmuno-precipitation - PEG Assay.

All results accumulated by the various institutes will be forwarded to the IAEA which will submit these to appropriate statistical analysis. At the completion of the work plan, the IAEA in collaboration with the WHO will organise a co-ordination meeting to which one representative from each institute will be invited.

7. Funding

	\$
Budget 11 institutes	= 33,000
Supply of monoclonal antibodies	= 5,000
Computer costs	= 3,000
One Co-ordination Workshop	= 15,000
One evaluation workshop	= 15,000
Training Course for 15 participants (2wks)	= <u>72,000</u>
TOTAL	= <u>143,000</u>

PROPOSAL FOR A RCP IN THE FRAME WORK OF
THE RCA FOR THE REGION
ASIA AND THE PACIFIC

I. Title: "Development of a ^{99m}Tc - generator system using low specific activity ^{99}Mo ".

II. Purpose:

To develop an appropriate technology for the production of ^{99m}Tc generators using low specific activity (n, γ) - produced ^{99}Mo in low power research reactors.

Efforts should be directed towards; a) development of a new prototype generator system and/or b) to the improvement of existing prototypes suitable to be used in the environment of a radiopharmaceutical unit of a hospital. This in turn would require a compact, safe and easy to handle generator.

III. Duration: 3 years initially.

IV. Coordination Meetings:

- First Coordination Meeting at the on set of the RCP. The operation of an existing prototype can be demonstrated at this occasion. BARC (India) can be very suitable place for this meeting.
- Second Coordination Meeting.

V. Mechanisms:

- Two prototypes can be distributed to centres in the area for their testing under local conditions, Thailand and Indonesia are two good and appropriate places (\$10,000 each).
- Other centres in the region can be provided with drawings of existing prototypes.

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PROPOSAL FOR A REGIONAL TRAINING COURSE ON
"PREPARATION AND CONTROL OF RADIOPHARMACEUTICALS"

Purpose: To provide intensive practical training for junior staff in aspects regarding the preparation, control and utilization of radiopharmaceuticals, and to acquaint them with modern techniques and instrumentation relevant to the field of radiopharmaceuticals.

Duration: 3 weeks

Participation: 16 candidates

Participants'

Qualifications: Academic degree in biochemistry, pharmacy or equivalent. They should be associated with a national programme in radiopharmacy, either in hospital nuclear medicine centres or in National Atomic Energy Commissions.

Place: Australia or Japan. It is recommendable to have a cycle of one course per year at one particular institute for a total duration of 3 years.

DRAFT SUMMARY REPORT
BY
THE JAPANESE EXPERT TEAM
ON THE
STATE OF RCA COUNTRIES IN THE MEDICAL AND BIOLOGICAL
APPLICATION OF RADIATION AND ISOTOPES
-- FINDINGS, CONCLUSIONS AND RECOMMENDATIONS --

(To be submitted to the Third RCA Working
Group Meeting at Jakarta, Indonesia,
May 21 - 27, 1981)

A survey was made by a team of Japanese experts from February 8 to February 28, 1981, on the current status of medical and biological application of radiation and isotopes in six countries in South Asia, namely, Indonesia, Malaysia, The Philippines, Singapore, Sri Lanka and Thailand. The team consisting of seven experts in relevant fields of medical science and industry was headed by Dr. T. Terasima, Deputy Director-General of the National Institute of Radiological Sciences, Chiba. It visited 32 major institutions and facilities which are engaged in activities related to the use of radiation and isotopes in medical and biological areas. The results of investigation by this team are summarized as follows:

1. Findings

1) Radiation biology is, in general in an infantile stage. In some countries, e.g., the Philippines and Indonesia, foundations are laid for the development, especially for application-oriented research in agriculture. Researches on the biological effects in relevance to cancer radiotherapy, or low-level radiation effects on humans are yet to come. Bionucleonics, use of RIs in biological and medical research, finds its activity only in a limited number of countries such as Malaysia and Singapore.

2) Nuclear medicine is comparatively well established in every country including Sri Lanka where it is the frontier of nuclear science with national emphasis. However, its availability to medical practice for general public is still marginal. Degree of the development differs widely from country to country. Liver and/or thyroid diseases seem to be the subject of common interest for regional cooperative research. A major problem exists in supply and maintenance of nuclear equipments, supply of RIs (except for Singapore), and in training of man-power.

3) Radiotherapy plays a considerably important role among various modalities of cancer treatment in every country. Demand for radiotherapy surpasses, without exception, the availability with respect to facilities and equipment. Treatment protocols remain essential and were introduced from the U.S. or European countries, although the spectrum of cancer as well as the characteristics of cancer and of host with regard to radiation

response may require different approaches. There are deficiencies in basic radiobiological research and standardization of dosimetry. Effectiveness of radiotherapy and efficiency of the practice may be improved by introducing computers for treatment planning and patient data control, if supporting technological levels of the country (e.g., stability of electric power supply, maintenance, man-power, and etc.) warrant installation of such apparatus. This is already being made in Singapore and Malaysia, and is in planning stage in Thailand.

4) Importance of health physics and radioecology is recognized by every country. Environmental survey and health physical practices are being pursued in countries where nuclear reactors are in operation or under construction. However, functional machinery is generally in early developmental stage and requires intensified support with regard to equipment and man-power. The treatment and disposal of radioactive wastes resulting from medical use of RIs are found to be a common concern among these countries.

2. Conclusion and Recommendation

1) In the field of radiation biology and bionucleonics, means should be provided to facilitate training course at master's level as well as post-doctoral on-the-job training at laboratories in developed countries. Researches in radiobiology and medical physics should be encouraged to develop a basis of cancer radiotherapy and radiation risk studies. A coordinated research programme may be initiated on the radiation attenuation of parasites and other infectious agents of importance in RCA countries.

2) In the field of nuclear medicine, its potentiality in diagnostics should be made familiar to medical doctors by means of regional seminars and study visits.

Although economic consideration seems in general not to support domestic production of radioisotopes for nuclear medicine and bionucleonics in the Asian Region, efforts should be made to give support to countries possessing research reactors in order to develop more sophisticated technologies to produce radiopharmaceuticals. It may possibly be fulfilled through short term (a few months) training of personnel in specific

subject areas, in combination with an adequate supply of equipment. For the countries having no nuclear reactors, support should be made to facilitate well-balanced provision of nuclear and non-nuclear equipment, facilities, and man-power.

3) In the field of cancer radiotherapy, following activities should be implemented by IAEA in collaboration with WHO and UNDP.

1. A coordinated research on the biological and physical bases for the improvement of cancer radiotherapy. Whithin this framework, intercomparison and standardization of dosimetry for therapy should be initiated as the first step. Studies on the application of computers may also be included.

2. Information exchange by means of regional seminars and personnel exchange.

4) In the field of radiation health sciences, development of man-power in health physics and radioecology should be encouraged with the first priority, possibly through strengthening and expanding IAEA fellowship programme. This is particularly important in view of the current trend and prospect of increasing number of nuclear applications in the Asian Region and of associated risks to workers and general public. As the first step, it is recommended to convene a regional seminar to review the current status of radiation health sciences and to work out plans to promote future activities in these areas.

5) In addition to the above, a feasibility study should be initiated to develop certain mechanisms and systems to produce, and to maintain, dependable and enduring medical and research equipment suitable for use in the Asian Region. Another feasibility study may also be initiated to the specified Intra-Regional Research/Training/Operation Centres which are distributed among RCA countries taking into account specific resources and needs of the country and the Region, e.g., Nuclear Medicine Centre in one country and Health Physics Training Centre in another.

SUMMARY REPORT
ON
WORKSHOP ON MEDICAL AND BIOLOGICAL
APPLICATION OF RADIATION & ISOTOPES
August 17-28, 1981, Tokyo

The Government of Japan

EXECUTIVE COMMITTEE OF THE WORKSHOP
National Institute of Radiological Sciences

Chairman	Dr. T. Terasima
Scientific Secretary	Dr. S. Kobayashi
Administrative Secretary	Mr. M. Yamada
Members	Dr. T. Arai
	Dr. T. Iinuma
	Mr. T. Kondo
	Dr. A. Kurisu
	Dr. H. Matsudaira
	Dr. H. Matsuzawa
	Dr. M. Saiki
	Dr. M. Suzuki-Yasumoto
	Dr. Y. Tateno
	Dr. H. Tsunemoto
	Dr. I. Watanabe

The Workshop on "Medical and Biological Application of Radiation and Isotopes" was held under the auspices of Japanese Government in Tokyo from August 17 to 28, 1981, with collaboration of 13 experts in relevant fields of medical science from 10 Asian countries, i.e., Bangladesh, India, Indonesia, Korea, Malaysia, Pakistan, Philippines, Singapore, Sri Lanka, and Thailand.

The Workshop was composed mainly of presentations in four subject fields, namely, RADIATION BIOLOGY & BIONUCLEONICS, NUCLEAR MEDICINE, RADIATION THERAPY, and RADIATION HEALTH SCIENCE. A total of 19 lecture papers were presented on the current state of the arts in respective fields. Twenty nine status reports in these subject fields were contributed from 10 Asian countries. In addition, five study-tours were successfully conducted with keen attendance from the participants. Finally, the results of the Workshop were summarized after general discussion as described below.

I. Areas of Importance and Common Interest

1. Radiation biology is, in general, in an infantile stage, in spite of its importance as a basis for various areas of radiation research. However, in some countries, results and progress are expected particularly for application-oriented research in medicine, veterinary medicine and agriculture. Development of BIONUCLEONICS is rather limited in extent. Japan has made relatively intensive progress in this field since late 1950s.

Areas of common interest are indentified as follows.

- 1) sensitive biological indicators for low dose effect studies,
- 2) fundamental radiobiology as a basis for radiotherapy,
- 3) mutation breeding,
- 4) application of radiation in immunization against parasitic and infectious diseases,
- 5) chromosomal damage and its practical implications.

2. In most Asian countries, nuclear techniques are relatively well introduced for diagnosis of endemic diseases and, in some countries, are employed for enhancement of live-stock production. The potentiality of nuclear medicine is sufficiently recognized. However, its availability to medical and agricultural use is hampered, to a greater or a lesser extent, for various reasons, e.g., lack of technical know-how, difficulty in procurement of nuclear equipment and reagents, difficulty in maintenance of analytical equipment, shortage in man-power concerned, irregular supply

of radioisotopes, and so on,

The diagnostic use of ultra-sound is promising.

Areas of common interest are :

- 1) study on endemic goiter: diagnosis, treatment and prophylaxis,
- 2) study on Grave's disease: treatment,
- 3) study on liver diseases: correlation among hepatitis B, liver cirrhosis and hepatocellular carcinoma.

3. Among various cancer treatment modalities, the role of RADIATION THERAPY is of considerable importance, although the incidence and the relative frequency of cancers differ among Asian countries.

Telecobalt machines and linear accelerators are commonly used in many cancer centers. Orthovoltage X-ray generators are also available to supplement a shortage of high efficiency therapy machines. Combination of chemotherapy with radiation is routinely practiced in every country. In some countries difficulties in maintenance and repair reduce utility of therapy machines. In addition, a shortage of qualified radiotherapists and radiation engineers constitutes crucial disadvantage in the development of radiotherapy.

The use of computer for treatment planning and patient data control is about to be undertaken in a few countries.

Areas of interest are listed below.

- 1) studies on treatment of specified tumors: dosimetry intercomparison, standardization of the protocol,
- 2) clinical trials with combined treatment modalities: hypoxic cell sensitizers, anti-tumor agents, hyperthermia and so on.

4. To keep pace with a development of atomic power generation, RADIATION HEALTH SCIENCE, especially radio-ecological and health physical studies, are being pursued in several countries. Necessity of technical development and exchange of information in RADIATION HEALTH SCIENCE is recognized.

Interest is shown in application of latest nuclear techniques for measurement of environmental contaminants. Need for emergency medical care in case of nuclear accident is recognized.

The treatment and disposal of radioactive wastes resulting from medical and agricultural uses of radioisotopes are found to be of common concern in these countries.

II. Recommendation for Future Collaboration

Several forms of collaboration are considered and recommended in order to implement possible future plans.

1. **Personnel Exchange:** The personnel exchange between laboratories/institutions is generally useful for a transfer of scientific ideas, and have to be encouraged. This can be effected by study-visit of specialists and on-the-job training for others. In any subject field, this program is extremely suited for high-level training. To obtain more fruitful results, long-lasting implementation of the program may be preferable.
2. **Research Coordination:** This style of cooperation is hopeful, particularly in areas of research where its design is explicit as well as substantial. The activity not only permits comparison of results among countries but provides incentive for a development of areas concerned. It may be implemented either bilaterally or multilaterally. Much benefit will be expected from a coordinated research on (1) improvement of cancer radiotherapy, (2) nuclear medicine approach to regional diseases of importance in Asia, (3) radiation biology applied to life sciences, and (4) radioecology and health physics.
3. **Group Training Course:** There exists much demand for this form of cooperation. It may be one of the most prompt and efficient ways to transfer technologies, and successful pursuit of this program will make immeasurable contribution to medical practice and welfare. The course is particularly recommendable for upgrading infrastructure of radiation engineering, and health physics, although applicable to other needful subjects.
4. **Seminar/Workshop:** Cooperation in this style is suitable for establishing a practical as well as an academic core of experts among Asian countries. It is recommended to hold this type of meeting on topics which are considered to be timely and/or needful. A regional seminar regarding RADIATION HEALTH SCIENCE may be one of the subjects to be convened at the nearest possible time.
Issuance of "News Letters" and exchange of national periodicals are also worth considering for deeper penetration and wider distribution of information.
5. It is strongly hoped that above cooperative efforts are accompanied by an adequate supply of equipment and analytical material. It is essentially important that procurement of nuclear, non-nuclear equipment and facilities, and development of man-power is well-balanced.

6. In order to implement future plans worked out in each subject field, efforts are to be made to emphasize the usefulness of this cooperation program. In this connection, the IAEA in collaboration with UNDP and WHO may be one of the competent and appropriate organizations to sustain the program.

Feasibility study may be initiated on the specified Intra-regional Research/Training/Operation Centers which are located among RCA countries taking into account specific resources and needs of the country and the region, e.g., Nuclear Medicine Center in one country and Health Physics Training Center in another. It is also hoped that Nuclear Emergency Center is founded at an appropriate location in Asia.

A

FINDINGS AND RECOMMENDATIONS
IN
FOUR SUBJECT AREAS

I. Radiation Biology and Bionucleonics

Findings

Current status of radiobiological research and educational system are in the early embryonic stage in some southeast Asian countries. The importance of fundamental radiobiological study for and its far-reaching influence on radiotherapy, agriculture, and other life sciences, however, are well understood by delegations from each country. Based on these current status and common recognition, we may conclude that fundamental radiobiological studies should be promoted by the cooperative activities. To encourage the field of interest in each country, the following activities are recommended.

