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

INDEX

# 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.

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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 satisfaciton 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.

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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 constrasted 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.

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The full-scale project was initiated on April 1, 1982. As formally accounced 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%.

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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.

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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 radiopharmaceuticals 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.

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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.

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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.

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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.

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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.

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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.

Appendix 1

FOURTH RCA WORKING GROUP MEETING

June 17 - June 21, 1982

Kuala Lumpur , Malaysia

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Appendix 2

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 proejct 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.

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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 deligent 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 Parliment 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<br>Deputy Director General<br>Department of Research and Isotopes<br>International Atomic Energy Agency |
| | Welcoming Remarks | Minister of Science, Technology and Environment, Malaysia |
| | Coffee Break | |
| 10:30 | Invited Lecture<br>"Japan's Experience in Nuclear Science and Technology" | Prof. T. Mukaibo<br>Acting Chairman<br>Japan Atomic Energy Commission |
| | Invited Lecture<br>"Development of Nuclear Science and Technology in Australia" | Dr. D.G. Walker<br>Acting Director<br>Australian Atomic Energy Commission Research Establishment |
| | Invited Lecture<br>"Development of Nuclear Science and Technology in India" | Dr. R. Ramanna, Director<br>Secretary to the Government of India<br>Bhabha Atomic Research Centre |
| | Invited Lecture<br>"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<br>Dr. D.G. Walker, Australia<br>Minister of Science, Technology and the Environment, Malaysia<br>Chief Delegates from all other RCA Member States<br>Prof. M. Zifferero, IAEA |

FOURTH RCA WORKING GROUP MEETING

June 17 - June 21, 1982

Kuala Lumpur, Malaysia

PROGRAMME

June 17, 1982

| | | |
|---|---|---|
| 9:00 | Opening of the Meeting | Prof. M. Zifferero<br>Deputy Director General<br>Department of Research and Isotopes<br>IAEA |
| | Welcoming Remarks | Deputy Minister<br>Science, Technology and Environment<br>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

| | | |
|---|---|---|
| 9:30 | IV. Future programmes and new proposals (continued) | |
| | - Food Irradiation | |
| | Break | |

.../

11;) - 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

* * * * *

# 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 suceptibility 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 Philippiens 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).

.../

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 let 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 sounterh 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

| C.S.I. (Country) | RA No. | Proposed Allocation* (US$) |
|---|---|---|
| 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 indentification 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 Ceric/cerus ($Ce^{4+}/Ce^{3+}$) 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 dosemeters, 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, belladona, 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 courties 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 | $ 3,000 |
| | 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 |

Appendix 7

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).

...2/

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 sedement 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:

