

DEVELOPMENT OF AN RCA REGIONAL PROFILE

**Report by
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Management of Technical Cooperation among Developing Countries
(RCA)

Task - RAS0048 05

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EXECUTIVE SUMMARY

The Working Group Meeting (WGM) on Extending the RCA Medium Term Strategy was conducted in Vienna 27-31 July 2009. One of its recommendations concerned the issue of determining the priority areas for the RCA Programme. The WGM proposed that a survey be conducted to determine the needs and priorities of the RCA Member States and that a consultant develop a Regional Profile based on the information obtained through the survey and on information on past RCA activities from various sources. The establishment of this Regional Profile would then be used contribute to the development of RCA Strategic Priorities for 2012-2017.

Following the endorsement of the WGM recommendations and proposals by the National RCA Representatives (NRs) at the 38th RCA General Conference Meeting held on 12 September 2009 at the IAEA Headquarters in Vienna, the RCA Focal Person sent a Questionnaire on 18 September 2009 to all NRs, which was designed to assist in understanding the effectiveness of the past projects and their contribution to addressing needs in specific technical areas and identifying priority areas for the future RCA Programme. Nine NRs provided responses to the questionnaire, although they did not all address the full spectrum of questions on the various thematic sectors and areas.

Dr John Easey accepted the contract to be the consultant to develop the regional profile, which covered the period 7 December 2009 and 29 January 2010. The two main subjects for analysis were the 119 RCA projects listed in TC-PRIDE and the completed questionnaires returned by the NRs.

As stipulated by the MTS WGM, Dr Easey compiled information on each of the current and past RCA projects such as: Project title; Implementation period; Budget; Objectives; Project achievements; prepared short summaries of the main achievements of each project areas; prepared tables and charts summarising the details of participation of the Member States in regional events; and provided information on the current trends in each project area. This information has been presented in the report annexes on each of the 23 identified technical areas.

He analysed the information on project area priorities, project benefits and project sustainability provided by the NRs in the questionnaires and has presented the results in a series of tables. The overall trend of the responses in questionnaires provided positive indicators about the performance of the projects and the technical situation at the national level in Member States. Most Member States have reported consistently that they have benefited from the projects. In general the majority had the support infrastructure for national programmes and, where appropriate, underpinning of these programmes from national societies / professional bodies and protocols, guidelines or standards. A large majority had identified linkages to end users and a significant proportion of these had reported that they have involvement with them. The main area of need appeared to be the availability of trained human resources and physical infrastructure, where there were numbers of reports of this being under some stage of development. On the questions related to sustainability, almost all responding Member States indicated that they had additional human resource development requirements that needed to be satisfied. In many cases this was linked to requests for additional technical assistance especially in the form of awards of scientific visits or fellowships. A number of responses also indicated that assistance was required with a

range of procurement from spare parts to consumables through to major equipment, even though such support for procurement and for scientific visits or fellowships fell outside of the agreed provisions of the RCA programme.

A number of the responses requested assistance in the awareness and promotion of the technologies with either endusers and/or with other Government Departments or Ministries or other stakeholders to make them more aware of the nuclear technologies and their advantages.

Because of variations in the NRs' methodology for ranking priorities, the consultant devised and trialled a numerical method to assist in grading the relative ranking of priorities for the technical areas. The results from this trial were consistent with other measures and appear to provide an objective means of assigning such rankings. He recommended that NRs adopt a common methodology to assist in future decision making on ranking priorities.

Some gaps and weaknesses in project areas were identified from the questionnaire responses and recommendations were made that the deficiencies be rectified when the projects were being designed for the 2012-2013 RCA programme. The recommendations related to a perceived need for greater emphasis on MSs at the project design stage so that the full extent of all the participating MSs requirements could be addressed and maximise the sustainability of the outcomes. This would include actions such as: improvements in human resource development outcomes through heightened greater consideration of training, including design of training materials to meet the needs not just for regional training events but also for follow up national training programmes being conducted by the MSs; targeted assistance for MSs with limited physical infrastructure through enhanced and programmed use of Regional Resource Units (RRUs); enhanced use of TCDC; and provision of support for awareness and promotion activities to key stakeholders.

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1. Background

The Working Group Meeting on Extending the RCA Medium Term Strategy, which was conducted in Vienna 27-31 July 2009, considered the issue of determining the priority areas for the RCA Programme and proposed the following procedure for the development of RCA Strategic Priorities for 2012-2017.

- Conduct of a survey to determine the needs and priorities of the RCA Member States.
- Development of a Regional Profile by a consultant based on the information obtained through the survey and information on past RCA activities.
- Formation of a Working Group that would include specialists in each Thematic Area for formulate the RCA Strategic Priorities for 2012-2017.

The proposed time frame for these activities is given in Annex 1.

Their report was considered by the National RCA Representatives at their 38th General Conference Meeting held on 11th September 2009 and the recommendations concerning the development of the regional profile were endorsed.

Dr John Easey was invited to be the consultant for this work and had discussions with the RCA Focal Person in Vienna 27 – 30 October 2009 on the nature and format of the report. His visit report is given in Annex 2.

1.1. Terms of Reference for the Consultant

The Working Group Meeting prepared the following terms of reference for the work of the consultant.

Based on:

- the feedback received from the Member States through the survey on the regional profile,
- the information available in the Agency databases,
- RCA Annual Reports and success stories,
- and other relevant sources,

the consultant will:

- Compile the following information on or each current and past project:
 - Project title
 - Implementation period
 - Budget
 - Objectives
 - Project achievements
- Prepare a short summary of the main achievements of each project area;
- Identify the gaps in each project area that need to be addressed ;

- Provide information on the current trends in each project area;
- For each project area prepare a table summarizing the details of participation of the Member States in regional events; and,
- Make him/herself available during the Meeting of the Working Group in late February 2010.

1.2. Implementation of Recruitment of the Consultant and related Actions

The consultant was recruited by the Agency to prepare the report between 17 December 2009 and 29 January 2010. The consultant arranged to meet during 25 to 29 January 2010 with the RCA Focal Person in Vienna to review the draft report prior to finalisation and distribution by the RCA Focal Person to the participants of the Working Group, which was scheduled to meet at the IAEA Headquarters in Vienna, 20 to 26 February 2010.

2. Review of Methodology and Procedures used in the Analysis of the RCA Projects

2.1 Overview

On 15 November 2009 there were 15 active RCA projects and 104 completed projects listed on TCPRIDE (Annex 3). For the purposes of this analysis these 119 projects were grouped into the following 9 thematic areas/sectors and 23 technical areas:

Thematic Area or Sector	Technical Area	No. of Projects	
		Completed	Active
Agriculture	Animal Health & Production	3	0
	Food Irradiation	4	2
	Plant Breeding	3	1
	Soils & Land Use	2	0
Energy	Energy	9	0
Environment	Air Pollution	2	1
	Fresh Water Resources	6	1
	Marine and Coastal Environment	4	2

Human Health	Cancer	8	1**
	Joint & Bone Disorders	3	0
	Medical Physics	0	1
	Nuclear Medicine Imaging	5	1
	Radioimmunoassay	4	0
	Tissue Grafts	2	0
Industry	Industrial Applications	13	0
	Nuclear Analytical Systems (NAS) and Nucleonic Control Systems (NCS)	2	0
	Non-destructive Testing and Tomography	3	1
	Radiation Processing	5	1
	Tracers and Sealed Sources	5	1
Radioactive Waste	Radioactive Waste	1	0
Radiation Protection	Radiation Protection	7	1
Research Reactor Utilisation	Research Reactor Utilisation	8	0
Technical Cooperation among Developing Countries (TCDC)	Technical Cooperation among Developing Countries (TCDC)	5	1
	TOTAL	104	15

** RAS/6/053 not scheduled to commence until 2010

The basic information on each project was extracted from the relevant Full Project Status Report (FPSR) and transcribed on to a Project Summary Sheet (Annex 4) to provide a standardised template for analysis. When necessary the information was supplemented where necessary with additional data from TCPRIDE. However the consultant observed a number of inconsistencies and errors in the information contained in the various FPSRs and has made the adjustments and assumptions to provide a more consistent basis for the overall analysis.