Recommendations

1. RCA program on "Medical and Biological Application of Radiation and Isotopes" which includes Radiation Biology and Bionucleonics, is hoped to be initiated and continued for at least 5 years.
2. Cooperative research projects relating to the following subjects are suggested to be planned by the RCA member countries.
 - 1) sensitive biological indicators for the effects of low dose radiation, including biological effects in the areas of high background natural radiation.
 - 2) fundamental radiobiology as a basis for radiotherapy
 - 3) mutation breeding
 - 4) application of radiation and isotopes in immunization against parasitic and infectious diseases, especially malaria and viral hepatitis
3. Personnel exchange and training course in connection with radiation biology and bionucleonics are suggested. The fields of interests for training course are for radioimmunoassay, measurement of radioactivity incorporated into plant and animals, macro- and micro-autoradiography, and so on.
4. In some countries, supply of research equipments and/or materials as a part of RCA activities may accelerate their own research activities. The equipments and/or materials desired vary among countries. Also, it must be noted that the supply of these equipments and/or materials should be linked with dispatch of specialist(s) to perform the initial works and of bio-medical engineers to maintain a highly efficient operation of equipments.
5. It is also recommended that a "News Letter on Asian Radiobiology and Bionucleonics" be published and circulated at regular basis (e.g., semiannual) among Asian radiobiologists as a medium for information exchange. The editing of the news letter may be carried out in rotation by participating countries.

II. Nuclear Medicine & Radiodiagnostics

Findings

In most countries in the southeast Asia, the nuclear medicine has been introduced for the diagnosis of thyroid diseases, and the tests of thyroid function and treatment of Graves' disease with radioactive iodine are the major part of the nuclear medicine in these countries. In addition, many countries in the southeast Asia have endemic goiter area and they are investigating the endemic goiter in collaboration with scientists in the United States, Canada, United Kingdom, France, Belgium and etc. It is quite obvious that the study on thyroid diseases is the area of common interest among countries of the southeast Asia.

The study on liver diseases is also an area of common interest in these countries, although the art is not fully introduced in this region. It is well known that the incidence of hepatocellular carcinoma and liver cirrhosis is much higher in the southeast Asia and the western part of Japan than that in the United States and Europe. The correlation between the hepatitis B infection and liver cirrhosis or hepatocellular carcinomas is one of the major projects all over the world. Recently the radioimmunoassay of hepatitis B-related antigens and antibodies was developed and the kits for RIA of HBs antigen and antibody, HBe antibody, HBe antigen and antibody are available on commercial basis. Many countries expressed their wish to study the liver diseases in their countries. However, it was emphasized that the techniques involved in preparation of RIA reagents and in its quality control are not universally available in the region.

Recommendation

1. According to the present status of the nuclear medicine and to the common interest among countries in the southeast Asia, the possible themes for future collaboration would be:
 - 1) study on endemic goiter: diagnosis, treatment and prophylaxis
 - 2) study on Graves' disease: treatment with ^{131}I
 - 3) study on liver diseases: correlation among hepatitis B, liver cirrhosis and hepatocellular carcinoma
2. In order to pursue the above cooperation, it will be necessary, at first:
 - 1) to establish the training course or to exchange personnels, especially young persons for 3 to 6 months.
 - 2) to have a seminar or conference 2 to 3 times a year to train young investigators enough to carry out the above studies and to make the very detailed programs of the collaborative works on the above fields.

- 3) Since some of the commercial kits are very expensive, it is proposed to teach young investigators during the training course how to establish the radioimmunoassay system in their own countries.

After training young investigators and having the detailed programmes, the above studies can be performed in each country in the style of research coordination. It is the strong wish of all the attendants to carry out the above studies as cooperative work, because the comparison of the results of above studies will not only bring a great benefits to the people in each country but also to contribute a great deal to the world-wide knowledge on the above field.

III. Radiation Therapy

Findings

In almost all countries in southeast Asia, the incidence of cancer is gradually increasing with some difference in the order of primary organs affected. The common cancers in these countries are those of stomach, lung, nasopharynx, oral cavity, breast and uterine cervix, of which increase of lung cancer is noteworthy. Radiation therapy, together with the surgery, is one of major modalities of cancer treatment. Linear accelerators and telecobalt machines are the main tools for cancer therapy in most of the countries, whereas orthovoltage X-ray machines are still actively used in many countries. Brachytherapy is also practiced routinely in these countries. However, the merits of high dose rate intracavitary irradiation unit, such as RALSTRON is not fully appreciated yet.

Maintenance services after the installation of machines seemed to be poor in some countries, which results in such situations that the equipments are not effectively employed in radiation therapy. It is also emphasized that the well-equipped hospitals are concentrated mostly in the capital area of the country, so that the patients living in the remote area have difficulty in receiving medical benefits.

In addition, many countries in southeast Asia suffer from the shortage of qualified radiotherapists and paramedical staff, especially in medical physics and electronics, requiring further improvement of the training system.

Chemotherapy alone or in combination with radiations are used in many countries. However, the use of chemotherapy agents is rather limited due to financial reasons.

It is suggested that the shortage of up-to-date therapy machines and of qualified experts should be filled for further progress of radiation therapy by close collaboration between countries concerned through the programs recommended below.

Recommendation

It is recommended that the following activities should be implemented as cooperative efforts.

1. Exchange of radiotherapists, physicists and technicians should be encouraged among countries concerned. Period of such exchange may be a few weeks for senior experts and longer term (several months) for junior personnel. One of the main themes may be treatment planning, including computer application.
2. Regarding the maintenance of therapy machines, training programme for medical engineers should be promoted to decrease reliance on the suppliers.
3. It is recommended that clinical cooperative works should be initiated between Japan and other countries. Prior to the start of such a study, intercomparison of radiation dose parameters should be preformed and the target cancer be selected.
4. It may be recommended that clinical trial should be carried out on combined therapy modalities as a cooperative programme. A programme might be initiated on clinical trials with anti-tumor agents or hypoxic cell sensitizers, which may be supplied at reasonable cost. Standardization of the protocols is necessary prior to the initiation of such a programme.
5. To implement these cooperative works effectively, it is recommended to convene a small meeting once a year, and, a large meeting once every 3 years, where specific targets defined, progress reviewed and programme updated and modified.

VI. Radiation Health Sciences

Findings

Various kinds of nuclear techniques are utilized in several of the countries concerned. All the participants recognized and stressed the necessity of technical development and exchange of scientific and technical information on safe control of radiation in man's environment, in order to promote nuclear techniques including utilization of radiation, radioisotopes and nuclear energy.

In addition to the above, many participants expressed their interest in the application of advanced nuclear techniques (e.g. atomic absorption spectrometry, activation analysis, and particle induced X-ray emission) for measurement of conventional environmental contaminants.

Attention was also paid to the need for scientific co-operative activities in relation to the medical care in case of nuclear emergency.

Recommendations

It is strongly recommended to hold a study meeting on radioecology and health physics in 1982, if possible and the Chairman of the Executive Committee of the Workshop and competent Japanese authorities be requested to initiate preparation of this meeting at early date. Programmes proposed and recommended for future activities of RCA in relation to environmental sciences and health physics are as follows:

1. Research co-ordination
 - 1) studies to establish mathematical models on reference man for assessment of radiation doses
 - 2) application of nuclear techniques (for example, atomic absorption spectrometry, activation analysis, particle induced X-ray emission) for measurement of conventional environmental contaminants.
 - 3) concentration of radionuclides and other harmful substances by biota (e.g. agricultural products, animals and fish).
2. Training courses:
 - 1) radiation monitoring
 - 2) radiation protection
 - 3) radioactive waste disposal
 - 4) emergency procedures in radiation accidents
3. Seminar and/or Workshop
 - 1) public health aspects of medical and industrial applications of nuclear techniques
 - 2) emergency care of radiation exposed personnel in a major accident in nuclear installation
 - 3) radioecology and health physics including information on environmental sciences and background knowledge on radiobiology, etc.
 - 4) monitoring of radioactivity
4. Personnel exchange in research and/or training

This might be useful, since several states recognize limited knowledge in this field of expertise. A few states other than Japan indicated their capability to supply experts and equipments.
5. Nuclear emergency assistance

International assistance activities might be desirable from the technical point of view. It is recommended that competent international organizations, such as I.A.E.A. and W.H.O. might continue and strengthen their efforts as to the practical means of assistance.

DRAFT WORKING PAPER
for
MEDICAL AND BIOLOGICAL APPLICATIONS OF NUCLEAR TECHNOLOGY
OF INTEREST TO THAILAND AND THE RCA REGION
(Romsai SUWANIK, M.D.)

I. PROBLEMS:

What is the constraint of a country's development programmes? In developing countries the main constraint of any programme is a lack of manpower who are competent particularly to help solve country's problems at the institutional peripheral or village level. They are trained in a generalized way to acquire the basic knowledge either as physicists, biochemists or physicians. On the other hand, specialists in a particular field are not yet directed to initiate activities suitable for solving problems in country's project in an investigative or methodical way. Frequently the team of relevant members for country's project has yet to be exposed with experiences specific to the project especially particularised technical knowledge, the management of the programme and most importantly the application to benefit people at large. Usually there is a gap between technical progress and application.

Medical nuclear technology in a general sense has a broad spectrum of activities which embraces production of particular manpower to help solve some country's problems using medical radioisotopes as a tool to meet the purpose. Especially in an environment full of deprivations like those in developing countries, the manpower is of priority importance which would lead to consequences such as development of specific technology relevant to the project, transfer of knowledge, management of the programme, evaluations, modifications and surveillance. Please see the article: role of universities in research to support national health development (attached) and also publication (attached).

For clarity and concerning nuclear energy in medicine, three areas of identification may be enumerated for examples to be encouraged for manpower development programme:

- * Nuclear Medicine: the uses of radioisotopes in investigating country's health problems
- * Treatment of cancer by radiation and related means or combination
- * Medical physics: to support the uses of nuclear energy in institutions and hospitals

II. WORK-TO-DATE

Medical nuclear institutions in Bangkok with reasonable supply of facilities receive regular visits and exchange of information with visiting colleagues in and outside of the country. The Nuclear Medicine Division has co-operated with the International Atomic Energy Agency for in-vivo and in-vitro quality control of procedures. Using such reliable nuclear medical procedures as a tool, some activities have been innovated in the form of clinical research in a medical school which have been expanded to field studies and further to biomedical and health services research in the form of interventions in the rural villages to attack country's problems like endemic goitre, iron deficiency anaemia and others. These intervention studies have been conducted to co-ordinate with the community medicine project.

Along the same direction of development, radiation therapy of cancer patients has encouraged mobile cancer units to provinces; the activities are on occasional basis. Medical physics has been carried out by the Physics Working Group.

Members of the Study Groups are well conversant with the problems peculiar to localities and have the accumulated faculties of knowledge and field experiences to be transferred for training. A course may be evolved from the present on-going activities. Guest colleagues from local and abroad

could be invited to join the task force.

III. METHODOLOGY

A demonstration project is hereby proposed for development on medical applications of nuclear energy in developing countries. A course of specific training for 3-4 weeks is to be provided once a year for the following purposes:

1. Help furnishing nuclear medicine laboratory, procedures on the aspect of quality control to ensure reliability of the radionuclide procedures.

2. Then as a reference laboratory the knowledge from the training course would be propagated to different hospitals in the countries.

3. Expanding research activities using radioactive material as a tool to field studies and further to intervention programme for eradicating the health problems of populations particularly in the rurals.

For the field studies, the cause and prophylaxis would be studied in depth so that its results would be digested for trials in interventions. The recommended methodology may be proved useful for the application to populations in endemic areas or groups of target populations.

Based on many years of experiences, specific contents to meet the above three steps of methodology would be transferred in the course of training for members of developing countries with similar problems as well as members from various regions of the country.

IV. TIME FRAME:

The project may be broken up into four distinct periods of activities. These time frame includes the following:

Bangkok

Week 1: Laboratory quality control: methods and alternatives.

Week 2/3: Selected procedures, rehearsals and perhaps field trips (extra).

Week 3/4: Discussion/workshop of individual country's problem. Course paper preparation which includes evaluations, modifications, conclusions and recommendations.

V. ASSUMPTIONS:

The proposed project activity includes the following assumptions:

- * The trainees may acquire their motivations towards the attitude of expanding his or her activities to benefit the populations in addition to their own limited sphere of routine work alone.

- * For those who have already or part of their activities involving the populations, they would gain or at least brush up their knowledge, encouraging ideas, confirmation of the proper way that they have done and continue doing for the good cause appropriately.

- * By this way of "getting together" in the regions co-operations in numerous ways are made possible, easier and more suitable. Consequences will happen in a chain-reaction and peaceful way of life.

VI. GOALS:

The goal is to furnish specific or tailor-fit training programme of developing manpower for the application of medical nuclear technology in research to support national health development in developing countries. The trainees would not be only competent in routine clinical work to serve within the hospitals but should and must be also particularly useful for the populations. They would have their awareness, knowledge, understanding with motivated sense of responsibilities and perhaps being able to initiate the programme in their own individual country which may have problems of similar nature.

Bangkok

VII. EXPECTATIONS:

It is expected or looking forward to start and replicate the streamlined programme of training of the same concept and philosophy both in Thailand and in different member countries. The programme will have to be practical, low cost and have replicable methodologies which have been proved to be cost-effectiveness.

For materializing these expectations, the preparedness of the trainees is quite important to produce an impact, if any, to the country's programme: They may be selected on previous exposure to the use of radioisotope techniques and their branching interests in the area of endemic goitre, iron deficiency anaemia, family planning and control, drug abuse. During the latter part of the course, they are expected to do case studies and programme formulation, and after the course in their own locality they are expected to conduct field studies and further expansion to intervention for the country's programme.

VIII. EVALUATION:

The project will be reviewed by internal evaluation on yearly basis. These annual evaluations will be conducted with working staffs in conjunction with those of the granting agency and the Thai AEC.

IX. FINANCIAL NARRATIVE:

Financial narrative...

IX. Finance narrative:

	Project duration: 3 y.	
	Per year in US\$	
	<u>Granting agency</u>	<u>Thai Government</u>
<u>Personnel</u>		
Per diem: attendants (30)	15,000	
teachers (15)	10,000	
invited teachers (5)	5,000	
secretariat (5)	4,000	
<u>Necessary equipment</u>	pending	350,000 (existed)
<u>Others</u>		
Teaching materials	10,000	
Local transportation	9,000	
Documentary	1,000	500
Support of investigative programmes	19,000	4,000
Books & publications	2,000	500
Stationeries	1,000	500
Field trips (extra)	4,500	
Totals	<u>80,500</u>	<u>355,500</u>

SPECIAL ARTICLE



Role of Universities in Research To Support National
Health Development Its Concept and Philosophy

Romsai Suwanik, M.D.*

Many of our younger colleagues exclaimed: "what I am doing in medical school seems to be confined to basic sciences and clinical practice. It is a routine daily work. We sometimes are getting bore of what we are doing everyday. How should I be more useful to the people? How should I do and how should I have the access to fulfil my good wishes".

This healthy attitude or, it means, rich resources may be tapped for use by the wealth of information on health and health service problems which are available at the Ministry of Health.

The role or preferably "*the sense of duty*" of universities in research to support national health development should be encouraged because of the following reasons:-

Higher learning is a privilege to be enjoyed with a sense of obligations that he or she should be used for the benefits of societies.

To make ourselves more useful to the country, we may work along the line of established policies of the Thai Government i.e. to pay prior attention to the rural communities. The guidelines of National Socio-economic Council, and of other higher learning institutions follow suit. Health for all by the year 2000 of WHO states the need of primary health care of at least 8 items which are essentially health and health service problems that the results of research work can be interpreted into action.

That explains why the words "problem oriented research-action". This may be the

important key factor to meet the challenge of the work that we must do.