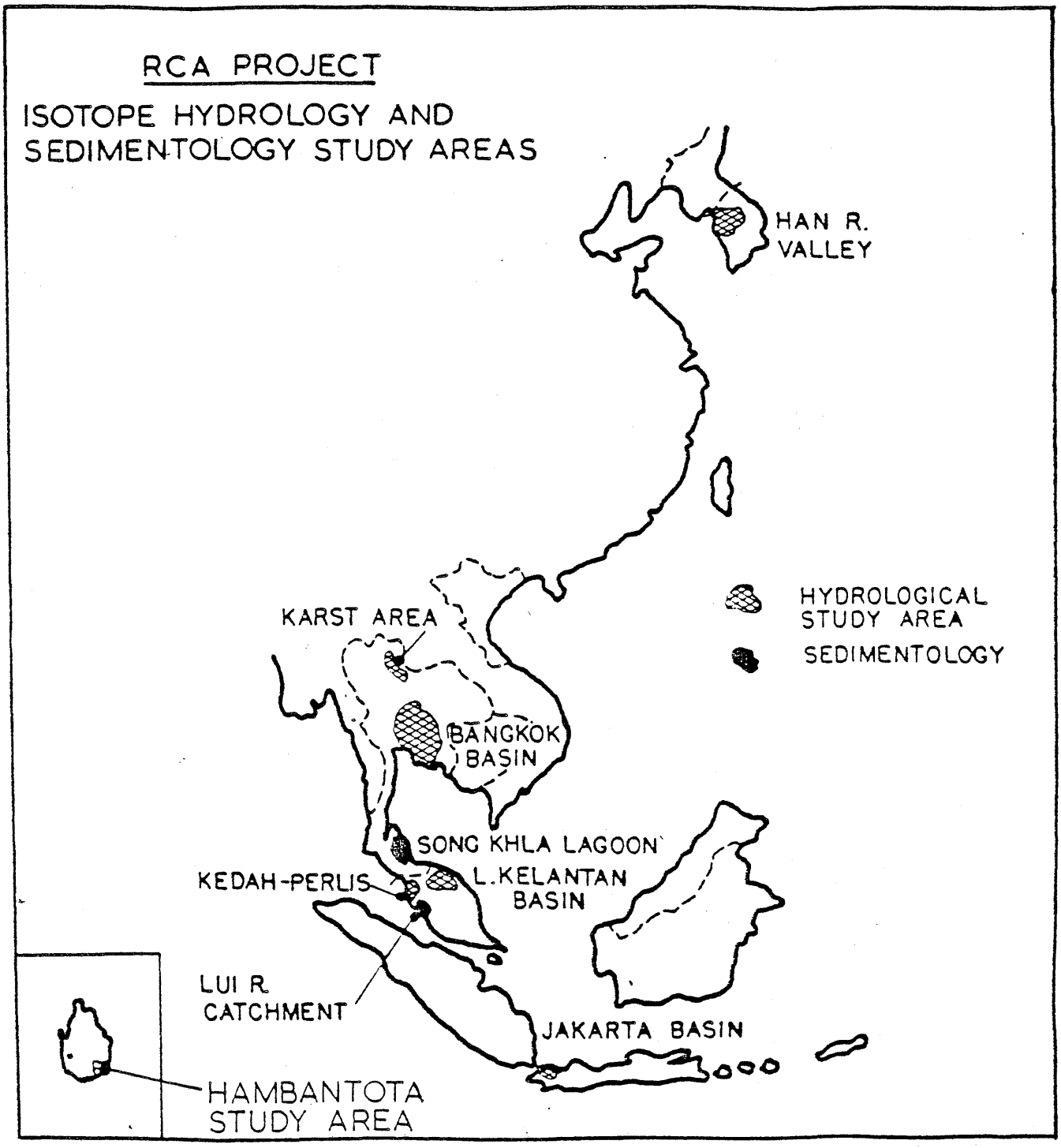
(i) In general these insights could only have been obtained with isotopic techniques as much of the necessary hydraulic data was unavailable;

(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<br>Water Supply Enterprise, City of Jakarta. |
| Thailand: | Department of Mineral Resources,<br>Royal Irrigation Department. |
| Malaysia: | Geological Survey,<br>Department of Irrigation and Drainage. |
| Sri Lanka: | Water Resources Board |


RCA PROJECT
ISOTOPE HYDROLOGY AND
SEDIMENTOLOGY STUDY AREAS
HAN R.
VALLEY
HYDROLOGICAL
STUDY AREA
SEDIMENTOLOGY
KARST AREA
BANGKOK
BASIN
SONG KHLA LAGOON
KEDAH-PERLIS
L.KELANTAN
BASIN
LUI R.
CATCHMENT
JAKARTA BASIN
HAMBANTOTA
STUDY AREA

1982 RCA ACTION PLAN

Table I

ESTIMATED COSTS

| TITLE | Technical Proj. Officer | 1981 Total Costs | Res. Contracts | 1982 Proj. Mtg. | Sub-Total | 1983-1986 |
|---|---|---|---|---|---|---|
| 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 |
| Reg. Proj. on Neutron Scattering | R. Muranaka | 12,700 | - | - | - | - |
| Reg. Proj. on Isotope Applications in Hydrology and Sedimentology | B. Payne | 105,000 | 80,000 | 15,000 | 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 |
| TOTAL | | $2,775,299 | $365,000 | $135,000 | $3,138,279 | $8,709,699 |
| | | | ( 410,000) | ( 155.000) | ( 3,203,279) | ( 8,959,699) |

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
India
Indonesia
Japan
Republic of Korea
Malaysia
Pakistan
Philippines
Singapore
Thailand

7. Regional Co-operative Research Project on Maintenance of Nuclear Instruments

Bangladesh
India
Indonesia
Republic of Korea
Malaysia
Pakistan
Philippines
Sri Lanka
Thailand

8. Regional Co-operative Research Project on Isotope Applications to Hydrology and Sedimentology

Australia*
Indonesia
Republic of Korea
Malaysia
Thailand

9. Regional Co-operative Research Project on Semi-Dwarf Mutants for Rice Improvement

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

* Donor Government

Appendix 9

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.