The consultant devised the following documents and formats to set out the details of the RCA projects in a consistent fashion and also ease the task of absorbing the large volume of information involved:

- Project Summary Sheet
- Member State's Participation Chart
- Source of Expertise Chart
- Summary Chart for all Projects in one Area of Technology
- Source Profile Chart for Expertise used in one Area of Technology

2.2 Project Summary Sheet

The following comments relate to the criteria and methodology used to prepare the data for input into the Project Summary Sheet:

- **Project Title & Number** – These were copied from the FPSR. The consultant notes that some projects that are listed as being part of the RCA programme were not part of the programme when he was RCA Coordinator 1990 – 1995 (Annex 5). However for the purposes of his review they have been accepted as RCA projects.
- **Implementation Period** – The information given in the FPSR related to the administration of the project rather than the time the project was active. For the purposes of this review, the **project start date** has been taken as the year in which the first activity was implemented, rather than the 1st year of approval and the **project completion date** has been taken as the year in which the last activity was implemented, rather than the date when the project administrative work was completed.
- **Project Lead Country** – The concept of Project Lead Country (PLC) was introduced around 1997. PLC Records prior to 2003 are incomplete and may not be completely accurate. The details of the Project Lead Country (PLC) are not listed in the FPSR.
- **Budget** – The information has been copied from the FPSR. Where a project is still listed as active (i.e. the administrative actions to finalise the project have not been completed), the financial status at a specified time in November 2009 has been taken as the reference point.
- **Objectives** - The information has been copied from the FPSR.
- **Listed Participating Member States and Institutes** - The information has been copied from the list of the Recipient Institutes and Counterparts in the FPSR. However the consultant has observed that there are numerous cases

where the Member States listed in the subsequent FPSR implementation report data do not correspond with this listing. This raises a fundamental question as to the **definition of “participating”** for the purposes of further analysis discussed later in this report. The consultant has adopted the following criteria:

- ⇒ If a Member State has hosted or participated in one or more of a project’s regional training events, regional meetings / workshops or project review / management meetings, it has been classified as **“participating”**; and,
- ⇒ However if Member State’s only input to a project has been the provision of lecturing staff, expert assistance or the hosting of Fellows or Scientific visits then this has been classified as **“not participating”**, since this type of technological support is no more than has been provided by the non-RCA countries.

- **Implementation Achievements** – Implementation is typically through either the support of a regional based activity such as a training course, technical workshop/meeting or project management/review meeting, or a national focussed activity such as the award of a fellowship or scientific visit or an expert mission. The details about these inputs are quantitatively listed in the FPSR. For the purpose of this review, regional activities have been grouped into the following three classifications:

- ⇒ “Regional Training Courses” – where the primary objective is the provision of training to meet specified objectives;
- ⇒ “Meetings/Workshops” – where the primary purpose is concerned with technical issues; and
- ⇒ “Project Management” – where the primary purpose is concerned with planning, reviewing, evaluating or finalising a project.

In a few projects there were additionally Coordinated Research Projects associated funded by UNDP and a few had activities specifically linked to participation in conferences.

The separation of Member State’s participation in terms of regional training events, regional meetings/workshops or project review/management meetings is of interest. For example, some Member States, because of their degree of development, might not seek to access participation in regional training courses but might be active in providing input at regional meetings/workshops or project review/management meetings, while others might wish to concentrate their interest in regional training courses to support their human resource development requirements. Depending on their needs and technological status, individual Member States could favour focussing their participation to one or two of these categories rather than attending all of them.

When regional training courses have been hosted by Member States, there are instances where there are no formally documented details of participation from the host country in either the training event or in the lecturing and instruction tasks. For the purposes of these analyses it has been assumed that one person from the host country participated in each role for developing Member States and only the lecturing role for the developed Member States.

Similarly when regional meetings/workshops and project review/management meetings have been hosted by Member States there are often no formally documented details of the contribution or the participation by the host. For the purposes of these analyses it has been assumed that one person from the host country participated.

For the purposes of calculating the input to Member States from regional training courses, the number of working days for the course has been used rather than the difference between the start and finish date for the participation of individual trainees.

For all other events, the time given in the FPSR for the activity has been taken as the input.

Fellowships and Scientific Visits are accounted for on the basis of the number of awards. Some awards involve hosting by more than one country and in these cases the number of hosting countries will exceed the number of awards.

Expert assignments are accounted for on the basis of the missions listed in the FPSR. At times more than one expert may be involved in a mission, which will result in the number of experts involved in missions being greater than the number of missions. Expert missions carried out by staff from participating Institutes in RCA Member States have been credited to those Member States and not the staff's nationality, when these are different.

When technical missions have been carried out by nationals of RCA Member States while serving as IAEA staff, the credit is listed with the IAEA and not their country.

- **Technological Achievements** – the FPSR normally has a section listing the achievements of the completed projects. The format for this reporting has varied considerably over the years. There is usually reference to details of the implemented activities as well as the technological achievements. Since the quantitative implementation details have already been extracted and listed in the previous section of the Project Summary Sheet, the FPSR text on achievements has been edited by the consultant so that focuses on details of the technological achievements.
- **Additional Notes** – this contains additional information extracted from the FPSR achievements section that the consultant thought relevant to the review of the project. When IAEA staff from an RCA Member State has contributed technically to the project activities, the Member State is also acknowledged in this section.

2.3 Member State's Participation Chart

A Member State's Participation Chart has been created for each RCA project and provides a visualisation of the participation and the extent of the participation for each Member State in the three components of the regional programme, i.e. training courses, technical workshops/meetings or project management/review meetings.

2.4 Source of Expertise Chart

A Source of Expertise Chart has been created for each RCA project and provides a visualisation of the participation and the extent of the individual contribution by each Member State, the IAEA and Non-RCA Member States to the provision of technical inputs in the four components of providing lecturers for regional training courses, experts for expert missions or hosting of Fellowships or Scientific Visits.

2.5 Summary Chart for all Projects in one Area of Technology

A Summary Chart has been created for all RCA projects within a specific area of technology. Each project is listed in sequence with a brief summary of its basic implementation aspects and an associated visualisation of the participation by each Member State.

The use of expertise from the RCA Member States, the IAEA and Non-RCA Member States for the provision of technical inputs in the four components of providing lecturers for regional training courses, experts for expert missions or hosting of Fellowships or Scientific Visits is summarised for all the projects.

A table in the chart details the total number of events, the total number of participants and the total person days of effort provided to the RCA Member States in the implementation of all the projects in the one area of technology as well as the total budget employed.

2.6 Source Profile Chart for Expertise used in one Area of Technology

A Source Profile Chart has been created for each RCA project and provides a qualitative visualisation of the participation and the extent of the individual contribution by each Member State, the IAEA and Non-RCA Member States to the provision of technical inputs in the four components of providing lecturers for regional training courses, experts for expert missions or hosting of Fellowships or Scientific Visits. This chart should provide insights into any temporal variations in the source of expertise.

3. Agricultural Thematic Sector

Projects in the following four areas were the focus of the inputs for this thematic sector:

- Animal Health and Production;
- Food Irradiation;
- Plant Breeding; and,
- Soils and Land Use.

Since 1989 the following inputs of training and assistance have been provided to the RCA Member States in this thematic sector:

⇒ 48 RTCs for 693 participants;

- ⇒ 15 RWs/RMs for 143 participants;
- ⇒ 28 PMs for 475 participants;
- ⇒ 12 Fellowships;
- ⇒ 11 Scientific Visits; and,
- ⇒ 96 Expert missions.

In total there were 12,106 person days of input and the total expenditure on the sector was US\$5,549,345.

3.1 Overview of Animal Health and Production Projects

The following three projects concerned with the general area of animal health and reproduction have been implemented as part of the RCA Programme:

- Improving Animal Productivity and Reproductive Efficiency (RCA) - RAS/5/035;
- Production of Foot and Mouth Disease Antigen and Antibody ELISA Reagent Kit (RCA) - RAS/5/041; and,
- Integrated Approach for Improving Livestock Production Using Indigenous Resources and Conserving the Environment (RCA) - RAS/5/044.

All three projects had been completed at the time of this review.

Annex 6 contains the three individual Project Summary Sheets and associated Member State's Participation Charts and Source of Expertise Charts. In addition it has the Summary Chart covering all three Projects in the Area of Animal Health and Production and the Source Profile Chart for Expertise used in this Area.

Implementation of these three projects took place between 1999 and resulted in delivery of a total of 10 RTCs for 143 MSs participants, 4 RWs/RMs for 12 MSs participants, 7 PMs for 166 MSs participants, 2 Fellowships, 5 S/Vs and 30 Expert missions. There was a total of 2,763 person days input for the participating Member States. The total cost of the projects was US\$1,598,001.