To encourage workers in universities and in Ministry of Health, the seminar that has just been finished reaches its objectives to a certain degree. At least, the awareness and motivation thus communicated may lead to derivation of such an attitude.

The essence of concept and philosophy along this line may help lay the foundation for young investigators to *think* and *do* it at appropriate timings and to conform to other factors.

What we mean by "other factors" cover data base, planning process, micro-research, design and redesign, evaluation and recommendations from their experiences that have been accumulated. These other factors are the consequences of the thought and may be considered "the work" that they are going to do or trying directly or indirectly to solve the problems and accomplish the work within reasonable periods of time.

Conventionally, we shall have to meet with numerous constraints some of which may become real obstacles. Through the strategies of "self reliance" and "appropriate technology", the end will justify the means.

One of the principal functions of institutions is that of producing highly trained manpower, their assistants and auxiliaries of all branches and at all levels. With all supportive measures, such as curricula,

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Special Article

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extra-curricular activities, atmosphere to encourage attitudes towards population-based medicine, investigations and the building of working team, initiation, innovation, perseverance, conscience, etc., the goal can eventually be reached.

These kinds of thought and action follow the tide of nature, the medium way of life, the patience,

the flexibility, the forgiveness, etc. which stem from the broad view and the worldly virtues.

We may sum up our aim by the well-known statement by HM the King's Father, Prince Mahidol Songkla, - "I don't want you to be only a doctor, I want you to be a Man" and that by HM the King Bhumipol "How can an individual survive when the mass cannot?"

TITLE: MEDICAL AND BIOLOGICAL APPLICATION
OF NUCLEAR TECHNIQUES.

SUMMARY OF PROPOSALS

The objective of the paper is to review briefly and propose scopes in which research projects in the field of medical and biological application of nuclear technique which Malaysia, as a RCA member state is willing to participate.

There are four basic research areas within the RCA framework in which Malaysia is ready to participate. The areas of participation will include financial assistance, training and manpower development, experts aid, facilities and equipment and personal exchange.

The proposed scopes are (in the order of priority)

- (a) Nuclear Medicine : The development of RIA Kits.
- (b) Radiation Biology : Supply and use of Gnotobiotic laboratory animals.
- (c) Preparation and control of radioactive labelled compounds of biological and medical importance and
- (d) Pollution control in Marine Environment.

In the development of RIA Kits, the priority of research will be given to the development of thyroid related hormones such as T_3 , T_4 and TSH . Tun Ismail Atomic Research Centre (PUSPATI) with the cooperation of National University of Malaysia (UKM) will develop the RIA techniques and produce RIA Kits to cater the need of local users. In the near future, PUSPATI will attempt to develop expertise in this area and organise training courses for interested individual or Agencies in subjects related to the development of RIA Kits.

The aim of breeding and research in Specific Pathogen Free (SPF) and Germ Free (GF) laboratory animals is to supply standardised animals for use in Radiation Biology Research, Nuclear Medicine approach to study regional diseases of importance in Asia, Radioecology and health physics and for the improvement of radioactive drugs, quality control,

safety and preclinical test, diagnosis and cancer radiotherapy. The proposal within the RCA framework will include establishing a centralised laboratory animal house and research centre for the production of the above laboratory animals. Other scope of collaboration will include equipping and installing facilities in the laboratory, exchange of personnels, training etc. in the related field, expert service and advice, and the exchange of breeding colonies and inbred laboratory animals. A priority will be given to breeding, production and supply of SPF/GF animals such as mice, rats and Guinea pigs or their exotic breeds.

The primary objective of the project in the preparation and control of radioactive labelled compounds of biological and medical importance is to produce and supply radioisotopes and radiopharmaceuticals for use in various institutions in Malaysia. There is a need for cooperation within RCA region in (i) The production of Radiopharmaceutical/Radioisotopes, exchange of raw materials pertaining to the synthesis of such chemicals and their derivatives, preparation and labelling procedures of radioisotopes; (ii) Research in the application of the prepared materials/compounds in biological and medical fields and (iii) The feasibility study for the scale of production of the chemicals.

The priority of the works in this area will be given to research activities of Tc - 99m radiolabelled compounds for use in Hospitals (eg. Tc - 99m HIDA). PUSPATI is expected to supply commonly used radiopharmaceuticals/radioisotopes such as I-131, P-32 etc. to various research institutions within RCA region in particular to Malaysia.

The research on pollution control will be initiated in response to current concern of the effect of dumping of waste to the marine flora and fauna and ecosystem. Research will give emphasis on the detection and study of the behaviour of heavy metals such as Mercury, Zinc, copper etc. and to organic compounds in marine samples. The development of reference analytical methods for the determination of these samples will also be given equal attention. It is envisaged that once data are available from studies in various RCA countries, coordinated control and regulation within RCA countries could be formulated.

It is hoped that by having such a proposal, nuclear techniques in the field of Medicine and Biology is further encouraged amongst the professionals and scientists in the region and particularly Malaysia. It is also hoped that a continuous flow of data and knowledge is made available between the member states within the RCA.

1. Title

Coordinated Research Programme on "Improvement of Cancer Therapy in Asian Countries by the Combination Treatment of Conventional Radiation and Physical or Chemical Means"

2. Scientific Background

It has become abundantly clear through the years that the successful applications of ionizing radiations in cancer treatment are often limited by the existence of radioresistant anoxic cells and the poor dose distribution. Initially, the major developments which resulted in improved clinical results were in physics: the design and construction of radiotherapy machines with higher photon energies and better depth doses. Subsequently, high LET radiation in tumor radiotherapy attracted the attention of radiotherapists away from the conventional radiations such as X-rays or γ -rays. However, the giant accelerators and generators which produce high LET radiation may prove too expensive and too sophisticated technically for the developing countries. Therefore, the combination treatment using conventional radiation by chemical or physical means is expected to be a useful alternative modality.

At the IAEA Seminar on "Prospective Methods of Radiation Therapy in Developing Countries" held in Kyoto, Japan in 1981, it was also pointed out that the combination of radiation and hypoxic cell radiosensitizers and/or hyperthermia will be the useful modalities for improvement of conventional radiation therapy in developing countries from the economical and technical points of view.

On the other hand, the following observations were made by a team of Japanese experts who made a study tour of six Asian countries in 1981 and by experts who attended the Workshop on Medical and Biological Application of Radiation and Isotopes in the RCA Countries (1981, Tokyo): (1) Although linear accelerators are available in a few countries, orthovoltage X-ray and telecobalt machines are the mainly used equipment items for radiation therapy of cancer in most countries. The equipped centers are concentrated in the capital or in a few large cities and are not easily accessible to patients living in rural areas; (2) Maintenance service of the therapy equipment appears to be unsatisfactory; (3) There is a shortage of qualified radiotherapists, physicists and technicians; (4) Chemotherapy is used in many countries but the use is limited due to the high cost of the drugs.

Certain recommendations were made which are given in the reports of the above-mentioned Study Tour and Workshop: (1) Exchange of radiotherapists, physicists and technicians for encouragement in their work; (2) Effective maintenance and service of the equipment; (3) Clinical co-operative work through the co-ordinated research programme.

Many developing countries might also be in this same situation, but at this present time attention should first be given to the Asian countries in which the present investigations have already been carried out. Therefore this new co-ordinated programme for Asia was initiated first in 1982. This CRP will be carried out within the framework of the RCA Programme, if it is approved by the RCA member countries as one of the RCA Programme activities in future.

3. Programme Goals

The newly co-ordinated programme aims at clinical studies on combination therapy of conventional radiations and physical and/or chemical agents under the co-operative work of these basic researches and also expects to improve the radiation therapy techniques in the Asian region.

(1) Encourage research on:

(i) Hypoxic radiosensitizers, especially misonidazole and its derivatives, and other chemical modifiers

(ii) Hyperthermia

(2) Introduction into clinical trials of these modalities

(3) Objective evaluation of clinical data obtained

(4) The subjects on technical engineering problems of instrumentation will be discussed and an effort for resolution by mutual aid will be made through this programme.

4. Relationship to other Agency Programmes

The co-ordinated research programme is closely related to another co-ordinated programme which is being carried out on a global scale with the same title.

5. Participating Institutes

Ten to twelve qualified scientists of institutes in the RCA region will cooperate to exchange views.

6. Implication for the Future

A duration of three to five years is envisaged with a research coordination meeting each year. The first research coordination meeting in 1983 will be held at an early date to set aside the necessary funds.

7. Budget

Contracts (1983)	US\$ 50.000
Research coordination meetings	<u>15.000</u>
	65.000

A part of the budget will be expected to be borne by the Government of Japan.

DRAFT PROPOSAL
FOR
THE ESTABLISHMENT OF A REGIONAL EMERGENCY
ASSISTANCE CENTER

PREPARED BY
THE PHILIPPINE ATOMIC ENERGY COMMISSION
QUEZON CITY

DRAFT PROPOSAL FOR THE ESTABLISHMENT OF A REGIONAL EMERGENCY ASSISTANCE CENTER

BACKGROUND:

With more than 50 nuclear power plants in operation, under construction, or on order, and the existence of research reactors within the region of Asia and the Far East, there is a need for the institutionalization of Emergency Assistance in cases of accidents requiring resources beyond national capabilities and bilateral agreements.

Some of the member states in the Region of Asia and the Far East are in the process of initiating their nuclear power program. Hitherto, others have not had sufficient operating experience especially in dealing with unexpected nuclear incidents. Generally, most states of the region have meager resources and these are better invested in more urgent development projects. However, resource demands of low probability but potentially significant occurrences like a nuclear emergency must be considered in nuclear development planning.

The competition in the allocation of scarce resources makes the establishment of all the needed expertise in the handling and management of nuclear accidents by each individual country a remote possibility. The pooling of resources among the neighbor countries is the best solution to establish the said expertise without putting too much burden on any one individual country. This concept of mutual assistance was recognized by the International Atomic Energy Agency (IAEA) and the signatories of the Nordic Mutual Emergency Assistance Agreement in connection with Radiation Accidents which was signed in 1963. It was made even more evident by the recent Three Mile Island accident wherein the lack of preparedness and training in emergency actions in the off-site local level and the lack of coordination among the technical groups managing the accident led to complications much beyond the most probable impact of the initiating event.

The establishment of a Regional Emergency Assistance Center (REAC) is expected to generate several benefits to both the member states and the IAEA. Included in these are:

1. Enhancement of self-reliance through the development of expertise within the region.
2. Shortening of response time during emergency due to the proximity of both the coordinating center and the assisting states.
3. Enhancement of emergency preparedness through adoptive training. Training within the region can take into account the national and regional cultural characteristics which can influence the effectiveness of emergency planning and assistance implementation thus facilitating the expeditious utilization of help given by an Assisting State.
4. Economical and effective implementation of the emergency programs of each state through pooling of resources. Unnecessary duplication of emergency equipment can be avoided thus reducing the cost of member states while maintaining availability of sufficient logistics.
5. Operations-cost reduction for the treatment of serious radiation injuries through the establishment of a single Medical Center capable of providing effective services. The acquisition and maintenance of highly sophisticated equipment for treatment in each state will be too costly considering that serious cases of radiation injuries are expected to be rare.
6. Enhancement of the planned global Emergency Assistance through the establishment of efficient Regional Emergency Assistance Centers which can serve as region-specific points for coordination.

7. Maximized utilization of existing nuclear facility operations experts within the region.

OBJECTIVES:

- a. To set up a Nuclear Emergency Assistance Center which will be instrumental in assuring preparedness for emergency and for pooling of resources within the Region of Asia and the Far East.
- b. To involve member states in the region in mutual emergency assistance under the umbrella of a Regional Cooperative Agreement with the support of the International Atomic Energy Agency.

PROGRAM OF ACTIVITIES:

The Center will be responsible for:

1. The establishment of a training center for emergency assistance and an expert visitor exchange program;
2. The identification and setting up of a Medical Center for definitive evaluation and treatment of serious radiation injuries which cannot be handled by national authorities; and
3. The establishment of an information center for operating experience on nuclear power plant operation.

ORGANIZATION OF THE CENTER:

The proposed Center will be staffed by the following:

1. Chief Technical Adviser/Director
2. Two (2) Senior Technical Personnel
3. One (1) Junior Technical Personnel
4. Two (2) Secretarial Staff

The Chief Technical Adviser/Director is proposed to be appointed by the IAEA and will act as the Director of the Center.

The Senior and junior technical staff will be contributed by the member states.

The secretariat staff will be contributed by the host state.

The terms of appointments shall be governed by existing policies of responsible organizations.

IMPLEMENTATION OF THE PROGRAM OF ACTIVITIES:

1. Mutual Emergency Assistance Agreement

The agreement shall provide for the establishment of a Regional Emergency Assistance Center (REAC) which shall serve also as a training and information center. It shall provide for the identification of a medical center for radiation injuries. The agreement shall also include financial obligations of member states, personnel assignments, and institutional linkages.

The REAC shall maintain an updated list of experts and equipment which can be made available by each state for emergency assistance and surveillance. It shall act as liaison between member states in such matters as compensation, donation, and foreign entry requirements. In cases of emergency, the Center shall act as the command post for the coordination of assistance originating from signatories to the Mutual Emergency Assistance Agreement.

A draft Regional Mutual Assistance Agreement in connection with Radiation Accidents is given in Annex I for possible adaptation.

2. Training Center for Emergency Assistance

The proposed Center shall organize training courses/seminars in cooperation with the IAEA and the States with advanced emergency assistance technology on various aspects of emergency assistance, including the handling of emergency monitoring equipment, medical radiation emergency assistance, emergency response planning, accident situation detection and assessment, protective response, emergency communication and public information, and emergency response training for local political entities.

The training courses may be conducted at the Center or in any member state.

The proposed Center shall also arrange for familiarization/exchange visitor program of technical experts to various operating plants within the region, subject to the approval and requirements of the concerned States.

The equipment requirements of these training courses will be obtained through the RCA and will be used by member states during emergencies.

The physical structures for this Center shall be provided by the host State.

3. Medical Center

Serious medical cases requiring treatment for radiation injury are expected to be exceedingly small. Hence the maintenance of facilities for these cases in every member state is not practical. The proposed Medical Center will be equipped with the necessary equipment and personnel for the definitive evaluation and treat-

ment of serious radiation injuries. The envisioned Center will be a regular hospital where special facilities for treatment of serious radiation cases may be added and where especially trained medical personnel may be provided.

4. Information Center

The Center is proposed to be a depository of information on operating experiences of nuclear power plants within the region and shall publish regularly bulletins and circulars on operating experience within the region for distribution to member states.

IMPLEMENTING PROCEDURES

1. Training and Information Center for Emergency Assistance

The Regional Emergency Assistance Center, upon identification of the member State's emergency assistance training needs, shall schedule training courses, seminars and scientific visits/expert exchanges between Regional Emergency Assistance Center signatory States (REAC states.) The Center is responsible for identifying the training venue and the trainers, and for evaluation of the qualifications of applicants to the training courses. It has overall supervision of the conduct of the training courses.

The Center shall negotiate for the exchange of experts between participating REAC states and for technical assistance from the IAEA and other advanced States. The flow diagram for the function of the training aspect of the Center is given in Figure 2.

Nuclear incidents and operational experiences are reported by member states to the Center which takes charge in publishing these information through notifications, bulletins, communications etc. and in distributing them to member REAC states. The Information Group, likewise, maintains an updated directory of emergency equipment and experts from participating REAC states. This function is

shown diagrammatically in Figure 2.