./..

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 benefication. 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 Ausgralian 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 PROPASAL
# 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 cervic.

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 radiophermaceuticals

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 theraputic gain using conventional machines available in the Region.

This sub-project provides over its five year term:

i) Ten special training corses 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 theraputic 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 activites, 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 cordination committees | $ 75,000 |
| Total | $ 3,425,000 |

2. Nuclear medicine for liver and thyroid diseases

Sub-Project duration ; 3 years

Nuclear medicine technique play a predominat role in dignosis 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) Insrallation 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 |
| Total | $ 880,000 |

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 immunoradiometricassay to detect parasite antigens in sera and urine of patients with malaria, filariasis or schistosomiasis, and to train technicians on these techniques.

Imput 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 (2 weeks, 15 participants per course) | $ 72,000 |
| | Total | $ 143,000 |

4. Preparation of radiophermaceuticals

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 radiophermaceuticals. The establishment technology for the production of $^{99m}Tc$ generator, radiophermaceuticals 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 radiophermaceuticals;
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 radiophermaceuticals | |
| 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 |
| Total | $ 515,000 |

TOTAL PROJECT COST

| Sub-Project | Cost |
|---|---|
| 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 radiophermaceuticals | $ 515,000 |
| TOTAL | $ 4,933,000 |

T. Iwasaki

Annex 1 to Draft Proposal

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 Develping Countries" held in Kyoto, Japan in 1981, the combination modalities of radiationand 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 $\gamma$-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 radiationand 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 hlepful 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 - US$ 5,000 x 10 x 5 years = US$ 250 ,000

RCM - US$15,000 x 5 = US$ 75,000

(2) Equipment US$ 2,500,000

(i) Whole body computed tomography including computer and X-ray units, - US$ 1,000,000

(ii) Linear accelerator (20 MeV) - US$ 1,500,000

(3) Training courses, (two times per year x 5 years) US$ 600,000

Trainee (20 x 4 weeks) Travel: US$ 1,000 x 20 = US$ 20,000

Per diem: US$ 40 x 20 x 28 days = US$ 22,400

Lecturer (8 x 1 week) Travel: US$ 1,000 x 8 = US$ 8,000

Per diem: US$ 60 x 7 days x 8 = US$ 3,360

Local cost: US$ 6,240

Total cost: US$ 60,000 x 2 times x 5 years = 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
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 (reasonably 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 $B_{12}$, 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-precipation - 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) | = | 72,000 |
| TOTAL | = | 143,000 |

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,$\gamma$) - 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.

# 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. an 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 endurable 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 deseases 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 radioecological 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 coorperation 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 endimic 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 sotheast 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, HBc 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: treatemnt 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 seminer 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 concerened 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).

Bangkok

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 activites 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$

| | Granting agency | Thai Government |
|---|---|---|
| **Personnel** | | |
| Per diem: attendants (30) | 15,000 | |
| teachers (15) | 10,000 | |
| invited teachers (5) | 5,000 | |
| secretariat (5) | 4,000 | |
| **Necessary equipment** | pending | 350,000 (existed) |
| **Others** | | |
| 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 | 80,500 | 355,500 |

J. Med. Ass. Thailand 64:125-126, 1981 (March)

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 previlege 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-cum-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" covers data base, planning process, micro-research, design and redesign, evaluation and recommendations in the light of 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 resonable 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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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.

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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 $T_3H$. 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 Guniea 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 concerned 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.

Appendix 17

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 $\gamma$-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 firstin 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 | 15.000 |
| | 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 estalibshment 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 adaption.

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 trainors, 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.