3.1.1 Improving Animal Productivity and Reproductive Efficiency (RCA) - RAS/5/035

The major technical achievements reported for this project related to the use of medicated blocks and herbal remedies as a cost effective means of worm control in almost all the participating Member States, with the use of the medicated blocks resulting in an increase in farmer income per animal from 33% to 445%.

Out of the 47 new feeds evaluated by participants in this project, 39 new feed resources have been identified as having a good potential to be used as animal feeds. New feeds have been introduced to farmers in 5 Member States and the average cost-benefit ratio following this step was 1:3.7. As a result of the introduction of these feed resources, the income of farmers has increased between 9% and 185%, depending on the cases studied.

3.1.2 Production of Foot and Mouth Disease Antigen and Antibody ELISA Reagent Kit (RCA) - RAS/5/041

The project did not achieve its objectives due to problems in obtaining the required sera.

3.1.3 Integrated Approach for Improving Livestock Production Using Indigenous Resources and Conserving the Environment (RCA) - RAS/5/044

The major technical achievements reported for this project related to the reduction in methane emissions due to adoption of the new feeding strategies in Bangladesh, China, Indonesia, Pakistan and Thailand ranged from 15-70%. Bangladesh, Indonesia, Pakistan and Sri Lanka have reported improved manure management practices that increased the nitrogen and phosphorous content of the manure, which produced increased yields in rice and fodder ranging from 25-40%.

Feeding strategies have also resulted in increased weight gain and milk production of dairy animals. Increase of milk yields of approximately 25% have been observed in Bangladesh and the Philippines. Bangladesh, China, Indonesia and Myanmar have reported an increase in the average daily weight gain of animals ranging from 15-70%.

Almost all the participating Member States have achieved genetic improvement in their livestock although through different reproductive techniques.

3.2 Overview of Food Irradiation Projects

The following six projects concerned with the general area of food irradiation have been implemented as part of the RCA Programme:

- Improving Food Irradiation Process Control and Acceptance (RCA) – RAS/5/020;
- Public Acceptance and Trade in Irradiated Food (RCA) – RAS/0/022;
- Irradiation as Sanitary & Phytosanitary Food Treatment (RCA) – RAS/5/034;
- Application of Food Irradiation for Food Security, Safety, and Trade (RCA) - RAS/5/042;
- Novel Applications of Food Irradiation Technology for Improving Socioeconomic Development (RCA) – RAS/5/046; and,
- Enhancing Sanitary and Phytosanitary Treatment of Regional Products for Export by Irradiation (RCA) – RAS/5/050.

The first four projects had been completed and RAS/5/046 and RAS/5/050 were active at the time of this review.

Annex 7 contains the six individual Project Summary Sheets and associated Member State's Participation Charts and Source of Expertise Charts. In addition it has the Summary Chart covering all six Projects in the Area of Food Irradiation and the Source Profile Chart for Expertise used in this Area.

Implementation of the first of these projects commenced in 1989 and up to the present review the total effort for all six projects has resulted in delivery of a total of 16 RTCs for 248 MSs participants, 2 RWs/RMs for 34 MSs participants, 7 PMs for 97 MSs participants, and 20 Expert missions. There was a total of 2,628 person days input for the participating Member States. The total funding provided so far to the projects was US\$1,279, 341.

3.2.1 Improving Food Irradiation Process Control and Acceptance (RCA) – RAS/5/020

Several market tests, transportation trials and consumer acceptance studies were carried out during this project. A number of countries in the region introduced regulations to control the production and sales of irradiated food, and other countries were in the process of formulating them. Several semi-commercial and commercial irradiators were established in Bangladesh, India, Indonesia, the Republic of Korea, Japan, Thailand and Vietnam, most of which were used for processing food on a commercial scale. An estimated 130,000 tonnes of food and food ingredients were processed by irradiation in these countries between 1990 and 1993.

The success of this project was the main basis for initiating RPF Phase IV, Public Acceptance of Trade Development in Irradiated Food in Asia and the Pacific in 1994-95, thus extending the programme into the intra- and inter-regional trade arena.

3.2.2 Public Acceptance and Trade in Irradiated Food (RCA) – RAS/0/022

Market trials of irradiated food were completed in Bangladesh, China, Indonesia, Pakistan, the Philippines, Thailand and Vietnam, creating such a wide awareness of the effectiveness of this technology among plant quarantine officials in the region that ASEAN countries decided to adopt a harmonized protocol on food irradiation in 1997.

Through the project, representatives of 14 RCA Member States adopted a schedule for the incorporation of a "Harmonized Regulation on Food Irradiation for Asia and the Pacific" into national regulations within the following two years.

3.2.3 Irradiation as Sanitary & Phytosanitary Food Treatment (RCA) – RAS/5/034

The activities under this project facilitated the public acceptance of irradiated food and horticultural commodities.

3.2.4 Application of Food Irradiation for Food Security, Safety, and Trade (RCA) - RAS/5/042

As a result of the project, harmonized regulations governing irradiation of food products have been adopted by the Philippines and Vietnam, while the other Member States were at various stages of adopting such Regulations. A number of domestic and trade trials have been conducted successfully amongst countries. This included:

- 2 trial shipments of 16 tonnes of irradiated mangoes exported from Australia to New Zealand,
- the export of 1 tonne of irradiated mangoes from Pakistan to the United Arab Emirates,
- the export of 10 tonnes of irradiated food commodities from Pakistan to United Kingdom,
- the export of 2 tonnes of food commodities Indonesia to Europe, the Middle East, Asia and the Pacific, and the USA and
- the export of 4.65 tonnes of irradiated frozen fruits from the Philippines to the Middle East.

In addition, several domestic trade trials were also conducted in several countries and in most cases the irradiated products were well accepted by farmers, traders and consumers. The volume of food processed by irradiation increased in the region, as did the number of irradiation facilities. Quality assurance for the irradiation facilities was also strengthened as a result of the training received under this project.

3.2.5 Novel Applications of Food Irradiation Technology for Improving Socioeconomic Development (RCA) – RAS/5/046

This project is currently active. A recent project summary is given in the Project Summary Sheet in Annex 7.

3.2.6 Enhancing Sanitary and Phytosanitary Treatment of Regional Products for Export by Irradiation (RCA) – RAS/5/050

This project is currently active. A recent project summary is given in the Project Summary Sheet in Annex 7.

3.3 Overview of Plant Breeding Projects

The following four projects concerned with the general area of food irradiation have been implemented as part of the RCA Programme:

- Increasing the Capabilities of Common Grain Legumes (RCA) – RAS/5/021;
- Mutational Enhancement for Genetic Diversity in Rice (RCA) - RAS/5/037;
- Enhancement of Genetic Diversity in Food, Pulses, and Oil Crops and Establishment of Mutant Germplasm Network (RCA) - RAS/5/040; and,
- Improvement of Crop Quality and Stress Tolerance for Sustainable Crop Production Using Mutation Techniques and Biotechnology - RAS/5/045.

The first three projects had been completed and RAS/5/045 was still active.

Annex 8 contains the four individual Project Summary Sheets and associated Member State's Participation Charts and Source of Expertise Charts. In addition it has the Summary Chart covering all four Projects in the Area of Plant Breeding and the Source Profile Chart for Expertise used in this Area.

Implementation of the first of these projects commenced in 1989 and up to the present review the total implementation effort for all four projects has resulted in delivery of a total of 17 RTCs for 239 MSs participants, 5 RWs/RMs for 64 MSs participants, 7 PMs for 126 MSs participants, 3 Fellowships, 1 S/Vs, and 28 Expert missions. There was a total of 4,972 person days input for the participating Member States. The total funding provided to the projects was US\$1,884,864.

3.3.1 Increasing the Capabilities of Common Grain Legumes (RCA) – RAS/5/021

As a result of the project, a 10-30% increase in nitrogen fixation was achieved in soybean, mungbean, groundnut, chickpea and cowpea. This permitted a 20-25% increase in grain yield without application of nitrogen fertilizers in those nitrogen limiting soils, and cereal-legume rotation increased the cereal yield by about 20-50%, as compared to cereal-cereal rotations.

Rhizobium inoculation technology was very well received; in Thailand the production of Rhizobium inoculant bags exceeded one million, and in Bangladesh the demand rose from almost zero to seven million.

The project met the demands of the target beneficiaries and has been well accepted by the participating countries.

3.3.2 Mutational Enhancement for Genetic Diversity in Rice (RCA) - RAS/5/037

Under this project, a total of 45 trials were conducted in nine countries covering 19 locations in the region. As a result of this project, 13 mutant varieties and 4 other accessions were selected for high yield, reduced plant height, disease resistance, early flowering and/or aroma. The aforementioned mutant varieties and accessions would be included in national yield trials and/or used as parent in breeding.