2. Emergency Conditions

In the event of an emergency the requesting Regional Emergency Assistance Center signatory State (REAC State) informs and requests the Center for assistance. The Center identifies and notifies the appropriate assisting REAC State which shall send assistance to the Requesting State. The Center also informs the IAEA which will arrange if necessary, for assistance from non-REAC states. The Requesting REAC state may inform the IAEA directly if it so wishes.

Should there be cases of serious radiation injuries the proper treatment of which is beyond the capability of the requesting State, the Center shall arrange for treatment in the Medical Facility for Radiation Injuries which shall also be a training center for medical treatment for radiation injuries. The flow diagram for the operation of this Facility is shown in Figure 2.

The diagrammatic representation of the emergency assistance response flow is given in Figure 1.

3. Funding Requirements

3.1 The following are proposed to be funded by the RCA

- (a) Operating expenses at \$90,000/3 years, and
- (b) Salaries of the Chief Technical Adviser/
Director

3.2 Equipment requirements are proposed to be funded by the RCA and some donor countries which may be identified by the Center once it is operational.

3.3 The training and exchange visitors program is proposed to be funded through the member State's participation in the UNDP or through bilateral agreements which may be negotiated through the Center.

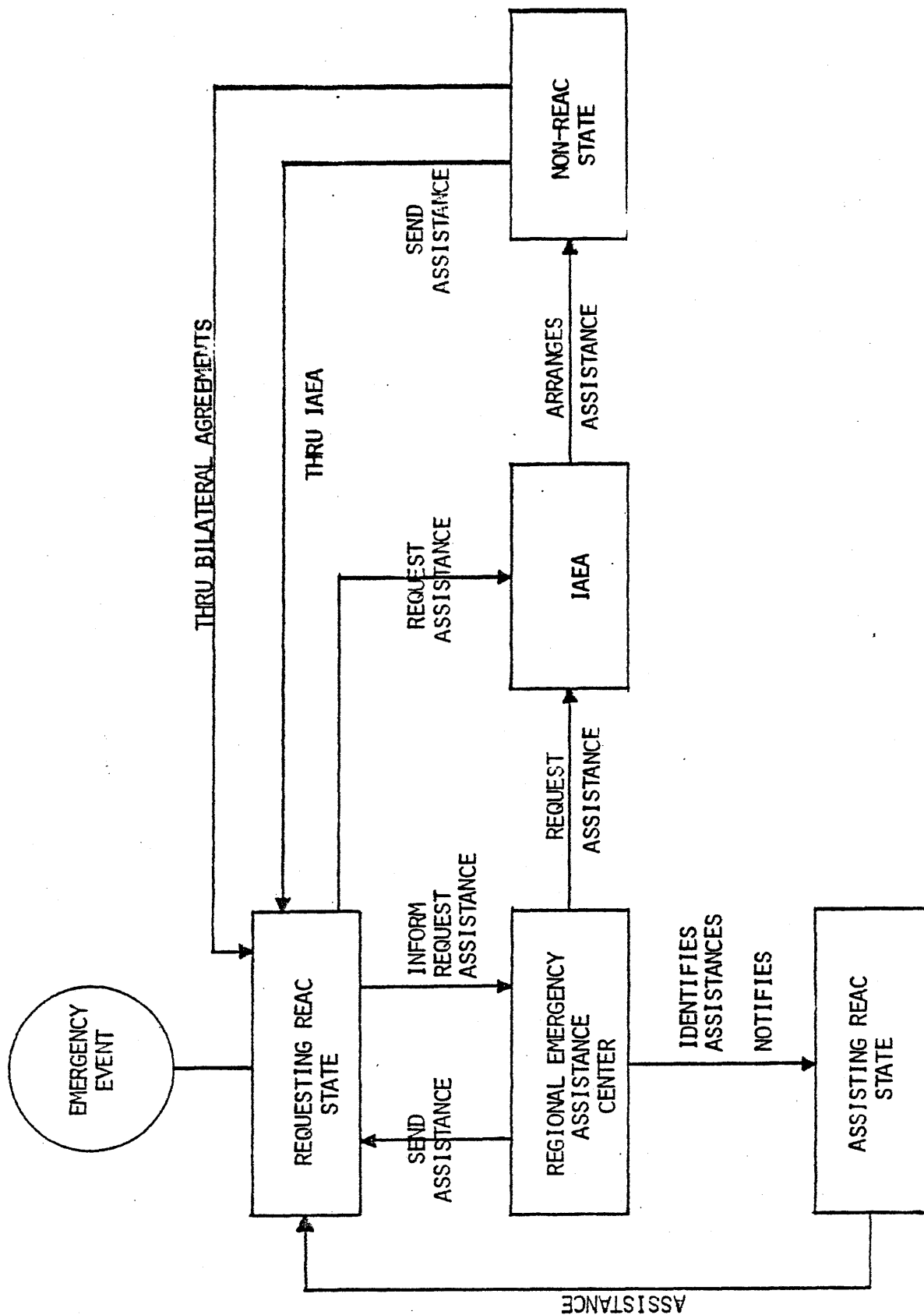


FIG. 1 EMERGENCY ASSISTANCE FLOW DIAGRAM

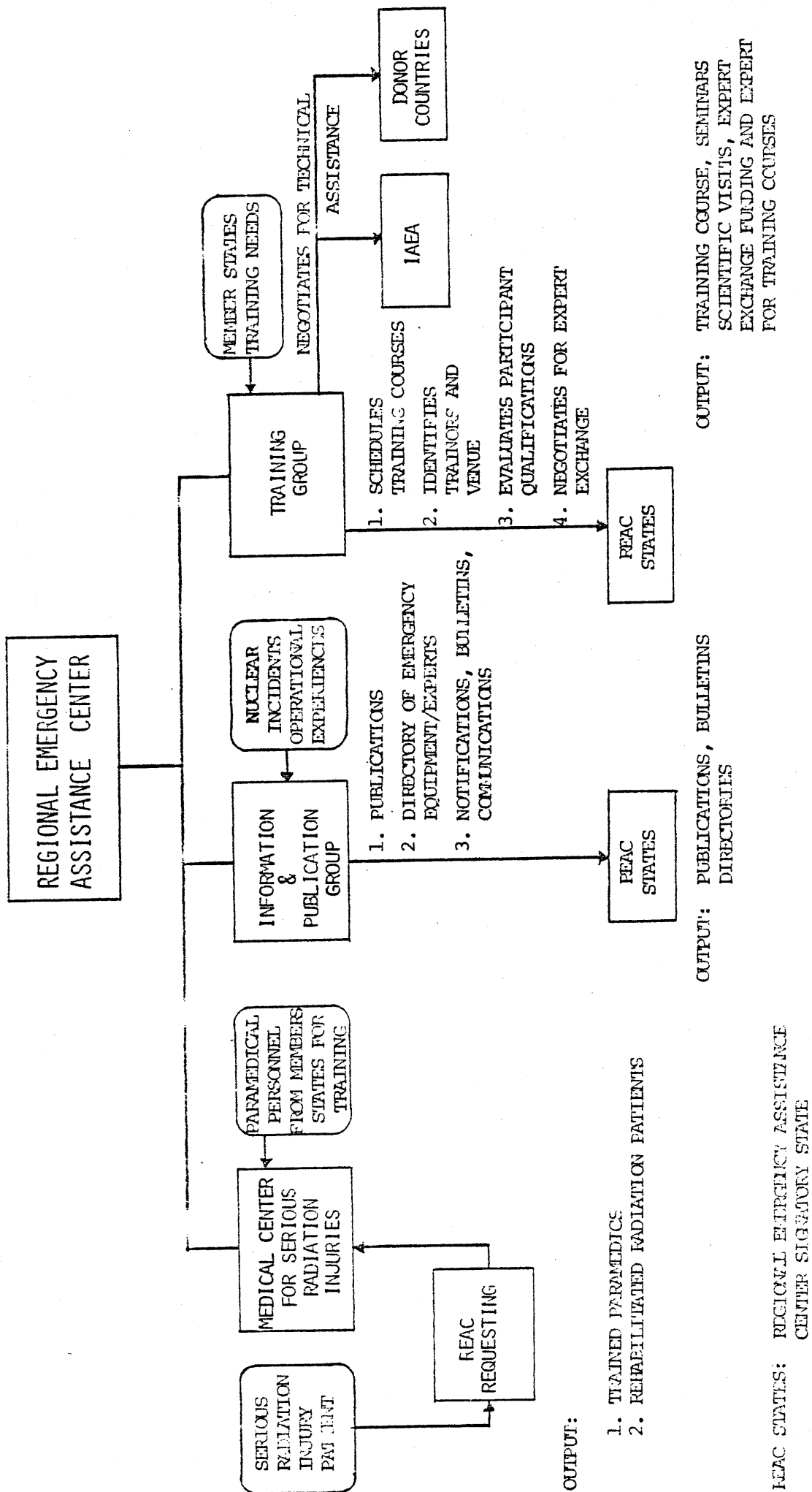


FIGURE 2. ADDITIONAL FUNCTIONS OF THE REGIONAL EMERGENCY ASSISTANCE CENTER

ANNEX I

REGIONAL MUTUAL EMERGENCY ASSISTANCE AGREEMENT
IN CONNECTION WITH RADIATION ACCIDENTS

The States in the region of Asia and the Far East, as Contracting Parties, desiring to assist each other to the extent possible in the event of an incident involving damage from ionizing radiation and to establish, in advance, the terms upon which a Contracting State, requesting assistance (hereinafter referred to as the "Requesting State"), may use the assistance provided by another Contracting State or by the International Atomic Energy Agency (hereinafter referred to as the "Assisting Party"), have agreed as follows:

ARTICLE I
GENERAL TERMS OF ASSISTANCE

1. Except when urgently needed, assistance to be requested and/or provided shall be coursed through the Regional Emergency Assistance Center. The contracting member state shall establish such a Center within the territory of a Contracting Member State in the region.

2. The Requesting State shall have full responsibility for the use of the assistance in conformity with this Agreement, and any personnel provided by the Assisting Party shall be subject to the direction and supervision of the Requesting State in the performance of their functions while with the territory of the Requesting State.

3. Equipment or materials shall remain the property of the Assisting Party, unless otherwise agreed, and shall be returned to it at its request.

4. The Requesting State shall employ the assistance exclusively for the purpose for which such assistance has been made available and shall itself provide, to the extent of its capabilities, any local facilities and services required for the proper and effective administration of the assist-

ance, and for the protection of personnel, equipment and materials.

5. The assistance shall not be used in such a way as to further any military purpose.

6. The Contracting states shall furnish the Center with a current listing of experts and equipment available within their jurisdictions.

ARTICLE II SPECIAL FUNCTIONS OF THE AGENCY

1. The International Atomic Energy Agency shall, at the request of and in consultation with the Requesting State:

1.1 Assist in securing from its Member States, not parties to this Agreement, such assistance as cannot readily be provided by the other Contracting Parties, and

1.2 Co-ordinate the provision of assistance.

2. At any time after he has been notified by a Contracting State of the existence of an emergency within its territory, the Director General of the Agency may designate, in consultation with that State, an observer, who may enter its territory for the purpose of investigating the nature and extent of the emergency and reporting to him thereon. The Director General may, in addition, authorize such person to act as his representative.

ARTICLE III SPECIAL FUNCTIONS OF THE REGIONAL EMERGENCY ASSISTANCE CENTER (REAC)

1. The Regional Emergency Assistance Center, hereinafter referred to as the Center, shall, at the request of and in consultation with the

Requesting State:

- 1.1 Provide and arrange for required assistance;
- 1.2 Coordinate provision for emergency assistance within the region and from the IAEA;
- 1.3 Provide medical treatment for serious radiation injuries;
- 1.4 Conduct training Courses and seminars on emergency assistance and treatment of radiation injuries, and negotiate for technical assistance for equipment, expert and training from donor countries and international organizations;
- 1.5 Provide information on nuclear facilities operating experiences especially within the Region;
- 1.6 Arrange for exchange of experts among contracting member states; and
- 1.7 Maintain an updated list of experts and equipment in all aspects of emergency assistance

ARTICLE IV
FINANCIAL PROVISIONS

1. In all emergency assistance events:

1.1 The Requesting State shall defray all expenses payable within its territory in connection with the assistance and shall pay to assisting personnel a reasonable subsistence allowance in local currency.

1.2 The Assisting Party shall defray such expenses relative to the assistance provided by it as are payable outside the Requesting State, including the following:

- 1.21 Salaries of personnel;
- 1.22 Purchase price, or fees due for the use of equipment facilities or materials;

1.23 Cost of transport of personnel, equipment or materials outside the territory of the Requesting State, including subsistence allowances for personnel; and

1.24 Cost of treatment for serious radiation injuries at the Center's Medical Facility for Radiation Injuries.

1.3 Unless otherwise agreed, the Requesting State shall reimburse the Assisting Party for any expense incurred pursuant to paragraph 1.2. Such reimbursement should correspond to the reasonable cost of the service, treatment, equipment, materials or facilities, or of the use thereof, to the Assisting Party at the time they were made available. Reimbursement shall be effected not later than sixty days after the Assisting Party has notified its claim to the Requesting State.

2. For all training and expert/exchange visitors programs in emergency assistance within the Region:

2.1 The government of the participants in training courses and in expert/exchange visitors programs shall defray the cost of transportation to and from the training site and the stipend or allowances of the participant, unless funds for these have been negotiated for by the Center from other sources.

ARTICLE V LIABILITY

1. The Requesting State shall bear all risks and claims resulting from, occurring in the course of or otherwise connected with, the assistance rendered on its territory and covered by this Agreement. In particular, the Requesting State shall be responsible for dealing with claims which might be brought by third parties against the Assisting Party or personnel. Except in respect of liability of individuals having caused the damage by willful misconduct or by gross negligence, the Requesting State shall hold the Assist-

ing Party or personnel harmless in case of any claims or liabilities in connection with the assistance.

2. The Requesting State shall compensate the Assisting Party for the death of, or temporary or permanent injury to, personnel, as well as for loss of, or damage to, non-perishable equipment or materials, caused within its territory in connection with the assistance.

3. The Assisting State shall bear all risks and claims in connection with damage or injury occurring in its own territory.

4. The Requesting and the Assisting States shall be released from their obligations under paragraphs 1 - 3 to the extent that the damage is covered by an operator of a nuclear installation who is liable for nuclear damage under the applicable national law.

5. The provisions of this Article shall not prejudice any recourse action under the applicable national law, except that recourse actions can be brought against assisting personnel only in respect of damage or injury which they have caused by willful misconduct or gross negligence.

ARTICLE VI

DESIGNATION OF COMPETENT AUTHORITIES

1. The competent authorities authorized by the Contracting Parties to receive requests for and to accept offers of assistance and to accept communications relating thereto shall be listed by the Center and updated regularly.

2. Contracting parties shall be informed of any changes in those listings.

ARTICLE VII
FACILITIES, PRIVILEGES AND IMMUNITIES

The Requesting State shall afford in relation to the assistance, the necessary facilities, privileges and immunities with a view to securing the expeditious performance of functions under this Agreement. In relation to assistance provided by the International Atomic Energy Agency, the Requesting State shall apply the Agreement on the privileges and immunities of the Agency.

ARTICLE VIII
USE OF INFORMATION

An Assisting Party shall not make any public statements concerning the incident, nor communicate any information obtained by it under this Agreement, except with the consent of the Requesting State.