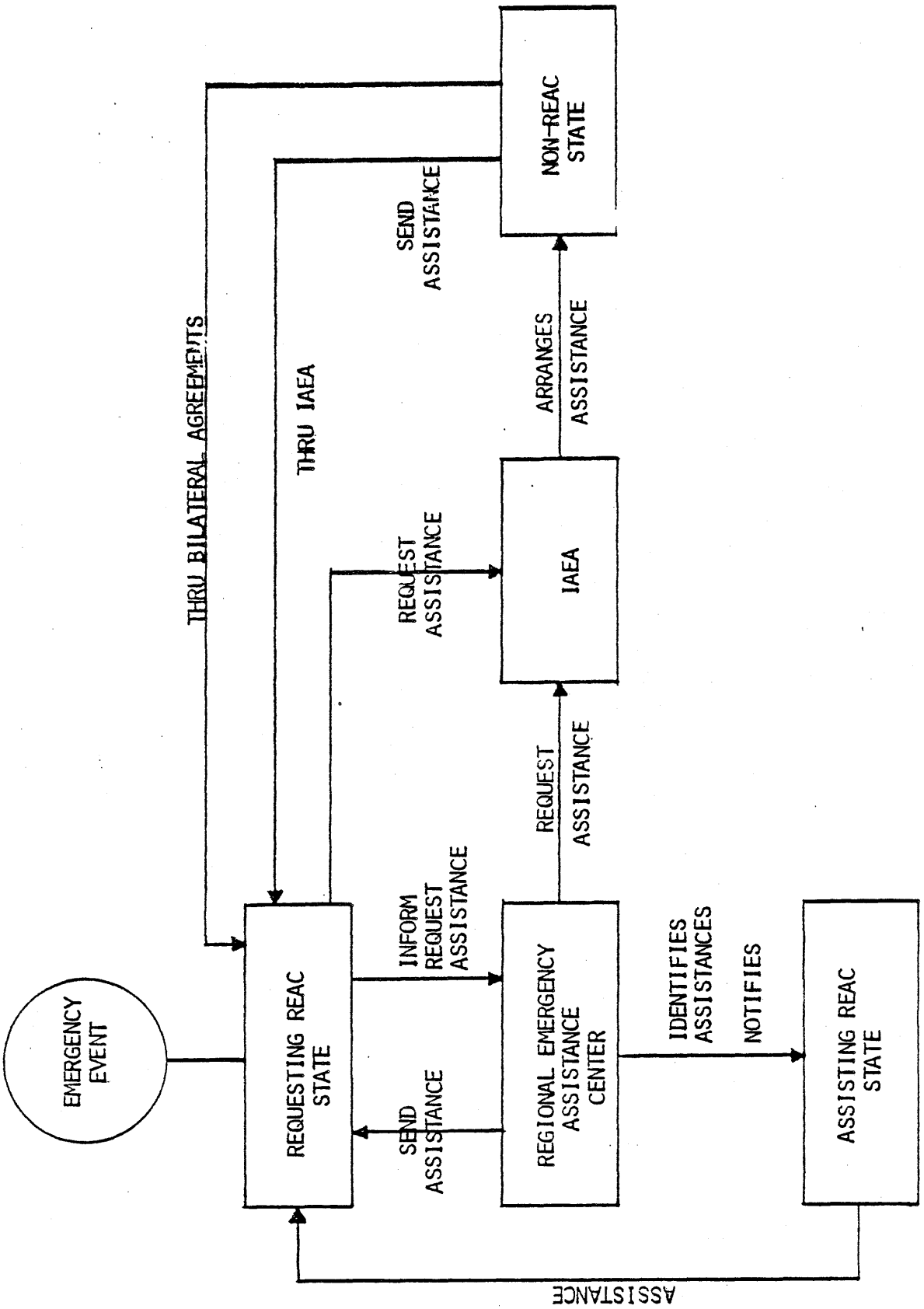


FIG. 1 EMERGENCY ASSISTANCE FLOW DIAGRAM

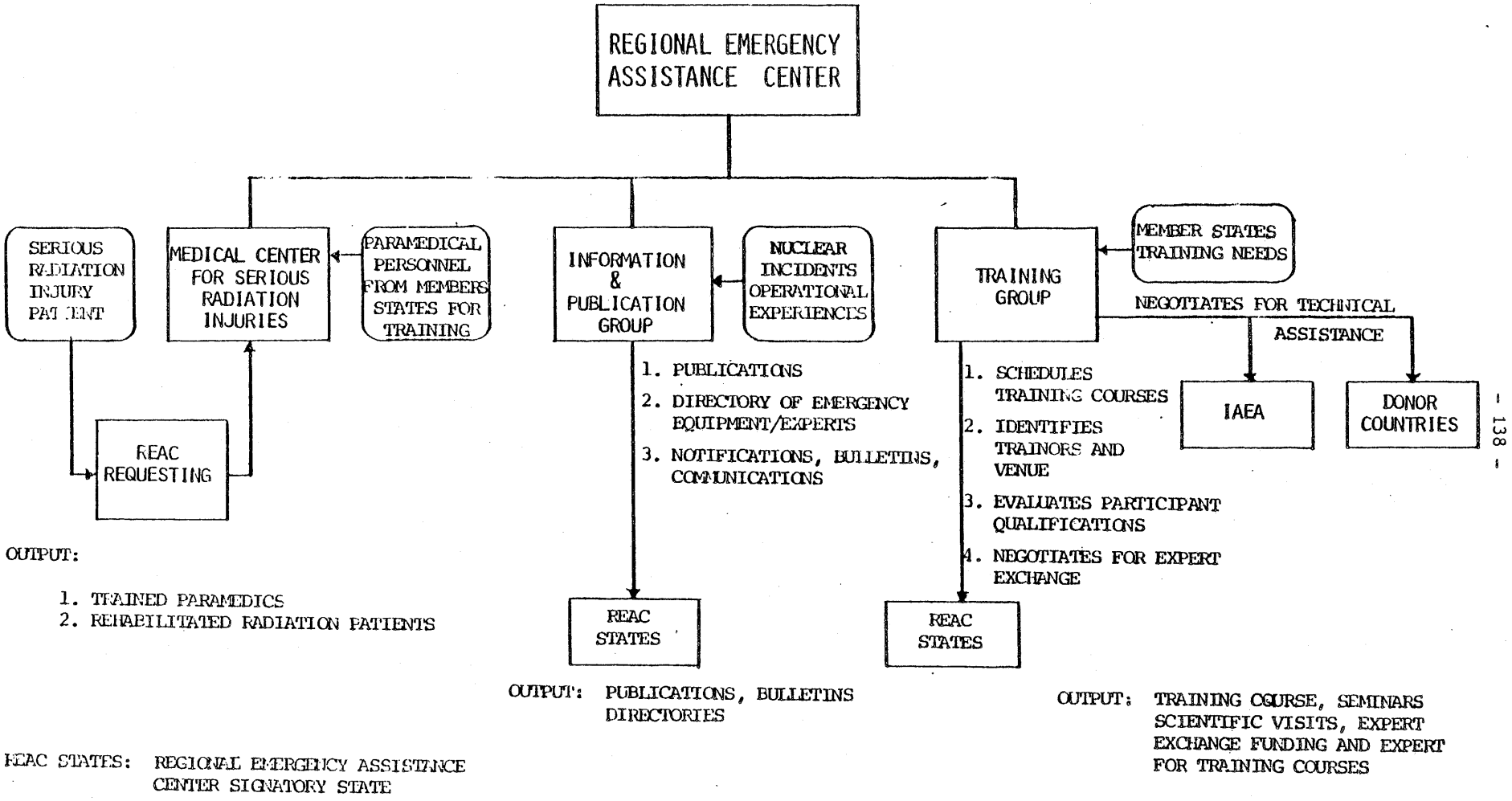


FIGURE 2. ADDITIONAL FUNCTIONS OF THE REGIONAL EMERGENCY ASSISTANCE CENTER

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 sercices 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 maydesignate, 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 assitance 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, occuring 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 occuring 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, RRIVILEGES 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 arbital 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 initial10 to 30 minutes is important but must depend on the emergency capacility 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.

Appendix 21

IAEA

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 infrastucture 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 cabability, 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 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 marshall 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 occured 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 ths 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 imterim 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 infrastucture 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 cabability 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.

Appendix 22

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 disinfestation 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 | | | | 420,000 |

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 man power 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 bonding in some organic materials.

The RCA/UNDP 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 ~~[illegible]~~ 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 sticked 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 INCULDING 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, garlics 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 intrepretation 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 BARC 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, microprocessor-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.

i) 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 Trilateral 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 fine-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 lecteinizing 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 occurrance 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 Bereau 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 Lampur, Malaysia

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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 Extention 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 setforth 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 setforth 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 radiopharmaceuticals.
- 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.