Some outstanding rice varieties have also been developed and released for commercial cultivation in Bangladesh, China, Indonesia, Thailand and Viet Nam.

3.3.3 Enhancement of Genetic Diversity in Food, Pulses, and Oil Crops and Establishment of Mutant Germplasm Network (RCA) - RAS/5/040

Under the first project component on radiation-induced mutation breeding technology combined with biotechnology, the new varieties of Soybean, Ground nut, Mung bean, Wheat, Sorghum and Sesame were developed by participating Member States and released to farmers while some were to be released after field testing.

Mutation techniques had been also used to produce novel mutations for enhancing crop quality and resistance to biotic and abiotic stresses. The following were some examples:

- (a) The soybean crinkle leaf disease - Four resistant and two moderately resistant mutant lines were developed using gamma irradiation. Yield trials had shown that these lines had also a significantly higher yield than commercial varieties.
- (b) Soybean is highly susceptible to salinity - Four developed plant lines consistently showed high salt tolerance in M2 and M3 generation.

(c) Phytic acid is the main anti-nutritional component in soybean and other cereals and legumes - Two mutant lines with reduced phytic acid content were developed and have been tested in yield trials.

Under the second project component a Mutant Germplasm Network (MGN) was established and regional mutant multi-locational trials were conducted.

3.3.4 Improvement of Crop Quality and Stress Tolerance for Sustainable Crop Production Using Mutation Techniques and Biotechnology - RAS/5/045

This project is currently active. A recent project summary is given in the Project Summary Sheet in Annex 8.

3.4 Overview of Soils and Land Use Projects

The following two projects concerned with the general area of soils and land use have been implemented as part of the RCA Programme:

- Restoration of Soil Fertility and Sustenance of Agricultural Productivity (RCA) - RAS/5/039; and,
- Sustainable Land Use and Management Strategies for Controlling Soil Erosion and Improving Soil and Water Quality (RCA) - RAS/5/043.

Both projects had been completed.

Annex 9 contains the two individual Project Summary Sheets and associated Member State's Participation Charts and Source of Expertise Charts. In addition it has the Summary Chart covering both Projects in the Area of Soils and Land Use and the Source Profile Chart for Expertise used in this Area.

Implementation of the first of these projects commenced in 2001 and up to the present review the total effort for both projects has resulted in delivery of a total of 5 RTCs for 62 MSs participants, 4 RWs/RMs for 33 MSs participants, 7 PMs for 85 MSs participants, 7 Fellowships, 5 S/Vs, and 18 Expert missions. There was a total of 1,743 person days input for the participating Member States. The total funding provided to the projects was US\$787,139.

3.4.1 Restoration of Soil Fertility and Sustenance of Agricultural Productivity (RCA) - RAS/5/039

Two complementary approaches were utilized to achieve the overall objective of this project. Under Part I of the project, promising crop, soil and fertilizer management practices for increasing crop production in rice-based cropping systems were identified through the use of Nitrogen-15 techniques. These were pilot tested and transferred to the end users: extension workers and farmers.

Part II was carried out to address the measurement of soil erosion/ sedimentation and associated pesticide contamination. Each participating RCA country conducted studies on soil redistribution and its relationship to soil quality parameters, as well as on associated pesticide contamination through the use of nuclear and related techniques. They prepared basic experimental protocols on the studies undertaken according to the needs and priorities in each country.

Through these activities, the participating Member States developed capabilities in the use of nuclear techniques to monitor soil erosion and to improve soil fertility.

3.4.2 Sustainable Land Use and Management Strategies for Controlling Soil Erosion and Improving Soil and Water Quality (RCA) - RAS/5/043

The fallout radionuclides (FRN) technology was successfully used by the participating countries in the project. The excellent results of the proficiency test show that the current analytical resources were sufficient to further successfully implement the FRN technology in the region. Therefore the FRN technology can be continued to be reliably and in a sustainable way used in the region. Most participating counties have secured or intend to secure new funds for continuing research projects.

4. Energy Sector

Since 1988 the following inputs of training and assistance have been provided to the RCA Member States in this sector:

- ⇒ 25 RTCs for 478 participants;
- ⇒ 12 RWs/RMs for 135 participants;
- ⇒ 12 PMs for 150 participants;
- ⇒ 1 Fellowships;
- ⇒ 0 Scientific Visits; and,
- ⇒ 23 Expert missions.

In total there were 7,011 person days of input and the total expenditure on the project was US\$2,552,377.

4.1 Overview of the Energy Sector

The following nine projects concerned with the general area of energy have been implemented as part of the RCA Programme:

- Regional/WASP Users Workshop (RCA) - RAS/0/012;
- Energy and Nuclear Power Planning (RCA) - RAS/0/013;
- Nuclear Power Planning (RCA) - RAS/0/021;
- Energy, Electricity and Nuclear Power Planning (RCA) - RAS/0/023;
- Comparative Assessment of Electricity Generation Options (RCA) - RAS/0/028;
- Role of Nuclear Power and Other Energy Options in Mitigating Greenhouse Gas Emissions (RCA) - RAS/0/033;
- Role of Nuclear Power and Other Energy Options in Competitive Electricity Markets (RCA) - RAS/0/038;

- Tracing Future Sustainable Paths through Nuclear and Other Energy Options (RCA) - RAS/0/041; and,
- Formulation of Sustainable Energy Development Strategies in the Context of Climate Change (RCA) - RAS/0/045.

All nine projects had been completed at the time of this review.

Annex 10 contains the nine individual Project Summary Sheets and associated Member State's Participation Charts and Source of Expertise Charts. In addition it has the Summary Chart covering all nine Projects in the Area of Energy and the Source Profile Chart for Expertise used in this Area.

4.1.1 Regional/WASP Users Workshop (RCA) - RAS/0/012

The Workshop was implemented in 1987 with a view to facilitating long-term electrical generation planning studies and determining the optimum share of nuclear power.

4.1.2 Energy and Nuclear Power Planning (RCA) - RAS/0/013

The Agency assisted Member States in energy planning through the use of Agency developed tools (WASP, ENPEP), providing training in practical skills and methods for planning and implementing NPPs, particularly in nuclear power project management from pre-project activities (e.g. feasibility studies and bid evaluation) to commercial operations, and promoting co-operation among Member States. As a result of the project, 11 participating Member States acquired the capability to use Agency planning tools in expanding their electricity systems.

4.1.3 Nuclear Power Planning (RCA) - RAS/0/021

Participating Member States acquired advanced knowledge and practical experience in nuclear power planning and implementation. Regional co-operation was fostered by an increased use of regional expertise and through the identification of specific areas in which sharing of resources and facilities in the region could be expanded.

4.1.4 Energy, Electricity and Nuclear Power Planning (RCA) - RAS/0/023

Participating Member States acquired advanced knowledge and practical experience in energy, electricity, and nuclear power planning. The project was effective in promoting the exchange of information and experience among participating countries through the presentation of national reports on the current situation regarding information on energy, electricity, and nuclear power planning.

4.1.5 Comparative Assessment of Electricity Generation Options (RCA) - RAS/0/028

As a result of this project, the teams of national experts in the participating RCA Member States are now capable of undertaking a comprehensive analysis of their electric power sector.

The project proved to have significant impact in helping the management of electricity authorities in Member States in policy making as well as supporting decisions regarding the electricity sector and nuclear power issues.

4.1.6 Role of Nuclear Power and Other Energy Options in Mitigating Greenhouse Gas Emissions (RCA) - RAS/0/033

The Agency's methodologies and tools for carrying out Greenhouse Gas Emissions (GHG) mitigation studies were transferred to Member States so that they would be able to apply such methodologies and tools in conducting their respective GHG mitigation analyses. Member States regarded this project as being very important and useful because it provided policy makers with technically sound information for the meaningful participation in the international communications and negotiation related to GHG abatement efforts. Finally, the national studies conducted demonstrated that each participating Member State had established a core team of two to three researchers who were competent in dealing with GHG mitigation issues.

4.1.7 Role of Nuclear Power and Other Energy Options in Competitive Electricity Markets (RCA) - RAS/0/038

The project was effective in enhancing knowledge and skills of the participating RCA Member States in analysing energy and electricity issues and for developing medium to long term strategies for meeting future electricity needs.