ARTICLE IX
SPECIAL CONDITIONS

An Assisting Party or the Requesting State may attach special conditions to their request for, or offer or acceptance of, assistance. Such special conditions shall become binding as soon as they have been accepted by the other party or parties concerned.

ARTICLE X
SETTLEMENT OF DISPUTES

Any dispute concerning the interpretation or application of this Agree-

ment which is not settled by negotiation shall, at the request of any party to the dispute, be settled by arbitration, or, if the parties do not agree upon the constitution of an arbitral tribunal within three months after the request for arbitration was made, by the International Court of Justice.

ARTICLE XI TERMINATION OF ASSISTANCE

1. The Requesting State may, at any time and in writing, request, through the Center, the termination of the assistance provided under this Agreement.

2. An Assisting Party, after having given written notice, may terminate its assistance if:

2.1 In its opinion such assistance is no longer needed by the Requesting State, or

2.2 Its domestic needs so require, or

2.3 The Requesting State fails to observe the terms of this Agreement.

3. Upon such request for, or notice of, termination, the Requesting State and the Assisting Party shall consult together with a view to concluding any operations in progress at the time of such termination and facilitating withdrawal of the assistance.

ARTICLE XII ENTRY INTO FORCE

1. This Agreement shall enter into force upon:

1.1 signature without reservation in respect of ratification
or

1.2 signature with reservation in respect of ratification,
followed by ratification

on behalf of two States and the International Atomic Energy Agency. Instruments of ratification shall be deposited with the Director General of the Agency.

ARTICLE XIII WITHDRAWAL FROM AGREEMENT

Any party may withdraw from this Agreement by written notice to that effect addressed to the other parties and the Center. Such withdrawal shall take effect twelve months after the receipt of such notice. Withdrawal shall not, however, terminate the application of this Agreement in respect of any assistance commenced prior to the date of which withdrawal takes effect.

DONE in on on a single copy in English, which shall be deposited in the archives of the International Atomic Energy Agency, whose Director General shall send a certified copy hereof to each Contracting State.

RCA/10 Meeting
23 September 1981

PHILIPPINE DRAFT PROPOSAL FOR THE ESTABLISHMENT
OF A REGIONAL EMERGENCY ASSISTANCE CENTRE
Note by the IAEA Secretariat

I. INTRODUCTION

1. The purpose of this note is -

(a) to provide a brief survey of existing arrangements, including multilateral and bilateral agreements, relating to radiation emergency assistance; and

(b) to outline various practical aspects to be addressed in considering the establishment of a Regional Emergency Assistance Centre (REAC) for Asia and the Far East along the lines of the Philippine proposal.

II. EXISTING ARRANGEMENTS

A. At the international level

2. Since 1959 the Agency has established a Radiation Emergency Assistance Plan for providing assistance to any Member State upon request in the event of a radiation accident. An expanded programme on emergency response planning and preparedness has been carried out in recent years that covers the development of up-to-date technical guidance documents, training schemes and advisory missions.

3. Starting in 1963 the Agency, in co-operation with FAO, ILO and WHO, has collected information from Member States on the types of assistance that may be made available and the channels of communication with competent national authorities in radiation emergencies. The latest compilation of such information, which also provides indications on available resources, was published in November 1980 (IAEA-TECDOC-237) with the collaboration of the Office of the United Nations Disaster Relief Co-ordinator (UNDRO).

4. In 1977 the Agency concluded with UNDRO an agreement for closer co-ordination of their activities in rendering assistance in connection with a radiation accident. In such an emergency, the Agency will provide technical and scientific assistance, and it is also prepared to help in arranging between Member States for specialized (e.g. medical or radiological) assistance or support.

B. At the multilateral level

5. In 1963 the Agency concluded with Denmark, Finland, Norway and Sweden the Nordic Mutual Emergency Assistance Agreement in Connection with Radiation Accidents (INFCIRC/49). The Agreement which became effective in 1964, sets forth the terms and conditions under which a Contracting Party may use the assistance provided by another or by the Agency to cope with a radiation emergency. For the

processing of requests for and the provision of such assistance, the competent authorities of each Contracting Party are specified in an Annex to the Agreement.

C. At the bilateral level

6. In recent years, a number of bilateral agreements have been concluded between neighbouring countries in Western Europe for the exchange of information about radiation accidents and for radiation protection in case of emergency, such as between

- the Federal Republic of Germany and Switzerland (31 May 1978);
- France and Switzerland (18 October 1979);
- Portugal and Spain (31 March 1980);
- France and the Federal Republic of Germany (28 January 1981).

7. These agreements provide for liaison and mutual information between the Contracting Parties about radiation emergencies, and for co-operation between them concerning protective measures taken or planned by each of them. To this end, an appropriate system for mutual information is to be maintained in operation by them and liaison established between the central units of such a system. Mutual alarm centres will be set up in case of need but no other standing organization is required for the purposes of the agreements referred to above.

III. PRACTICAL ASPECTS RELATING TO THE PROPOSED REAC

8. There are some practical aspects concerning this proposal that require further elaboration. The most important ones are: (a) the cost and funding of the various functions envisioned for the proposed REAC; (b) the identification of possible alternative arrangements and existing facilities that could meet this need; and (c) the justification for such a Centre based upon a real need in terms of accident experience within the Region. These aspects would form the cost-benefit analysis for the proposal, which is essential to making decisions on a project of this scope.

9. The basic facility and equipment needs of the proposed REAC and its associated medical centre need to be determined and discussed in the proposal in order to indicate the capital investment required. The proposed staffing for the REAC appears to be inadequate to carry out the four basic functions proposed for the REAC which are: training, medical centre, coordinating emergency assistance, and an operating experience information service.

Staffing requirements, including salaries, should be re-examined in the light of the proposed functions and what they entail. The Information Centre (Operational Experience) function of the proposed REAC, with 52 nuclear power plants in the Region, requires in-depth study as to costs, staffing, data collection and analysis, and dissemination of information. It may duplicate existing bilateral information exchange arrangements and other existing sources of such information.

10. For comparison, an existing emergency facility in the United States, handling three of the four functions proposed for the REAC, i.e. Training Centre, Medical Centre and Coordinating Emergency Assistance, but excluding the Information Centre (Operational Experience) function, represents a capital investment of about \$1 million, and annual operating costs of \$1.2 million with a dedicated staff of 20 people.

11. Finally, the location of the proposed REAC and its associated medical centre needs to be identified. Japan, a potential member of REAC, has about 60% of the nuclear power facilities in the proposed REAC Region. Most of the nuclear technology resources related to the support of the proposed REAC are in Japan. The World Health Organization (WHO) is planning the establishment of a Radiation Emergency Medical Assistance Centre in Japan by 1982. These aspects need to be taken into account in the process of considering the REAC proposal.

(21 September 1981)

Quotation from Summary Report of RCA/10

Agenda Item V

Project Proposal for the Establishment of a Regional Nuclear
Emergency Assistance Centre in Asia and the Far East

The Chairman explained that the detailed proposal for the "Establishment of a Regional Nuclear Emergency Assistance Centre in Asia and the Pacific" by the Government of the Philippines (Appendix 8) had been distributed to RCA Member States for their review and comments to be made at this meeting.

The Deputy Director General, Department of Research and Isotopes reported the Agency's opinion of the proposal stated in the attached paper

(Appendix 9) which points out the need for further elaboration in terms of i) justification and need for such a centre, ii) cost and cost-benefit analysis of the proposal, and iii) possible alternative arrangements and existing facilities, as well as iv) the location of such a centre. He also pointed out that the experience at Oak Ridge National Laboratories in the United States shows a capital cost of about US\$1 million and operating costs of US\$1.2 million, excluding the Information Centre.

The Representative of the Philippines briefly explained the background of the Proposal.

The Representative of Japan stated that his Government is of the opinion that continued exchange of views on the Philippines proposal is necessary and appropriate and proposed to continue discussions at the Fourth RCA Working Group Meeting in Kuala Lumpur in 1982. This was agreed to by all participants.

The Representative of Australia mentioned that his Government generally supports the comments of IAEA on the Philippine proposal. He also pointed out that speedy response to any emergency during the initial 10 to 30 minutes is important but must depend on the emergency capacity of the respective Governments; after that point in time the Government should seek the assistance of IAEA, equally on a regional basis.

The Representative of the Republic of Korea stated that the Philippine proposal should be reviewed in greater detail before implementation. He also pointed out the importance of assistance by suppliers of nuclear reactors in an emergency.

The Representative of India mentioned that regional emergency assistance in the second phase would be a very useful and important subject for further discussions between RCA countries and IAEA. He also pointed out that the Seminar on Radiation Emergency Preparedness (Health Physics and Medical Aspects) for Asia and the Pacific Region (India, December 1981) would provide an opportunity for such discussions.

The Chairman concluded that the RCA Member States should consider and further discuss the Proposal in future meetings, in particular the 4th RCA Working Group Meeting, to assess it in more detail.

26 April, 1982

General Thoughts Concerning the Establishment of Regional Emergency Assistance Centers in Support of the Nuclear Power Industry.

Prepared by: Harold E. Collins, Senior Officer, Emergency Preparedness, Division of Nuclear Safety, International Atomic Energy Agency, Vienna.

I. Introduction

The establishment of a few Regional Emergency Assistance Centers in support of the worldwide nuclear power industry is, in principle, a prudent idea. Given the real possibility, albeit of low probability, that a serious accident at one of the world's nuclear power stations might require a substantial emergency response effort, it is possible that the required response to mitigate any severe radiological consequences and to achieve other recovery both on-site and off-site, could tax the resources of a country experiencing such an accident. To say that effective response to such an event might be beyond the capabilities of a developing country where a nuclear power facility has experienced a severe accident is a real possibility. Even highly developed countries with many nuclear power facilities and a large technical supporting infrastructure could find themselves hard-pressed to cope effectively with a serious accident having severe off-site radiological consequences in particular. Therefore, establishing some kind of worldwide response capability, based along regional lines and keyed to areas of nuclear power development, seems to be an idea whose time has come.

II. Existing Response Facilities

There are already in existence a few centers around the world, that are in the main if not in part, devoted to establishing a partial base of technical expertise for coping with serious emergencies. However, even these existing centers are not developed enough or to the degree that they should be. Most of the existing centers, if not all, are devoted to mainly the medical aspects of handling a fairly limited number of "casualties" of a radiological accident in a facility using nuclear or radioactive materials. Historically and generally, these facilities were established to provide medical care for workers at these facilities.

With respect to the nuclear power industry, Regional Emergency Assistance Centers that represent the amalgamation of the several technical and scientific disciplines needed to cope with a severe accident, coupled with a consideration of various practical social aspects, have yet to evolve. However, since the accident at the Three Mile Island nuclear power station in the United States, we are now starting to see a more sophisticated approach, at least nationally among several nuclear power coun-

tries, to acquiring a multi-disciplined approach to the problem of responding effectively to an emergency. An example of such an activity is the establishment in the United States of the Institute for Nuclear Power Operations (INPO), an industry based organization which came in to being shortly after the Three Mile Island accident. Among its many functions, which are largely related to an industry self-policing function in nuclear power operations, is an emergency preparedness function which can be used to marshal the large number of technical resources needed to respond to a serious accident. In Europe, the OECD/NEA is becoming more actively involved in emergency preparedness matters, to cite another example.

III. Responding to an Emergency

Responding effectively to a very serious accident with mainly just on-site radiological consequences and severe damage to the nuclear plant itself, such as that which occurred at Three Mile Island, requires a very substantial technical effort crossing many lines of engineering and scientific and social disciplines. Had the Three Mile Island, or the Browns Ferry Nuclear Power Plant fire of a few years earlier, resulted in significant off-site radiological consequences, many more technical resources would have to have been brought to bear than was the actual case. The type and nature of these resources are presented in the IAEA's publication "Planning for Off-Site Response to Radiation Accidents in Nuclear Facilities", Safety Series 55, June, 1981.

The establishment of a Regional Emergency Assistance Center in support of the nuclear power industry requires a well developed technical infrastructure within any perceived host country. All countries, as a first step, should have a developed capability to respond to emergencies at their own facilities. The degree of development of this response capability should be roughly proportional to the size of the nuclear industry in terms of numbers of facilities. Generally, a country that has experienced an accident at one of its facilities, should as a minimum be able to mount a self sufficient response during the first 2 or 3 days of the accident. This is about the time that it would take to get substantial resources into the requesting country that needed assistance. Small accident assessment teams would be able to arrive sooner to assess needs however. This could be done under the provisions of the Agency's existing Radiation Emergency Assistance Plan initially established in 1959 and now in the process of being upgraded into a more comprehensive Nuclear Accident Assistance Plan (NAAP).

IV. Future Regional Emergency Assistance Centers and International Initiatives

As pointed out in the foregoing discussion in Section II, the existing centers in the world today such as the Radiation Emergency Assistance and Training Site (REAC/TS) located at Oak

Ridge in the United States and a few other similar centers around the world are, in the main, more oriented to the medical aspects of responding to emergencies. Organizations such as INPO or OECD/NEA, although not yet fully developed in this area, nevertheless more closely resemble what is envisioned for Regional Emergency Assistance Centers. Further development of a few more organizations such as these seems to be a useful undertaking.

Establishment of Regional Emergency Assistance Centers cannot effectively take place without the substantial involvement of the nuclear power industry, involved governments and international organizations. An integrated infrastructure must and should be established on a regional basis or on bilateral or multi-lateral bases between involved countries. Merely constructing or acquiring a building to house such a center, staffing it and providing for its operational expenses, will not in itself ensure that a real response capability exists. The problem is much more complex than that. Such an organization must serve as a catalyst within a region to bring the various and diverse capabilities together that are required to mount an effective emergency response. Further, the organization must have credibility within its sphere of influence and this can only be achieved by the whole-hearted involvement and support by all of the constituents.

Related to the above, is the recent United States initiative with the IAEA, commenced in earnest last year, which deals with establishing a protocol for international co-operation in Mutual Emergency Assistance and Nuclear Safety. This initiative, discussed at the Agency's Board of Governors meeting last summer and again in February of this year, will be the topic of an Agency sponsored Experts Group Meeting in late June and early July of this year. This Group, invited this month from all of the Agency's Member States, is to report their findings and recommendations on this proposal to the Board in February of 1983. The work of this Group will address the matter of Regional Emergency Assistance Centers. Establishment of Regional Emergency Assistance Centers before the work and deliberations of the Expert Group is complete and before the Board of Governors takes the Group's Report under advisement, may be premature at this time.

V. Interim Alternatives

General

A number of interim alternatives can be identified and proposed until resolution of the proposed initiative takes place next year. Some of these alternatives are listed below.

A. Identifying the Resource Base Within the Region.

Definitive regional studies to identify the technical infrastructure and resource base within the several involved countries could proceed. Clear justification for any proposed location of a Regional Emergency Assistance Center should be established taking into consideration all of the important factors mentioned in the foregoing Sections II, III and IV.