The participating Member States conducted specific country studies on the evaluation of nuclear power and other energy options in achieving sustainable energy development. The respective national study reports identified the role and other energy options in the future energy mix for each respective country and showed how nuclear power and other energy options would compete in a restructured/deregulated electricity market. Those national study reports were submitted to the respective authorities for adoption and implementation.

In general the project assisted participating Member States in conducting energy planning in a more balanced way and in developing energy strategies in a sustainable manner.

4.1.8 Tracing Future Sustainable Paths through Nuclear and Other Energy Options (RCA) - RAS/0/041

National Indicators of Sustainable Energy Development (ISEDs) specific to the Member States were finalized through this project. The national energy development scenarios were monitored and revised to ensure their compatibility

with the sustainable development objectives of Member States, using the specific national ISEDs.

Finally, energy options were assessed for designing future sustainable energy paths, based on the national energy development scenarios. The reports of the national studies have been compiled and published as IAEA Working Material for future reference.

The major factors identified in tracing future sustainable energy paths were shared with the national policy makers in almost all Member States. Response actions suggested by the national teams were incorporated into the national energy planning as important considerations for achieving sustainable development in Member States.

4.1.9 Formulation of Sustainable Energy Development Strategies in the Context of Climate Change (RCA) - RAS/0/045

Participating Member States created energy development scenarios, in which nuclear power was introduced as a means not only to supply electricity but also to reduce future green house gas (GHG) emissions. One of the major achievements throughout the national studies was a cost-benefit analysis assessing the additional economic costs driven by introducing nuclear power and the benefit of alleviating the burden on GHG emissions.

Generally, the national studies revealed that increasing the share of coal resources is of national economic interest, because it provides both reliable energy supply and efficient allocation of energy resources. However, increasing the share of coal resource would lead to climate change concerns on the national, regional and global level due to significant increase of GHG emissions. The introduction or expansion of nuclear power was determined to significantly help reduce future GHG emissions and foster environmentally sound sustainable energy development.

The most important outcome of this regional project was that participating national teams from the Member States are now equipped with appropriate analytical tools to evaluate all technological options with regard to economics, environmental costs and benefits as well as the overall impact on social and economic progress. They are also now able to elaborate their own countries' sustainable energy development strategies, make decisions on energy sector development, assess the potential role of nuclear power and other energy options and incorporate recent energy issues in the region.

5. Environment Thematic Sector

Projects in the following three areas were the focus of the inputs for this thematic sector:

- Air Pollution;
- Fresh Water Resources; and,
- Marine and Coastal Environment.

Since 1987 the following inputs of training and assistance have been provided to the RCA Member States in this thematic sector:

- ⇒ 28 RTCs for 525 participants;
- ⇒ 14 RWs/RMs for 227 participants;
- ⇒ 25 PMs for 410 participants;
- ⇒ 39 Fellowships;
- ⇒ 14 Scientific Visits; and,
- ⇒ 111 Expert missions.

In total there were 11,211 person days of input and the total expenditure on the project to the date of this review was US\$5,529,077.

5.1 Overview of the Air Pollution Projects

The following three projects concerned with the general area of Air Pollution have been approved for implementation as part of the RCA Programme:

- Improved Information about Urban Air Quality Management (RCA) - RAS/7/013;
- Isotopic and Related Techniques to Assess Air Pollution - Joint UNDP/RCA (RCA) - RAS/8/082; and,
- Characterization and Source Identification of Particulate Air Pollution in the Asian Region (RCA) - RAS/7/015.

The first two projects had been completed at the time of this review and RAS/7/015 was scheduled to be completed at the end of 2011.

Annex 11 contains the three individual Project Summary Sheets and associated Member State's Participation Charts and Source of Expertise Charts. In addition it has the Summary Chart covering all three Projects in the Area of Air Pollution and the Source Profile Chart for Expertise used in this Area.

Implementation of the first of three projects began in 1999 and so far has resulted in delivery of a total of 10 RTCs for 190 MSs participants, 5 RWs/RMs for 63 MSs participants, 8 PMs for 138 MSs participants, 19 Fellowships, 6 S/Vs and 26 Expert missions. There was a total of 3,728 person days input for the participating Member States. The total expenditure for the projects to the time of the review was US\$2,055,634.

5.1.1 Improved Information about Urban Air Quality Management (RCA) - RAS/7/013

A regional database combining high-quality data characterizing airborne particulate matter in the fine and coarse breathable modes has been established. The database focuses on urban, suburban, rural and industrial sampling location in 15 Member States for the sampling period from January 2003 to December 2006. It contains more than 10 000 individual filter data analysed by nuclear analytical techniques for up to 40 chemical species. This enables fine and coarse particulate

matter compositions to be quantitatively determined for each of the sampling site in these Member States. The complete, quality assured (validated) database was made available to all the participating Member States and the IAEA. Sources of air pollution at local and trans-boundary scales were identified and quantified, using advanced receptor models.

The project has generated information on the type and location of specific sources contributing to the total mass of air particulate matter.

5.1.2 Isotopic and Related Techniques to Assess Air Pollution - Joint UNDP/RCA (RCA) - RAS/8/082

The project has resulted in the development of:

- a much better understanding of transboundary pollution episodes as well as local source/receptor relationship that will have significant benefits to a number of end users in the region.
- the ability of many of the participating institutions to perform source identification and apportionment based on the data that were collected.

The sampling, analysis and apportionment tasks carried out under the project had been essential in providing extensive, credible, policy-relevant information for various end users to use in formulating and implementing air quality management strategies.

5.1.3 Characterization and Source Identification of Particulate Air Pollution in the Asian Region (RCA) - RAS/7/015

This project is currently active. A recent project summary is given in the Project Summary Sheet in Annex 11.

5.2 Overview of the Fresh Water Resources Projects

The following seven projects concerned with the general area of Fresh Water Resources have been approved for implementation as part of the RCA Programme:

- Isotope Hydrology Workshop and Seminar Support (RCA) – RAS/8/059;
- Isotope Use in Managing and Protecting Drinking Water (RCA) – RAS/8/084;
- Investigating Environment and Water Resources in Geothermal Areas (RCA) – RAS/8/092;
- Use of Isotopes in Dam Safety and Dam Sustainability (RCA) – RAS/8/093;
- Isotope Techniques for Groundwater Contamination Studies in Urbanized and Industrial Areas (RCA) – RAS/8/097;
- Assessing Trends in Freshwater Quality Using Environmental Isotopes and Chemical Techniques for Improved Resource Management (RCA) – RAS/8/104; and,

- Assessing Trends in Freshwater Quality Using Environmental Isotopes and Chemical Techniques for Improved Resource Management (RCA) – RAS/8/108.

The first six projects had been completed at the time of this review and RAS/8/108 was active, scheduled to be completed at the end of 2011.

Annex 12 contains the seven individual Project Summary Sheets and associated Member State's Participation Charts and Source of Expertise Charts. In addition it has the Summary Chart covering all seven Projects in the Area of Fresh Water Resources and the Source Profile Chart for Expertise used in this Area.

Implementation of the first of seven projects began in 1987 and so far has resulted in delivery of a total of 9 RTCs for 186 MSs participants, 8 RWs/RMs for 153 MSs participants, 10 PMs for 176 MSs participants, 15 Fellowships, 4 S/Vs and 34 Expert missions. There was a total of 4,284 person days input for the participating Member States. The total expenditure for the projects to the time of the review was US\$1,845,715.

5.2.1. Isotope Hydrology Workshop and Seminar Support (RCA) – RAS/8/059

These events were held in China. No further details have been able to be uncovered.

5.2.2. Isotope Use in Managing and Protecting Drinking Water (RCA) – RAS/8/084

Participating Member States have developed capabilities to undertake a quantitative assessment of the water resources, assess the impact of industrialization and urbanization on the quality and quantity of such resources, and generate predictive models to enable decision makers to formulate management schemes for the judicious utilization and protection of the region's limited drinking water resource. National programmes using site trials are expanding the skill base and the Visual MODFLOW software is being used by all participating Member States to generate flow data for their study areas.

5.2.3. Investigating Environment and Water Resources in Geothermal Areas (RCA) – RAS/8/092

Participating RCA countries developed the capability of applying isotope techniques, with the aid of both natural isotopes and artificial radiotracers, in the management of their geothermal reservoirs. In particular benefits were extended to seven geothermal fields with a total installed electric power generation capacity of 1320 MWe.

Isotope investigations were carried out on a total of 33 prospective geothermal reservoirs. The isotopes used include oxygen-18, deuterium in water and sulphur-34, carbon-13 in water and gas samples. This project led to the compilation of hydrological information on the origin of geothermal fluids and reservoir temperatures, which is essential for the planning for the further development of these geothermal resources.

In general, the project contributed to the formulation of appropriate strategies for the management of reservoirs and for addressing the changes in fluid characteristics with a view to ensuring sustainable geothermal power generation in the region of East Asia and the Pacific.

5.2.4. Use of Isotopes in Dam Safety and Dam Sustainability (RCA) – RAS/8/093

The project demonstrated the usefulness of integrating isotopic tools with the management programme for dams in the areas of site selection for dams, site investigations, watershed studies, dam and reservoir designs and dam construction. It bridged the gap between scientists and dam owners by providing them with increased awareness of the applicability and benefits of isotope techniques and also increased collaboration among them. Finally, it enhanced the Member States' safety management capabilities of dams, particularly, in investigating dam and reservoir leakages and the safety of dams through the application of isotope technology.

5.2.5. Isotope Techniques for Groundwater Contamination Studies in Urbanized and Industrial Areas (RCA) – RAS/8/097

This project started in 2003 has promoted the use of isotope hydrology techniques in addition to conventional techniques (hydrogeological, chemical, and biological) for the study of pollutant behavior and contaminant transport in groundwater systems. It was extended to the 2005/2006 cycle to carry out a sub-project titled 'Geogenic Contamination of Groundwater', with special reference to arsenic, fluoride and other metals from natural sources. Participating Member States have reported on the enhanced understanding of hydrological systems that has resulted from the successful applications of the isotope hydrology techniques to studies of national importance.

5.2.6. Assessing Trends in Freshwater Quality Using Environmental Isotopes and Chemical Techniques for Improved Resource Management (RCA) – RAS/8/104

The project filled the gap in information availability regarding ground water resource management, expanded the efforts into the development of a full-fledged regional database on water quality. Participating Member States reported on successful application of environmental isotopes to the investigation of important national ground water problems.

5.2.7. Assessing Trends in Freshwater Quality Using Environmental Isotopes and Chemical Techniques for Improved Resource Management (RCA) – RAS/8/108

This project is currently active. A recent project summary is given in the Project Summary Sheet in Annex 12.

5.3 Overview of the Marine and Coastal Environment Projects

The following six projects concerned with the general area of Marine and Coastal Environment have been approved for implementation as part of the RCA Programme:

- Marine Contaminant and Sediment Transport (RCA) - RAS/8/065;
- Management of Marine Coastal Environmental Pollution (RCA) - RAS/8/083;
- Enhancing the Sustainability of the Marine Coastal Environment (RCA) - RAS/7/011;
- Improving Regional Capacity for Assessment, Planning, and Response to Aquatic Environmental Emergencies (RCA) - RAS/8/095;
- Establishing a Benchmark for Assessing the Radiological Impact of Nuclear Power Activities on the Marine Environment (RCA) - RAS/7/016; and,
- Harmonizing Nuclear and Isotopic Techniques for Marine Pollution Management at the Regional Level (RCA) - RAS/7/019.

The first four projects had been completed at the time of this review and RAS/7/016 and RAS/7/019 were active, both scheduled to be completed at the end of 2011.

Annex 13 contains the six individual Project Summary Sheets and associated Member State's Participation Charts and Source of Expertise Charts. In addition it has the Summary Chart covering all six Projects in the Area of Marine and Coastal Environment and the Source Profile Chart for Expertise used in this Area.

Implementation of the first of six projects began in 1989. These projects have so far resulted in the delivery of a total of 9 RTCs for 149 MSs participants, 1 RWs/RMs for 11 MSs participants, 7 PMs for 96 MSs participants, 5 Fellowships, 4 S/Vs and 51 Expert missions. There was a total of 3,199 person days input for the participating Member States. The total expenditure for the projects to the time of the review was US\$1,627,728.

5.3.1. Marine Contaminant and Sediment Transport (RCA) - RAS/8/065

Institutes in the participating countries have had their capabilities upgraded for the collection and preparation of marine sediments and for the analysis of pollutants for using marine radioactivity.

5.3.2. Management of Marine Coastal Environmental Pollution (RCA) - RAS/8/083

Scientists from RCA Member States with the assistance of regional experts developed a three-dimensional model of the hydraulic processes within Manila Bay; evaluating the model using the radio-tracer data gathered; applying the model to the prediction of harmful algal blooms (HABs) production within Manila Bay and other related activities. The sediment transport and hydrodynamics at Port Songkla were successfully modeled, and modeling software of pollutants in a

body of water using 3-dimensional model was successfully demonstrated for Manila Bay.

5.3.3. Enhancing the Sustainability of the Marine Coastal Environment (RCA) - RAS/7/011

This project, approved in 2003, aimed to enhance the quality of life in the coastal zone through the application of nuclear techniques to address problems associated with ameliorating the effects of historical pollution and minimizing the impact of effluent released in the coastal zone. The project established and/or enhanced capabilities to monitor paralytic shellfish poisoning (PSP) toxins in six RCA Member States.

An additional 2,537 records from Phase II containing more recent data on radionuclide concentrations were added to the Global Marine Radioactivity Database (GLOMARD) to update data for the region. This brought up the total number of records from ASPAMARD into GLOMARD to 4,325. The GLOMARD database identified large-scale oceanographic circulation processes and established better-defined benchmarks on radionuclide concentrations in the marine environment. The information generated was provided to coastal environmental protection agencies in the Member States and was used to introduce measures to reduce coastal pollution.

5.3.4. Improving Regional Capacity for Assessment, Planning, and Response to Aquatic Environmental Emergencies (RCA) - RAS/8/095

Through the project, participating Member States' knowledge was enhanced regarding the behaviour of contaminants in aquatic systems. Practical experience was achieved in the application and interpretation of nuclear techniques for evaluating bioaccumulation and the environmental fate of contaminants in aquatic systems. This output enabled Member States to acquire substantial comprehension of the theoretical background, practical applications and interpretation of state of the art probabilistic ecological risk assessment modelling for radionuclides and non-radioactive contaminants.

5.3.5. Establishing a Benchmark for Assessing the Radiological Impact of Nuclear Power Activities on the Marine Environment (RCA) - RAS/7/016

This project is currently active. A recent project summary is given in the Project Summary Sheet in Annex 13.

5.3.6. Harmonizing Nuclear and Isotopic Techniques for Marine Pollution Management at the Regional Level (RCA) - RAS/7/019

This project is currently active. A recent project summary is given in the Project Summary Sheet in Annex 13.

6. Human Health Thematic Sector

Projects in the following six areas were the focus of the inputs for this thematic sector:

- Cancer;
- Joint & Bone Disorders;
- Medical Physics;
- Nuclear Medicine Imaging;
- Radioimmunoassay; and,
- Tissue Grafts.

Since 1984 this thematic sector has provided the following inputs of training and assistance to the RCA Member States:

- ⇒ 107 RTCs for 2036 participants;
- ⇒ 42 RWs/RMs for 323 participants;
- ⇒ 40 PMs for 535 participants;
- ⇒ 17 Fellowships;
- ⇒ 9 Scientific Visits; and,
- ⇒ 223 Expert missions.

In total there were 26,167 person days of input and the total expenditure on the project to the date of this review was US\$13,754,654.

6.1 Overview of the Cancer Projects

The following eight projects concerned with the general area of Cancer have been approved for implementation as part of the RCA Programme:

- TC on Brachytherapy of the Uterus Cancer (RCA) - RAS/6/006;
- Quality Assurance in Radiation Therapy (RCA) - RAS/6/027;
- Nuclear Medicine Applications (RCA) - RAS/6/028;
- Distance Education in Radiation Oncology (RCA) - RAS/6/033;
- LDR and HDR Brachytherapy in Treating Cervical Cancer (RCA) - RAS/6/035;
- Management of Liver Cancer Using Transarterial Radioconjugate Therapy (RCA) - RAS/6/036;
- Improvement in Quality of Radiotherapy for Frequent Cancers in the Region (RCA) - RAS/6/040; and,
- Application of High-Precision 3D Radiotherapy for Predominant Cancers in the RCA region (RCA) - RAS/6/048.

All eight projects had been completed at the time of this review.

Annex 14 contains the eight individual Project Summary Sheets and associated Member State's Participation Charts and Source of Expertise Charts. In addition it has the Summary Chart covering all eight Projects in the Area of Cancer and the Source Profile Chart for Expertise used in this Area.