B. Training and Education

- (1) The region could request the assignment of a few well qualified persons from the nuclear industry and appropriate government organizations involved in nuclear power development, operations and regulation, to an organization such as INPO for training and educational purposes. Such an assignment should be for a minimum of 6 months and preferably one year to provide adequate time for training and education in the emergency preparedness field and the supporting technical disciplines.
- (2) Additionally, the Agency plans to offer its Second Interregional Training Course in Planning, Preparedness and Response to Radiological Emergencies, early next year at the Argonne National Laboratory in the United States. The training course will be 4 to 5 weeks in length. It follows the first of this course, conducted at Argonne 1-19 February this year, which was highly received by the participants. Several persons from Far East Asian countries participated in this first course. Attendance by additional qualified individuals at the second course which will be offered formally by the Agency this summer, would enhance the Region's collective capability on emergency preparedness matters and these individuals could then form the regional nucleus for pursuing further emergency preparedness initiatives within the region such as the establishment of a Regional Emergency Assistance Center.

C. Participation in the Experts Group Meeting.

The Region should be well represented at the meeting of the Expert's Group discussed in Section IV and which will meet in Vienna 28 June through 2 July, 1982 in Vienna. This will help to more precisely define Regional objectives and will allow all participants to share views and discuss practical initiatives of other Member States in other regions of the world.

Future Plans for Food Irradiation under the RCA

Most activities on food irradiation in developing countries in the RCA region are still at the laboratory level. Some of the research projects under the RPFI, especially those in India, Indonesia, the Philippines and Thailand are already being carried out at pilot scale. It is expected that the results to be presented at the second Research Coordination Meeting on the RPFI, planned for Bangkok from 22 to 26 November 1982, will show clear benefits of food irradiation for:

- (a) Insect disinfection and shelf-life extension of mangoes;
- (b) Improving hygienic properties of spices;
- (c) Preservation and sanitizing fishery products;
- (d) Sprout inhibition of onions.

To accelerate practical application of food irradiation in the region, activities under the RPFI should be expanded to pilot and/or semi-commercial scale studies on the four selected areas and be carried out in close collaboration with the food industry and trade. It is anticipated that food irradiation could improve the socio-economic status of the population in the region not only by reducing losses of food (increasing food availability), but also by expanding the trade of surplus food during the peak seasons. In order to achieve this objective, the following financial assistance would be necessary to carry out the programme:

	US\$			
	1983	1984	1985	1986
Research and development activities	80,000	80,000	80,000	80,000
Annual coordination meeting	25,000	25,000	25,000	25,000
TOTAL	105,000	105,000	105,000	105,000
GRAND TOTAL				<u>420,000</u>

As the legal mechanism for collaboration already exists under the RPFI, the above activities and budget could be carried out as the "Phase II" of the RPFI with continued financial support from the Government of Japan. In addition, the Government of Japan should continue to provide training opportunities for scientists from developing countries and expert services to these countries in the region through the Japan International Cooperation Agency (JICA).

Commercial Development in Food Irradiation

In addition to the commercial potato irradiator in Japan, commercial activities are going on or will be carried out in several countries, especially in Europe and the USA, according to the information below:

COMMERCIAL ACTIVITIES IN FOOD IRRADIATION

Country	Commercial Irradiator Location	Status (Year)	Products Treated	Approx. Capacity
Belgium	MEDIRIS* Fleurus	completed (1980)	spices, animal feed	100 m ³ / month
France	Pallet-irradiator (2 million Ci ⁶⁰ Co)	planned (1982)	food in general	
Hungary	AGROSTER Joint Co. Budapest	planned	spices, onions, potatoes	---
Italy	Commercial Vegetable Irradiator Fucino Cooperative Fucino	under construction	potatoes, onions, garlic	20,000 tons/ month
Japan	Shihoro Potato Irradiator Shihoro, Hokkaido	completed (1973)	potatoes	10,000 tons/ month
Netherlands	Pilot Plant for Food Irradiation Wageningen	completed (1968)	frozen chicken, froglegs, organic dye, spices	1,500 tons/ year
	GAMMASTER* Ede	completed (1972)	spices, frozen frog- legs, shrimp	1,000 tons/ year
	GAMMASTER Ede	under construction		
South Africa	Fruit and Vegetable Irradiator Tzaneen	completed	mangoes, strawberries, potatoes, onions, etc.	---
U.S.A.	Multipurpose* West Memphis, Arkansas	completed (1981)	spices, poultry (will treat food when permission is received)	---

*Mainly used for sterilizing medical supplies.

COUNTRY STATEMENTS ON RCA

Australia
India
Indonesia
Japan
Republic of Korea
Malaysia
Philippines
Sri Lanka
Thailand

IAEA: RCA - 4th WORKING GROUP MEETING
SESSION JUNE 17, 1982

TOPIC V - COUNTRY STATEMENTS ON RCA

AUSTRALIAN STATEMENT

This year is important to Australia not only because it marks the tenth anniversary of the Regional Cooperative Agreement but also because it marks the successful conclusion of the Isotope Hydrology Project and the commencement of Australia's involvement in a new project on "On-Stream Analysis and Control of Mineral Concentrators".

The Australian Government has advised the IAEA of its decision to contribute the sum of \$A655,000 over a five year period, 1982-87, to support a sub project of the IAEA RCA Regional Project on Industrial Applications of Isotopes and Radiation Technology. In addition to this cash contribution Australian scientists and officers will be made available for project implementation. The decision to support this sub-project is consistent with Australia's strong commitment to the IAEA Technical Assistance Program and the Regional Cooperative Agreement.

The Australian developed On-Stream Analysis System is a proven system both technologically and economically. The main advantages in better control of mineral concentrators and consequent lower cost of processing of ores are:

- (a) an increase in export earnings and
- (b) the possibility of economic mining of lower grade ores.

The sub-project program involves theoretical training and practical application through the utilization of a demonstration unit at an operating plant. Training will be at a sufficient level to equip, in particular, personnel from the Philippines Atomic Energy Commission, with the knowledge to undertake training courses following the completion of the sub-project.

Australia's primary aim in its involvement RCA projects is to equip personnel from participating countries with the ability to utilize the techniques associated with the application of the particular technology. While the projects themselves are of limited duration - 4 years for the Isotope Hydrology Project and 5 years for the On-Stream Analysis Sub-Project - it is hoped that the benefits will continue through the ongoing application of the techniques learned and through the use of capital equipment.

It is in this context that Australian scientists and officers will be approaching the forthcoming Isotope Hydrology Project Review Meeting to be held at the Australian Atomic Energy Commission Research Establishment from 1-5 November 1982. It is hoped that participants at that meeting will be in a position to draw up ongoing scientific programs in this area, though in the absence of Australian financial input.

Australian involvement in the RCA is not restricted to the above projects. In 1981 an Australian scientist from the University of Western Australia served as a consultant to the coordinated research program on the use of induced mutations for improvement of grain legume production in South East Asia. AAEC scientists are actively involved in the CRP on radiation sterilization practices significant to local medical supplies and conditions for Asia and the Pacific. Australian experts have attended Working Group Meetings and training course associated with the sub-project on Non-Destructive Testing.

Ministerial approval has been obtained for Australia to agree to the extension of the RCA for a further five years from 12 June 1982. Arrangements are in hand which will enable Australia in the near future to notify the Agency of Australia's accession to the extension.

INDIA

REGIONAL COOPERATIVE AGREEMENT PROGRAMME
- COUNTRY STATEMENT

Dr. R. RAMANNA

It gives me great pleasure to be here to-day in connection with the 10th Anniversary of the RCA. It is particularly so since India was among the first to be associated in a programme for the development of nuclear science through regional collaboration. I am referring to the IPA (India, The Philippines, Agency) programme during 1964-69 for training and research in solid state physics using a neutron crystal spectrometer. Whereas India provided equipment and expert services, the Philippines hosted the programme.

The success of the IPA paved the way for the more broad-based Regional Cooperative Agreement for Research, Development and Training related to Nuclear Science and Technology (RCA).

The RCA objective, as you are aware, is to promote regional cooperation between Member States of IAEA in areas of common interest. This cooperation between countries in the region is expected to yield greater benefits and ensure regional self-sufficiency and self reliance.

The RCA programme owes its effectiveness to the basic objectives of cooperation among the countries of the region without dependence on developed countries. Thus

while the programmes are devised based on the regional needs, the expertise and equipment available in the developing countries of the region should be used to the maximum extent possible so that the developing countries in the region share the benefits of transfer of technology under similar socio-economic conditions.

India, as you are probably aware, has an advanced programme of research and development in the field of nuclear science and technology. The application of nuclear techniques in many areas of human endeavour such as agriculture, medicine, research and industry is an important part of the total nuclear energy effort in India. The infrastructure built and the programmes executed over the last 25 years of our development has made India largely self reliant in all the areas vital for the development of nuclear energy in the country. A large body of trained manpower has been a crucial factor in this.

Coming to the present status of RCA programmes in India, I am glad to say that the Indian participation in both the coordinated research programmes and in the industrial project has been very fruitful.

An intensive programme on radiation preservation of food particularly with respect to potatoes, onions, wheat and dried fish has been carried out. Clearances from the Ministry of Health are awaited for some of the products. In our opinion, the problem of consumer acceptance of irradiated food remains to be tackled and the regional collaboration on this aspect deserves consideration.

In the field of radiation sterilisation of medical products, the ISOMED plant at BARC has actively participated in the coordinated research programme. Besides sharing know-how with the other participating countries, India accepted three trainees from Malaysia and one each from Bangladesh and Indonesia.

The programme on improvement of grain legume production made good progress and the data available indicates that the Trombay groundnut cultivars are particularly high yielding in some states of India. Further work is in progress.

Under the project on neutron scattering techniques in applied research, important conclusions could be drawn from the neutron diffraction pattern of Niobium - Titanium alloys and on hydrogen bond-ing in some organic materials.

The RCA/JNDP Project on Industrial Applications of Isotopes and Radiation Technology is the first major step towards an intensive effort to achieve significant economic and social gains in the region through the application of nuclear techniques. It has been particularly gratifying to us at BARC as our expertise was called upon to assist in the formulation and processing of the project proposals.

The project, which commenced its activities in April this year, envisages that India ~~as a donor country~~ in the areas of tracer technology and medical supply sterilisation, will make available for regional use its expertise and facilities for purposes of providing special training, workshops, seminars and demonstrations. Action has been initiated at BARC to fully meet these requirements.

In the field of Non-Destructive Testing, India is already contributing towards the preparation of a Regional NDT Certification Standard and provides lecturers for training courses planned under the project.

The Bokaro Steel Plant is collaborating with BARC and RCA in the sub-project on nucleonic control systems. The BARC scientists are helping in the selection of an advanced nucleonic system for thickness control of hot rolled steel plates at the Bokaro Steel Plant. The installation of the equipment is planned for the current year.

It is clear from the project documents that the technology for many isotope applications is available within the region. The industrial project aims at technology transfer through sharing of the technology among the developing countries in the RCA region. It is therefore very important to draw on experience and expertise available in the developing countries in the region for the conduct, execution and management of the project activities. This approach of sharing of technology among the recipient countries will be more conducive to the socio-economic growth of the region as a whole.

Republic of Indonesia

Country Report/Country Statement

The Government of Indonesia continues to support and actively participate in the RCA Projects. Presently Indonesia has been joining 20 research projects with the Agency, either under research contract or under the RCA program.

In addition to the present existing projects, Indonesia will make effort to support and to take part in the new project activities under RCA umbrella, such as medical and biological application of radiation and radioisotopes, waste management, research reactor utilization, particularly in the development of skilled man-power. The current status of some of the existing projects are briefly summarized as follows :

I. UNDP Industrial Isotopes and Radiation Projects.

1. Radiation Processing.

The Bidders conference to select the most appropriate companies for the project has been conducted in Jakarta on October 19 - 21, 1982.

Following the approval from the Agency, Purchase Orders have been issued to Marubeni and to AECL Ltd. to supply for the project source handling equipment and Co-60 respectively.

The contract for shielding and building construction for Co-60 irradiation facility has been signed by BATAN and PT. Enmitra on April 8, 1982.

Two meetings have been conducted between BATAN and BATAN's engineering consultants - Marubeni - IAEA on February 1982 in Jakarta and April 1982 in Tokyo to discuss the design of the source handling equipment at the interface between mechanical and civil work parts.

Additional input to the project, amounting approx.

US \$ 200.000,- for Co-60 storage box, sleeve and some equipments has been approved by the Government of Indonesia. It is hoped that the Co-60 irradiation facility can be commissioned on early March 1983. Meanwhile research on radiation vulcanization of natural rubber latex is being continued. One IAEA expert from Japan has been assigned to Indonesia for three months (June - August 1981) and one staf has been sent to Takasaki Radiation Chemistry Establishment, JAERI, for one year on the job training in industrial dosimetry and radiation polymerization.

2. Nucleonic Control Systems.

Two engineers from Indonesia has been sent to take part in the integrated training-demonstration programs which were conducted in early 1982 in Tokyo and Banpong Thailand.

3. Nuclear Instruments Maintenance.

Indonesia has been actively participating in the program by sending three engineers to take part in the UNDP sponsored Train-the-Trainers Workshop on Nuclear Instruments Maintenance which was held on April-May 1981 in Kuala Lumpur,

and one engineer to the Workshop on Maintenance of Nuclear Instruments for Industrial Application which was held in Tokyo, November 1981.

II. Regional Project on Medical Supply Sterilization.

This regional project is now terminated. The last RC meeting was conducted in Manila, February 1982. Indonesia has participated in the project since the commencement of the project.

Results of the activities have been reported to the Agency and have been presented in the RC Meeting.

A few years ago the radiation sterilization technique has been introduced to the market and since then the technique has been utilized by some pharmaceuticals and medical supplies manufacturers.

According to the Indonesian Department of Health regulation; label "sterile" can be stuck to the bandages or cotton if they are sterilized by gamma radiation.

III. Regional Project on Food Irradiation.

Indonesia has been actively participating in this project.

Two research contracts are being carried out in Indonesia, namely Pilot Scale Studies on Dried Fish Irradiation and Gamma Irradiation of Spices (i.e. nutmeg, black pepper and white pepper). Results of the activities have been presented in the RC Meeting conducted in Tokyo, November 1981 and have been reported to the Agency.

IV. Regional Project on the Use of Induced Mutations for Improvement of Grain Legume Production.

Two research contracts has been awarded by the Agency to Indonesia. Results of the activities have been presented in the RC meeting in Chiang Mai Thailand on April - May, 1981.

V. Regional Project for Improving Domestic Buffalo Production Using Nuclear Technique.

Activity reports on the two research contracts in this projects have been presented in the Third RC Meeting held in Serdang, Malaysia on April 19 - 23, 1982. These two research contracts are :

- a. The utilization of pasture grass as basal diet for water buffaloes with the supplementation of concentrates.
- b. The use of radioimunoassay in the measurement of serum concentration of LH, FSM, Progesterone and estradiob-17 beta of cycling swamp buffalo cows and testosterone in young and adult swamp buffalo bulls.

VI. Regional Project on Isotope Application in Hydrology and Sedimentology.

Nuclear technique has been widely used in Indonesia for solving problems in the field of hydrology and sedimentology. Sediment movements in the three big harbours and in the two sites planned for harbour construction have been studied using isotopes technique.

Leakage of a number of dams and discharge measurement of some rivers have been studied also using this technique. Indonesia, which is participating in the RCA project on hydrology, is now developing and adapting technique of using environmental isotope to study the groundwater movements, dynamics and reserves. An electrolytic enrichment system and benzene preparation has been installed at Pasar Jumat with the assistance of an expert from Australian Atomic Energy Commission. An IAEA Research Contract on "Groundwater studies in Jakarta and vicinity" is now under implementation by BATAN.

VII. Regional Project on Health Related Environmental Research.

One research contract of this project is now being implemented in Indonesia namely "A Study on the Concentration Level of Trace Elements in Human Hair of Inhabitants of Jakarta Metropolitan". Progress report of the activity has already been submitted to the Agency.

VIII. Regional Project for Nuclear Instrument Maintenance.

One research contract is now under implementation in Indonesia. Report of the activity has been presented in the last RC meeting held in Yogyakarta on November - December 1981.

Beside these research contracts Indonesia is also submitting to the agency some other contracts which are now still awaiting the Agency's approval.

JAPAN - COUNTRY STATEMENT

(TO BE PRESENTED TO THE 4TH RCA WORKING GROUP MEETING, KUALA LUMPUR, MALAYSIA, 17 - 21 JUNE, 1982)

1. THE GOVERNMENT OF JAPAN HAS REPEATEDLY EMPHASIZED THAT THE IMPORTANCE OF TECHNICAL COOPERATION IN THE FIELD OF THE PEACEFUL USES OF NUCLEAR ENERGY TO DEVELOPING COUNTRIES IN MANY OCCASIONS. RECENTLY IN THE SPEECH OF MR. ICHIRO NAKAGAWA, STATE MINISTER FOR THE SCIENCE AND TECHNOLOGY AGENCY, AT THE IAEA GENERAL CONFERENCE IN SEPTEMBER, 1980, HE RECONFIRMED THE ABOVE MENTIONED RECOGNITION.

IN THIS CONNECTION, JAPAN, AS THE FOREMOST NUCLEAR POWER ORIENTED COUNTRY IN THE REGION CONCERNED HAS MADE A POSITIVE CONTRIBUTION TO PROMOTING THE REGIONAL COOPERATIVE ACTIVITIES IN TERMS OF BOTH TECHNOLOGY AND FINANCE UNDER THE FRAMEWORK OF THE RCA.

2. FURTHERMORE, THE GOVERNMENT OF JAPAN, AT THE CABINET MEETING OF JUNE 8, 1982, HAS ALREADY DECIDED TO ACCEPT THE FIVE MORE YEARS, RECOGNIZING THE IMPORTANCE OF THE RCA, AND PROMPTLY NOTIFIED OUR DECISION TO THE IAEA. THE GOVERNMENT OF JAPAN HAS ALSO DECIDED TO HOST THE INTERIM OFFICE OF THE UNDP INDUSTRIAL PROJECT IN TOKYO AND OPENED IT IN JUNE 14, 1982, RECOGNIZING THE IAEA'S AND PARTICIPATING COUNTRIES' REQUEST.
3. ON THE OTHER HAND, IN MANY OCCASIONS SUCH AS THE RCA GENERAL CONFERENCES AND WORKING GROUP MEETINGS, WE HAVE REPEATEDLY EXPLAINED ITS BASIC POLICY ON TECHNICAL COOPERATION WHICH AIMS AT "HUMAN RESOURCES DEVELOPMENT" OF MEMBER STATES OF THE RCA AND THEREFORE WE PLACE GREAT EMPHASIS ON THE SO-CALLED SOFT-WARE TYPE TECHNICAL COOPERATION PROMOTING THE PROJECTS INCLUDING RESEARCH COORDINATING MEETINGS, SEMINARS, WORKSHOPS, SENDING EXPERTS, PERSONEL TRAINING, ETC.

4. THE GOVERNMENT OF JAPAN CONTINUES CONTRIBUTION AND PARTICIPATION TO THE FOOD IRRADIATION AND UNDP INDUSTRIAL PROJECTS.

IN ADDITION, WE WILL MAKE AS MUCH EFFORT AS POSSIBLE TO SUPPORT THE PROPOSED PROJECT ON MEDICAL AND BIOLOGICAL APPLICATION OF RADIATION AND RADIOISOTOPES, TAKING INTO ACCOUNT THE NEEDS OF THE MEMBER STATES OF THE RCA.

THIS YEAR, AFTER THIS MEETING, THE GOVERNMENT OF JAPAN WILL TAKE NECESSARY MEASURES TO HOST THE FOLLOWING WORKSHOPS AND MEETINGS :

- (1) STUDY MEETING ON RADIATION ENVIRONMENT AND RELATED SUBJECTS (SPONSORED BY JICA) TOKYO, 16 AUGUST - 10 SEPTEMBER, 1982.
- (2) THE SECOND RCA/UNDP WORKSHOP ON MAINTENANCE OF NUCLEAR INSTRUMENTS FOR INDUSTRIAL APPLICATIONS, TOKYO, NOVEMBER, 1982.

THE FINANCIAL CONTRIBUTION BY THE GOVERNMENT OF JAPAN TO THE RCA PROJECTS IS AS FOLLOWS :

- (1) US \$80,000 FOR THE FOOD IRRADIATION PROJECT
- (2) US \$110,900 FOR UNDP INDUSTRIAL APPLICATION PROJECT.

FINALLY, WE WOULD LIKE TO ADD THAT WE ARE CONSIDERING THE CONTRIBUTION TO SUCH COOPERATIVE ACTIVITIES BY THE JAPAN INTERNATIONAL COOPERATIVE AGENCY (JICA) AND OTHER RESOURCES AS NECESSARY.

* COUNTRY STATEMENT
RCA WGM/4

REPUBLIC OF KOREA

The Republic of Korea has a firm intention to support the regional cooperative programmes and projects being carried out under the RCA umbrella especially the cooperative research projects and the RCA/UNDP Industrial Project.

The Government of the Republic of Korea will also make great effort as possible as to initiate and implement new projects through close cooperation with the member states.

Current status of RCA research projects conducted by the Korea Advanced Energy Research Institute(KAERI) are as follows;

(1) Non-destructive testing

KAERI is very eager to develop and localize the NDT techniques for pre-and in-service inspection of nuclear power reactors. Korea has not actively participated in NDT training programs, but it is out firm wish to cooperate with regional member countries for advanced NDY technology.

(2) Hydrology and sedimentology

Tritium counting laboratory of KAERI is continuing its activities on environmental isotope aided studies on river and ground water in the region of Seoul and nuclear power plants site such as Kori Unit 1 (PWR) and Wolsung Unit 1 (PHWR) for monitoring and refernce purposes.

(3) Maintenance of nuclear instrumentation

Three pilot laboratories in Seoul area have been collected the data of voltage, temperature and humidity.

Effect of weather and condition of electronic equipment are being analyzed and evaluated.

(4) Food irradiation

Radiation effect packaging studies and economic evaluation of irradiated onions are being carried out. Studies also being focused on potatoes, garlicks and chestnuts especially by combined method of irradiation and natural low temperature. The Ministry of Agriculture and Fisheries and KAERI jointly studied the economic evaluation of large scale Co-60 irradiation source for preservation of foods such as potatoes.

(5) Induced mutation of soybean

For the inducement of mutation techniques into leguminous crops 1) selection of SMV-N resistant lines and some other agronomic characteristics of soybean in M_3 and M_5 generations, and 2) cercospora leaf spot disease and shattering resistant lines in mungbean treated with thermal neutrons are under progress by this project.

We are glad to invite research coordination meeting in this field in October in Seoul.

(6) Radiosterilization

Radiosterilization of medical supplies, KAERI offers as the regional training center for workshops our demonstration facility of 100 KCi Co-60 radiator and 300 KeV electron accelerator which is installed in 1975 with the cooperation of UNDP.

This year, KAERI wishes to host the RCA Cooperative Research Coordinating Meeting on Induced Mutations for Virus Disease Resistance in Soybean in mid-October in Seoul.

MALAYSIA

The Government of Malaysia continues to actively support participation in RCA programme. At present, Malaysia is participating in 6 IAEA/RCA Research Projects and 4 UNDP/RCA Industrial Projects. Malaysia considers the RCA programme as an important and effective vehicle for technology transfer to the developing countries and fully support the effort at level commensurate with the available resources. Malaysia is also interested in new projects involving medical and biological applications of radiation and isotopes, such as radioimmunoassay techniques and quality control of radiopharmaceuticals.

In Malaysia we do not as yet have a central body responsible for nuclear science and technology matters, such as an Atomic Energy Commission as the various member countries. This has handicapped us in the past because there was no agency to coordinate the various RCA projects. Early this year the Government of Malaysia has formed a National Committee on RCA whose functions are to,

- * appoint the Chief Investigator of the Research Group.
- * determine policies and priorities of the implementation of the RCA projects.
- * determine and approve financial commitments in aid of the RCA projects.
- * recommend new RCA project proposals to IAEA.
- * assist in the promotion of peaceful uses of atomic energy through RCA projects.

The formation of this committee indicates the government's serious support from RCA.

In the following we present a report of the status of the various projects which marks their progress from that reported at the 3rd. Working Group Meeting in Jakarta in May last year.

- a) Regional Cooperative Project on the Use of Nuclear Techniques in Improving Domestic Buffalo Production in Asia

Agricultural University of Malaysia (UPM) is National Coordinator

of this project. UPM has just recently hosted the Third Research Coordination Meeting at the Department of Veterinary Clinical Studies, UPM, Serdang, Malaysia 19th. - 23rd. April, 1982.

The research group has carried out a considerable amount of work to date. The group has successfully assessed the ovarian function of the swamp buffalo using nuclear techniques which were employed for the assay of progesterones in blood. The results of the work were presented at the Third Research Coordination Meeting. Further research will be carried out to determine the cause of the reproductive failure in Malaysian livestock.

b) Coordinated Research Programme on Isotope Application to Hydrology and Sedimentology

PUSPATI is the National Coordinator of this project. Other agencies collaborating in this project are the Drainage and Irrigation Department of Kelantan, the Geology Department of the National University of Malaysia (UKM) and the Geological Survey Department.

Following the RCA First Project Review Meeting held at KAERI Seoul, in October 1980, it has been accepted that the following activities are undertaken in Malaysia.

i) Continuation of the groundwater study in the Lower Kelantan River Basin.

Collection of groundwater and river water samples were carried out 4 times so far; twice, each in dry and wet seasons (i.e. May 1980, January 1981, May 1981 and January 1982). Whilst rain water samples are collected every month since May 1980.

ii) Reconnaissance study of groundwater in the area of Kedah/Perlis.

As the Kelantan study is phasing out, emphasis will shift to a groundwater study in Kedah/Perlis area; the groundwater samples were collected twice; one in April 1981 and the other in October 1982.

iii) Application of Cs-137 technique to sediment redistribution in the Lui River catchment.

Soil samples were collected last May. These samples were analysed for Cs-137 at AAEC laboratory.

iv) Technical Assistance.

Malaysia will receive a tritium enrichment facility from AAEC. The facility is being assembled at Lucas Heights for shipment to Kuala Lumpur sometime this year.

v) Education and Training.

Mr. Roslan Mohd. Ali will receive training in isotope hydrology at Lucas Heights under the IAEA Regular Programme of Technical Assistance.

Mr. B.L. Campbell an expert from AAEC visited Malaysia last December to optimise the counting systems, train personnel in sampling procedures and advise on interpretation of results.

c) Health Related Environmental Research

The national coordinator of this project is the National University of Malaysia (UKM). The initial stage of the project has been devoted to the analysis of standard reference materials by neutron activation analysis and atomic absorption spectrometer. Standard reference materials such as Soil-5, Lake Sediment SL-1, Animal Muscle H-4, Copepod MA-A-1 and Bowen's kale have been analysed. Further work has been carried out to develop analytical techniques for the determination of arsenic, cadmium, mercury, lead, zinc, cobalt, chromium, iron, antimony and thorium. Generally instrumental Neutron Activation Analysis (INAA) method give reasonably accurate and precise values for most of the elements determined. At a longer irradiation period mercury could be determined. The analytical techniques can now be used for the analysis of arsenic, copper, mercury, zinc in hair samples.

The application of Nuclear Techniques in this project is unfortunately still limited. This is due to the geographical distance of the irradiation facilities. It is expected that when the first Malaysian research reactor (PUSPATI) is commissioned in July, more NAA work on hair samples will be done. At the moment irradiation will still be carried out using EARC reactors.

d) Regional Cooperative Project on Food Irradiation

The participating agencies in this project are the National University of Malaysia (UKM) and the Agricultural University of Malaysia (UPM). Other agencies collaborating in this project are the Pepper Marketing Board of Malaysia and Malaysian Agricultural Research and Development Institute (MARDI). The Pepper Marketing Board of Malaysia controls the production and trade of pepper in Malaysia.

The research on volatile and non-volatile constituents of irradiated black and white pepper has been completed at the Nuclear Science Unit, National University of Malaysia. The results of this work were reported at the FAO/IAEA Seminar on Food Science and Technology, Tokyo 16th. - 18th. November, 1981.

At present, the group is in the process of completing the research on the effect of irradiation on microbial and insect contamination of pepper. The research includes:

- i) Identification of the pest (bacteria, fungi and insects);
- ii) Microbial and insect population studies at different stages of processing, from harvest until processing but before irradiation treatment;
- iii) Effect of irradiation on microflora and insect in the pepper.

The group will also be carrying out research in packaging and transportation of the irradiated pepper. All the researches which are carried out are geared towards pilot scale.

Other studies on food irradiation include irradiation of rice to investigate the changes in nutritive value and sensory quality during storage for three months, and irradiation of tomatoes to delay ripening and reduce microbial spoilage. These studies are carried out on a very small laboratory scale.

e) Regional Project on the Use of Induced Mutations
for the Improvement of Grain Legume Production

There are two projects carried out in Malaysia on improvement of food crops through induced mutations. Both projects are coordinated by the National University of Malaysia (UKM). The first project is the improvement of soybean through induced mutation and is undertaken by UKM, University of Malaya (UM), UPM, MARDI and the Rubber Research Institute of Malaysia (RRIM).

The second project is the Induced Mutation of Rice and is undertaken by UKM and MARDI.

The work involves the use of induced mutations to breed legume which are resistant against the brown plant hoper (BPH) and also resistant against major pests and diseases of rice in Malaysia. Two types of mutagens have been used in this study, namely ethylmethane sulphonate (EMS) and gamma irradiation Autogenic treatments. The project was initiated in 1979 and to date we have been successful in recovering a number of mutants resistant against blast and several against the BPH.

f) Coordinated Research Programme on Maintenance of Nuclear Instruments

The National Coordinator of this project is PUSPATI. This project has been carried out to a fairly good level of progress since it was started in December 1979. The objectives of the project are,

- 1) Data collection on instrument breakdown.
- 2) Building of power conditioning device which consists of drop-out relays, surge-suppressors and constant voltage transformers. The system will be tested in pilot laboratories and the data will be evaluated as its effects.
- 3) Working out detailed maintenance plans in pilot laboratories and implementation of the plan.
- 4) To improve local training programme on the use and maintenance of nuclear instrumentation.
- 5) To start the realisation of a National service centre in Malaysia.
- 6) Spare part pilot project.

Results Obtained

We have so far, succeed in developing and installing power conditioning devices, drop-out relay circuit, transient line and voltage protection circuit. These success together with the arrival of

equipments from IAEA (i.e. Three constant voltage transformers Model Gould - Type TCVN 1500J, 100 varistors type V275 LA40B and 40 of type V250 LA40A), we have further constructed three power conditioning devices for the maintenance plans in pilot laboratories.