Implementation of the first of the eight projects began in 1984. These projects have so far resulted in delivery of a total of 51 RTCs for 1071 MSs participants, 8 RWs/RMs for 106 MSs participants, 12 PMs for 151 MSs participants, 11 Fellowships, 9 S/Vs and 50 Expert missions. There was a total of 9,218 person days input for the participating Member States. The total expenditure for the projects to the time of the review was US\$4,972,332.

6.1.1. TC on Brachytherapy of the Uterus Cancer (RCA) - RAS/6/006

The training course provided intensive training to radiotherapists and medical physicists not adequately familiar with modern techniques, including safety considerations, in radiation therapy of carcinoma of the cervix.

6.1.2. Quality Assurance in Radiation Therapy (RCA) - RAS/6/027

This project had the objective to utilize the acquisition of brachytherapy equipment to promote the introduction of new techniques and QA in clinical practice.

As a result of the project inputs, the capabilities of the respective institutes and hospitals to provide radiotherapy treatment to cancer patients, particularly cervical cancer, was substantially enhanced and this contributed to an improvement of health care services in the region.

6.1.3. Nuclear Medicine Applications (RCA) - RAS/6/028

New strategies for dealing with a spectrum of clinical problems such as: postoperative treatment of thyroid cancer using radioactive iodine; new radiation techniques for preventing restenosis after angioplastic surgery; and using radioisotope (rhenium-188 lipiodol) for treating liver cancer, were devolved to participating Member States.

All participating Member States were able to provide nuclear cardiology service to their patients for the detection of coronary artery disease; GATED myocardial perfusion SPECT was introduced in 68 medical institutions/hospitals/clinics in 10 Member States.

In the case of thyroid cancer treatment in was expanded in seven Member States and treatment became available in three.

Significant achievements are also seen in the areas of liver cancer with physicians and scientists able to prepare Re-188 Lipiodol, and using the protocol and procedures for therapy and internal dosimetry for liver cancer.

Before 1997, none of the three techniques for management of breast cancer, scintimammography, sentinel lymph node mapping and gamma probe application were available in the 14 developing countries of the region, but today, 11 of them have all the three techniques available.

Through the project, significant cost saving were reported on the cost of screening, monitoring with micro-albuminuria (MA) and treatment with ACE inhibitor of Diabetes mellitus (DMs) patients with MA. Participating Member States have established a harmonized protocol on the use of micro-albumin measurement for early detection of kidney involvement in diabetes mellitus.

6.1.4. Distance Education in Radiation Oncology (RCA) - RAS/6/033

A distance-learning programme in the Applied Sciences of Radiation Oncology (ASOC) was developed to assist in training doctors from the region up to the level of professional college Part 1 (theory). The course consists of 80 modules on CD-ROM. It has been distributed to all Member States' National Representatives and in addition it can be downloaded as a 740Mb zip file from the IAEA web site.

6.1.5. LDR and HDR Brachytherapy in Treating Cervical Cancer (RCA) - RAS/6/035

The capabilities of the participating institutes in Member States to provide radiotherapy to cervical cancer patients have been improved. Furthermore, medical personnel trained in treatment planning using LDR and HDR Brachytherapy in the treatment of cervical cancer have developed harmonized protocols for quality assurance; thus contributing to an improvement of health care services in the region.

6.1.6. Management of Liver Cancer Using Transarterial Radioconjugate Therapy (RCA) - RAS/6/036

The project contributed to reducing morbidity due to liver cancer and to improving health through therapeutic nuclear medicine, including improving the treatment of hepatocellular carcinoma (HCC) by using transarterial rhenium-188 lipiodol. The project successfully developed human resources in the region.

6.1.7. Improvement in Quality of Radiotherapy for Frequent Cancers in the Region (RCA) - RAS/6/040

Comprehensive audits were carried out in eight Member States by QUATRO (Quality Assurance Team on Radiation Oncology) teams comprised of a radiation oncologist, a medical physicist and a radiotherapy technologist. These audits were conducted according to IAEA guidelines aimed at assisting Member States to improve the quality of their radiotherapy services.

The project improved the quality of radiotherapy in the RCA region. Almost all the Member States currently have national quality assurance programmes involving quality assurance of radiotherapy machines and patient safety. As a result of the QUATRO missions, participating Member States initiated actions to implement the recommendations of the QUATRO audits to improve the quality of their radiotherapy practice.

6.1.8. Application of High-Precision 3D Radiotherapy for Predominant Cancers in the RCA region (RCA) - RAS/6/048

The project write up not yet incorporated in the FPSR. A recent project summary is given in the Project Summary Sheet in Annex 14.

6.2 Overview of the Joint and Bone Disorders Projects

The following three projects concerned with the general area of Joints and Bone Disorders have been approved for implementation as part of the RCA Programme:

- Use of Radiosynovectomy in the Management of Patients Suffering from Painful Joint Disorders (RCA) - RAS/6/039;
- Diagnosing Osteoporosis Using Nuclear Techniques (RCA) - RAS/7/012; and,
- Preventing Osteoporosis and Promoting Bone Mass in Asian Populations Using a Food-based Approach (RCA) - RAS/6/041.

All three projects had been completed at the time of this review.

Annex 15 contains the three individual Project Summary Sheets and associated Member State's Participation Charts and Source of Expertise Charts. In addition it has the Summary Chart covering all three Projects in the Area of Joint and Bone Disorders and the Source Profile Chart for Expertise used in this Area.

Implementation of the projects began in 2003. These projects have resulted in the delivery of a total of 3 RTCs for 52 MSs participants, 1 RWs/RMs for 4 MSs participants, 4 PMs for 52 MSs participants, 0 Fellowships, 0 S/Vs and 4 Expert missions. There was a total of 536 person days input for the participating Member States. The total expenditure for the projects to the time of the review was US\$411,059.

6.2.1. Use of Radiosynovectomy in the Management of Patients Suffering from Painful Joint Disorders (RCA) - RAS/6/039

The project had the objective of improving the treatment of painful joint disorders, such as haemophilic arthritis and rheumatoid arthritis, using radiocolloids for radiosynovectomy. In general, its project objectives were achieved and human resources in the field of radiosynovectomy, harmonized treatment protocols were enhanced.

6.2.2. Diagnosing Osteoporosis Using Nuclear Techniques (RCA) - RAS/7/012

The project was approved in 2003 with footnote-a/ funding with limited hard core funding for an initial expert advisory group meeting. Since the footnote-a/ funding was not obtained during the project cycle of two years, the expected objective of the project was therefore not met.

6.2.3. Preventing Osteoporosis and Promoting Bone Mass in Asian Populations Using a Food-based Approach (RCA) - RAS/6/041

The project evaluated the effectiveness of food-based dietary intervention programmes by using nuclear and isotopic techniques to promote bone mass and prevent bone loss especially in the postmenopausal women. New information on calcium bioavailability from locally available, calcium rich, foods has been generated by the project. It was clearly highlighted that calcium carbonate was not an optimal calcium compound for food fortification, stressing the importance of careful selection of calcium compounds used in food fortification programmes. These results were important for further development of food based strategies to prevent osteoporosis in populations with habitually low calcium intake.

6.3 Overview of the Medical Physics Projects

The following project concerned with the general area of Medical Physics has been approved for implementation as part of the RCA Programme:

- Strengthening Medical Physics through Education and Training (RCA) - RAS/6/038.

The project was active and scheduled to be completed at the end of 2012.

Annex 16 contains the Project Summary Sheet and associated Member State's Participation Chart and Source of Expertise Chart. In addition it has the Summary Chart and the Source Profile Chart for Expertise used in this area.

Implementation of the project began in 2003. This project has so far resulted in the delivery of a total of 5 RTCs for 101 MSs participants, 9 RWs/RMs for 67 MSs participants, 2 PMs for 27 MSs participants, 0 Fellowships, 0 S/Vs, and 28 Expert missions. There has been a total of 1,662 person days input for the participating Member States. The total expenditure for the projects to the time of the review was US\$847,135.

6.3.1. Strengthening Medical Physics through Education and Training (RCA) - RAS/6/038

This project is currently active. A recent project summary is given in the Project Summary Sheet in Annex 16.

6.4 Overview of the Nuclear Medicine Imaging Projects

The following six projects concerned with the general area of Nuclear Medicine Imaging have been approved for implementation as part of the RCA Programme:

- Nuclear Instrument Maintenance (RCA) - RAS/4/008;
- Use of Computers in Technetium-99m Imaging (RCA) -RAS/6/016;
- Strengthening Nuclear Medicine in RCA Member States (RCA) - RAS/6/022;
- Distance-assisted Training for Nuclear Medicine Technicians (RCA) - RAS/6/029;

- Tumour Imaging Using Radioisotopes (RCA) - RAS/6/042; and,
- Strengthening Clinical Applications of PET in RCA Member States (RCA) - RAS/6/049.