Activities

I) A number of courses had been carried out in Malaysia in conjunction with the project:

1) Train the Trainees Course cum workshop (March-April 1981). The above course was sponsored by IAEA with the co-operation of the Government of Malaysia. It was held at the Technological University of Malaysia. Twenty-four participants from member states participated in the course. Overall it was quite successful with a few shortcomings as this was the first course organized by IAEA.

2) Local technician training course (12 April - 8th. May 1982). The course was organized by local lecturers and experts. One IAEA expert was also involved in giving few lectures. Eighteen local participants were selected to join the courses. The course was successfully organized and it was hoped that a follow-up courses on special instrumentation should be similarly organized such as Liquid Scintillation counter, micro-processor-based nuclear instrumentation, etc. to train in troubleshooting of such equipment.

II) Power - conditioning equipment.

Some power conditioning equipment were received from IAEA and were installed in the pilot laboratories. Part of the power-conditioning device was developed.

III) Radiation of National Service Centre

Malaysia is also geared towards the long term objective to realize a Scientific Instrumentation Centre to cater for the development and maintenance of scientific instrumentation in Malaysia.

g) UNDP/RCA Industrial Radiation Project

Malaysia hosted the first technical review meeting of the UNDP/RCA Industrial project on Radiation Processing 15th. 19th. February, 1982. The meeting reviewed the status of each sub-project which includes the work plan and the training programme for the personnel. Following

the meeting Malaysia has made some progress and is briefly reported as follows:-

1. Radiation Vulcanization of Natural Rubber Latex

Malaysia has fully supported this project and the Rubber Research Institute of Malaysia is the National Coordinator (RRIM). The current status of the project is;

- Pilot plant construction of a 150,000 Ci Cobalt-60 irradiation facility in Jakarta, Indonesia, to begin in March 1982 and to be commissioned in March 1983.
- Evaluation programmed of the radiation vulcanization of natural rubber latex to begin in June 1983 and expected to be completed by end of 1985.
- On job training and demonstration programmes for personel from participating countries to take place throughout the June 1983 to December 1985 period.

The Rubber Research Institute of Malaysia will serve as the main centre for carrying out the testing of the irradiated latex and products therefrom. The Malaysian Government has allocated a sum of US\$ 140,000 for Malaysia's participation in the sub-project. In return UNDP will provide a sum of US\$ 48,000 for the purchase of

testing equipment. Malaysia has provided UNDP through IAEA the details of the testing equipment requested. A programme for Malaysian personnel to undergo training or attachments at BATAN, Jakarta or in Japan has been prepared.

2. Surface coating of wood products and wire and cable insulation

Malaysia is interested and fully supported these projects. Representatives have been sent to Japan to visit irradiation plants. Details of the budgeting and implementation of these projects are being worked out. Malaysia has nominated officers to be trained in Japan under the IAEA fellowship programme. Plans are also being prepared to send supporting staff to work and train at the Pasar Jumat Research Centre, Jakarta, as soon as the irradiation plant gets underway.

3. Radiation Sterilization of Medical Products

Malaysia has indicated its interest and support for this project. Details of the budgeting and implementation of this project are being worked out. Plans are also being prepared to send officers to be trained at BARC India and KAERI, Korea.

h) Non-Destructive Training

The National Coordinator of this project is Standards and Industrial Research Institute of Malaysia (SIRIM).

A Working Group consisting of officers from NDT and Material Science Sections has been formed as to ensure the success of the implementation of the project. Details of the budgeting and the implementation of this project has been worked out.

Dr. R. Emmerich, an expert from IAEA was with SIRIM for 3 months to provide assistance in formulating NDT training courses which may be held in Jun 1982. Dr. Emmerich together with SIRIM officers carried out a study on the current status of NDT in Malaysia.

SIRIM, so far, has received Gamma Radiography Projector (Ir. 192 source) from IAEA under the technical assistance programme. SIRIM also has further purchased Ultrasonic flaw detector, probes, eddy current flaw detector, magnetic particle flaw detector and reference radiographs.

1) Nucleonic Control System - Minerals
Exploration, Mining and Processing

Malaysia has indicated its interest and support for this project. The Mine Research Institute, Ipoh, is the National Coordinator. Details of the budgeting, implementation and development of manpower are being worked out.

COUNTRY REPORT - PHILIPPINES

The Philippines has continuously supported the idea of regional cooperation in the development and safe utilization of nuclear science and technology. This was shown quite clearly when it concluded a Tri-lateral agreement with India and the IAEA on a cooperative programme known as the IPA Project. This programme involving neutron spectrometry research was hosted by the Philippines and supported by India with an initial grant of equipment and instruments. The Agency provided expert services and fellowships for participants. It was participated in by several countries within the region of Asia and the Far East which had acquired small research reactors. While the undertaking was modest in comparison with present efforts, the endeavor showed that regional collaboration is achievable. Although terminated at the end of its five-year term, it served as a precursor and prototype for the larger RCA/UNDP Industrial Projects.

During the first decade of the RCA, researchers from the Philippine Atomic Energy Commission (PAEC) universities, and other research institutions involved themselves in RCA coordinated research programmes and benefitted much from their participation. These cooperative activities have resulted in numerous research papers detailing results and read at conferences, workshops and seminars. Coordination meetings facilitated close interaction, personal contacts, and information exchanges among researchers.

The programmes participated in by Philippine Scientists and Technologists include such diverse areas as food irradiation and food preservation, pesticide residues, neutron scattering, irradiated vaccines, geochemical prospecting, radiation microbiology, induction of mutation, and health related environmental researchers. Although a number of research contracts have been successfully completed, investigations and studies related to these areas continue to be expanded utilizing the techniques developed by the respective groups.

Current participation includes nuclear techniques to improve buffalo production in Asia and nuclear instruments maintenance. In the former, RIA techniques were employed to establish working assays for serum progesterone and luteinizing hormones. Assay techniques for estradiol and milk progesterone are in progress. The project of instrument maintenance focused on nuclear medical equipment conditioning in two selected hospitals. Two courses on nuclear electronics have been held recently. In the UNDP Industrial Projects sub-project on Nucleonics Control in minerals exploration, mining and processing selection of a Philippine industrial partner was realised.

The PAEC favorably recommended to our government the country's continuing participation in RCA for the next five years. Sufficient funds were provided also to convert the present reactor system into a pulsed-type and to construct laboratory buildings for industrial applications, isotope production, waste management, and a Co-60 irradiation facility. Similarly, the infusion of technical assistance made it possible for our organization to initiate implementation of programmes dealing with graduate training in Medical Physics Radioimmunoassay Kit Production, and a Quality Assurance/Quality Control Training Centre. These recent developments are expected to result in greater participation of research institutions and industries in RCA activities.

For the future thrusts of RCA programmes, our scientists would like RCA member states to consider regional programmes in the following areas:

- (a) Medical and Biological Applications including quality control for radiopharmaceuticals, radioimmunoassay kit production, germ free animal colonies, biological indicators.
- (b) Trace and heavy elements behaviour in food crops, nutrition, marine and aquatic resources.
- (c) Reactor utilization such as neutron diagnostics, neutron dosimetry, and materials research.
- (d) Radiation technology and processes including interaction of radiation with cell membrane, single cell interactions, bone and tissue grafts sterilization.
- (e) Regional Emergency Assistance Scheme.

SRI LANKA STATEMENT

Sri Lanka wishes to thank the Government of Malaysia for hosting this meeting and making these excellent arrangements. Sri Lanka takes part in 6 RCA Research Projects Viz:

- (a) Use of induced mutation for improvement of Grain Legume Production.
- (b) Use of Nuclear Techniques to Improve Domestic Buffalo Production.
- (c) Maintenance of Nuclear Instruments.
- (d) Isotope Applications in Hydrology and Sedimentology.
- (e) Food Irradiation.
- (f) UNDP Regional Industrial Project.

The First Research Coordinator Meeting of the Grain Legume Project was hosted by Sri Lanka in 1975 and at present we hold one research contract.

The project on Domestic Buffalo Production is important for Sri Lanka because Sri Lanka is primarily an Agricultural country and the buffalo plays an important role in agriculture. In 1979 we hosted the Research Coordination Meeting and Workshops. In April this year we had another training workshop for local scientist. Sri Lanka holds 4 research contracts under this project. These projects are carried out at the Veterinary Research Institute and the University of Peradeniya. Sri Lanka Atomic Energy Authority has provided the salary of 2 research students to work on these projects under the supervision of the contract holders. Both research students are registered for postgraduate degrees in the University.

Sri Lanka holds one research contract under the project on Maintenance of Nuclear Instruments. Under this contract maintenance practices are being introduced in two laboratories. We strengthened the manpower available for instrument maintenance during the last year and significant progress has been achieved since then and the facilities at the Radioisotope Centre have been strengthened to serve as a central maintenance facility.

An engineer and scientist attended the train the trainers workshop held here in Kuala Lumpur and with their assistance and with the assistance of an IAEA expert we conducted a course for technicians, last

year, and this course was attended by over 20 technicians. The contents of the course have been since then reviewed and the second course is due to begin later this month.

Under the project on Isotope Application in Hydrology and sedimentology 5 sub-projects are being carried out.

Studies on sediment movement outside the Colombo Harbour where a new approach channel is going to be dug is underway. We had three engineers trained in France for this project. We injected one Curie of Iridium-192 labelled sand last month and already one set of measurements have been taken. Once this study is completed it is expected to extend this work to other areas.

Study of the occurrence of high salinity in the Hambantota area, a dry area in the South West of Sri Lanka, is underway. As we do not have the facilities for O-18, Deuterium and Natural Tritium Measurements, the samples are being sent to Vienna and Lucas Heights in Australia for analysis.

Studies on recharge and residence times of Ground Water in the Moneragala District, and area in the South of Sri Lanka, have started. Samples of this project are also analysed in Vienna and in Australia.

Some studies on the thermal springs in Sri Lanka also commenced recently.

A project on the use of fall out Cs-137 on erosion studies is about to start.

Sri Lanka hosted the regional seminar on isotope hydrology in November last year.

In the field of food preservation we hold one research contract. The research contract holder is a teacher of a recently established university about 200 miles from the only available radiation cell. Difficulty of obtaining transport facilities from the university is a handicap for this project. In February 1982 we hosted the research coordination meeting of this projects.

Regarding the UNDP industrial project we congratulate Dr. E.E. Fowler on his appointment as the Project Director and thank the Japanese Government for providing facilities for the project office in Tokyo. Under this project we have already trained a number of personnel. The Chief metallurgist and the Assistant Electrical Engineer of the Ceylon Steel Corporation participated in the workshop on maintenance of Nuclear Instruments for Industrial Applications held in Tokyo in November 1981. Steel corporation is now in need of non destructive testing facilities. Chief Chemist of the Ceylon Cement Corporation, an Engineer of the State Engineering Corporation and an Engineer of the Colombo Dockyards Limited, attended the Regional training course in the Practical Use of Radioisotope Techniques in Industry for Process and Quality Control held here in Kuala Lumpur in November last year.

An engineer of the National Paper Corporation participated in the Demonstration of paper manufacture using nuclear control system in February 1982. An engineer of the Ceylon Electricity Board underwent training at the BARC in India. The electricity Board is now in need of NDT facilities.

We have set up a non destructive testing laboratory at the Bureau of Ceylon Standards with the Assistance of the Agency.

The Ceylon Petroleum Corporation will install shortly some non destructive testing equipment.

The Rubber Research Institute is taking part in the Radiation Processing sub project. The Head of the Rubber Chemistry Department is the participant from Sri Lanka on this project. The equipment and the facilities available at the RRI laboratories, strengthened by more items supplied under the project will be used for testing irradiated produced rubber products.

Training through the workshops and training courses organized under this UNDP Project is limited to the engineers, scientists and technicians who are directly associated with the activities, the project is supporting. However, it is necessary that some others who are not directly involved, but important in decision making, also get some idea of these techniques and their potential. To fulfil this need, the Sri Lanka Association for the Advancement of Science has agreed to

organize a seminar on 'the use of Nuclear Techniques in Industrial Development'. The main speakers at this seminar will be those who received training under this project.

Thank you.

THAILAND-COUNTRY STATEMENT

The Fourth Working Group Meeting of the RCA Member States

16-21 June 1982

Kuala Lumpur, Malaysia

On behalf of the Thai AEC, I have the honour to inform the Meeting that a formal notification to the Agency of the Government of Thailand acceptance of the Second Agreement to extend the Regional Co-operative Agreement of 1972 is now being communicated to the Agency.

Thailand has been active in the RCA from the early years of its implementation and, throughout the first ten years of the Agreement, continued to participate in and contribute to almost every project initiated under the framework of RCA. In respect of the on-going RCA projects, we have already discussed their status, progress and future action plans in the preceding sessions. The roles of each contributing Member States in these on-going projects are already well summarized in the status reports prepared by the respective project officer, therefore, we shall refrain from making further reference to Thailand's interest and roles in the on-going projects in this country statement.

Following the acceptance of Member States of the Second Extension Agreement, the RCA shall continue in force for a further period of five additional years with effect from 12 June 1982. It is very timely, therefore, that this Fourth Working Group of the RCA is now being convened (in June 1982) to, inter alia, discuss the work plan for 1983, and also new proposals and future programmes of the RCA.

As far as Thailand is concerned, we are now under the "Fifth Five-Year National Economics and Social Development Plan", which came into effect from 1 October 1981 and covers the period from our fiscal year 1982 to 1986. Our national planning in the utilization of nuclear technology for the current years has to be within the framework of the objective-oriented operation programmes and complementary to national development targets set forth by the Fifth Five-Year Plan.

As already known to the Agency and our counterparts in the Member States, the Office of Atomic Energy for Peace (OAEP), being Thailand's national competent authority on nuclear energy, is serving as a principal advisory body to the Thai Government in nuclear energy matters. Apart from the advisory functions, OAEP also operates its own research reactor center and associated research and development facilities.

In implementing RCA programmes, OAEP has been assigned the roles of the national RCA counterpart and also of central liaison office for the co-ordination of RCA activities within the country. And in order to secure the broad objectives of RCA, co-operations of other appropriate local institutes in the government and/or private sectors are always sought by OAEP both at project management and working levels.

Therefore, new project proposals under the RCA will have to be reviewed and processed by OAEP in submitting them for government consideration. In this connection, OAEP has to prepare to "defend" a new project proposal on the following grounds:

- Strong regional interest, technical feasibility and potential benefits to the Region.
- Project objectives related to our own national development target(s) as set forth by the NESD Fifth Five-Year Plan.
- Project requirements, nature and level of supports to be contributed by the Thai side.
- Resources which could be made available to the Project from government and private sectors, taking into consideration the capability and willingness of government and private institutions to share project management and financial responsibility with the OAEP.

In the event that a large financial contribution to a project is to be provided from the government fund, a cost/benefit analysis is also required to the satisfaction of the National Economic and Social Development Board (NESDB) and finance authorities before OAEP making further move toward securing the government formal agreement to participate in a new regional project.

In the light of the above clarifications, and with respect to the proposals made and discussed at this Meeting, OAEP is pleased to state its strong intention to support the following project proposals:

- Initiation of a new programme on medical and biological applications of nuclear techniques, with particular references to (a) training and field demonstration aspect of the programme and (b) preparation of radio-pharmaceuticals.
- Initiation of the second phase of the co-ordinated research on food irradiation within the framework of the existing RPFI.
- Shifting of emphasis of the existing Radiation Sterilization Project from Medical Product and Supplies to Biological Tissue Graft.