The first five projects had been completed at the time of this review and RAS/6/049 was active, scheduled to be completed at the end of 2011.

Annex 17 contains the six individual Project Summary Sheets and associated Member State's Participation Charts and Source of Expertise Charts. In addition it has the Summary Chart covering all six Projects in the Area of Marine and Coastal Environment and the Source Profile Chart for Expertise used in this Area.

Implementation of the first of six projects began in 1988. These projects have so far resulted in delivery of a total of 19 RTCs for 316 MSs participants, 17 RWs/RMs for 95 MSs participants, 9 PMs for 122 MSs participants, 1 Fellowships, 0 S/Vs and 75 Expert missions. There was a total of 7,065 person days input for the participating Member States. The total expenditure for the projects to the time of the review was US\$3,665,456.

6.4.1. Nuclear Instrument Maintenance (RCA) - RAS/4/008

Participating Member States acquired advanced knowledge and practical experience in the maintenance and repair of nuclear medicine equipment, in upgrading analogue gamma cameras with IBM PCs and relevant clinical software, in advanced technology to protect nuclear medicine instruments from electrical disturbances, and in routine QC of multihead SPECT systems.

As a result of the project, significantly improved services for maintenance, repair and QA-QC are available in RCA countries, and co-operation in the region has been strengthened. Gamma camera user associations have been established in several countries and these associations take care of QC, timely updating of clinical software and personnel training on about 500 gamma cameras and SPECT systems in the area.

Survey methods to record the performance of gamma cameras have been developed, tested and accepted by both users and manufacturers and their collaboration has been improved.

6.4.2. Use of Computers in Technetium-99m Imaging (RCA) -RAS/6/016

The project improved the diagnostic skills of nuclear medicine practitioners from the region. The project has helped to upgrade nuclear medicine diagnostics in those countries.

6.4.3. Strengthening Nuclear Medicine in RCA Member States (RCA) - RAS/6/022

The project assisted RCA Member States in developing their human resources for nuclear medicine technologists by coordinating a distance assisted training (DAT) programme. DAT course materials were produced and experts advised on and assisted in the course implementation and evaluation in four Member States.

Thirteen participants acquired knowledge and practical skills in basic physics and radiation safety, radiopharmacy, nuclear medicine instrumentation, computer in nuclear medicine and nuclear medicine imaging in endocrinology, gastroenterology, respiratory system, skeletal system, nephrology and cardiology. Thirteen trained technologists were tested, evaluated and certified by a special advisory and assessment expert mission through a pilot study conducted in India, Malaysia and Sri Lanka.

6.4.4. Distance-assisted Training for Nuclear Medicine Technicians (RCA) - RAS/6/029

The achievements report to finalise this project is not yet available. A recent project summary is given in the Project Summary Sheet in Annex 17.

6.4.5. Tumour Imaging Using Radioisotopes (RCA) - RAS/6/042

The project transferred technology for nuclear medicine imaging and sentinel lymph node imaging to participating Member States with the objective of improving the clinical management of cancer patients using nuclear medicine techniques.

Thirteen centres in China, Malaysia, Philippines and Thailand adopted the new techniques on PET/CT applications in oncology introduced through this project. Twelve centres in China, Indonesia, Malaysia, Philippines, Thailand and Vietnam introduced new techniques for sentinel lymph node detection in their breast cancer management programs and five centres in China established SPECT and CT as a result of this project.

6.4.6. Strengthening Clinical Applications of PET in RCA Member States (RCA) - RAS/6/049

This project is currently active. A recent project summary is given in the Project Summary Sheet in Annex 17.

6.5 Overview of the Radioimmunoassay Projects

The following four projects concerned with the general area of Radioimmunoassay have been approved for implementation as part of the RCA Programme:

- Train-the-Trainers on Data Processing in Radioimmunoassay (RCA) - RAS/6/010;
- Radioimmunoassay of Thyroid Hormones (RCA) - RAS/6/011;
- TC on Radioimmunoassay and Its Clinical Applications (RCA) - RAS/6/012; and,
- Radioimmunoassay for Hepatitis B Diagnosis (RCA) - RAS/6/018.

All four projects had been completed.

Annex 18 contains the four individual Project Summary Sheets and associated Member State's Participation Charts and Source of Expertise Charts. In addition it has the Summary Chart covering all four Projects in the Area of Radioimmunoassay and the Source Profile Chart for Expertise used in this Area.

Implementation of the projects began in 1986. These projects have resulted in the delivery of a total of 9 RTCs for 149 MSs participants, 2 RWs/RMs for 18 MSs participants, 6 PMs for 87 MSs participants, 0 Fellowships, 0 S/Vs, and 11 Expert missions. There was a total of 2,640 person days input for the participating Member States. The total expenditure for the projects to the time of the review was US\$1,887,588.

6.5.1. Train-the-Trainers on Data Processing in Radioimmunoassay (RCA) - RAS/6/010

The regional course trained specialists in the computerized processing of Radioimmunoassay Data in order to enable them to train their colleagues in their home countries, thereby improve the reliability of Radioimmunoassay in the region.

6.5.2. Radioimmunoassay of Thyroid Hormones (RCA) - RAS/6/011

Through the project bulk reagent methodology, as opposed to commercial kits, was successfully introduced in over 100 participating laboratories in 14 Member States, and over 600 scientists have been trained in the technique. The cost of assays was reduced by a factor of 10 in real terms, with consequent increase in workloads of over 100%, on average. Regional, and in some cases national, self-sufficiency was achieved for all primary reagents required, except for iodine-125, which was still imported.

Analytical reliability of the assays was assured by the establishment of good radioimmunoassay practice, with special attention to quality control.

A regional scheme for reagent sharing and distribution was set up. A regional external quality assessment scheme was established under the project is continuing without further Agency support.

6.5.3. TC on Radioimmunoassay and Its Clinical Applications (RCA) - RAS/6/012

The regional training course provided a basic understanding of Radioimmunoassay (RIA) and its clinical applications to participating Member States who wished to develop their own RIA Systems.

6.5.4. Radioimmunoassay for Hepatitis B Diagnosis (RCA) - RAS/6/018

This Radioimmunoassay (RIA) project enabled the establishment of in-house assays based on bulk reagent methodology in nine participating Member States and also encouraged the local production reagents which significantly reduced costs, established good quality RIA practice with proper attention to QC and data

processing, and developed human resources, including the skills required for the local production of reagents.

Quality assessment schemes was sustainably established and contributed to the growth of RIA with assured quality.

The effectiveness of the programme was shown by the increased workload in clinical RIA and a large number of research projects being carried out using RIA techniques. A regional RIA capability has now been established.

6.6 Overview of the Tissue Grafts Projects

The following two projects concerned with the general area of Tissue Grafts have been approved for implementation as part of the RCA Programme:

- Radiation Sterilization of Tissue Grafts (RCA) - RAS/7/003; and,
- Quality Assurance in Radiation Sterilization of Tissue Graft (RCA) - RAS/7/008.

Both projects had been completed.

Annex 19 contains the two individual Project Summary Sheets and associated Member State's Participation Charts and Source of Expertise Charts. In addition it has the Summary Chart covering both projects in the Area of Tissue Grafts and the Source Profile Chart for Expertise used in this Area.

Implementation of the first of the projects began in 1988 and the two projects resulted in the delivery of a total of 20 RTCs for 347 MSs participants, 5 RWs/RMs for 33 MSs participants, 7 PMs for 96 MSs participants, 5 Fellowships, 0 S/Vs and 55 Expert missions. There was a total of 5,046 person days input for the participating Member States. The total expenditure for the projects to the time of the review was US\$1,971,084.

6.6.1. Radiation Sterilization of Tissue Grafts (RCA) - RAS/7/003

Through the project tissue grafts of amnion, skin, bone chips and ligaments were able to be produced on a routine basis, and amnion were widely used in the region as wound dressing.

The development of a modular multimedia curriculum for tissue banking covering all stages involved in the operation of such a facility was initiated. Regional participation in curriculum development with the commitment of participants to its content and relevance was a major achievement.

The project contributed to the development and upgrading of 16 multi-tissue banks in participating Member States.

6.6.2. Quality Assurance in Radiation Sterilization of Tissue Graft (RCA) - RAS/7/008

Under this project, the major achievement was that all the tissue bank facilities in the Asia and Pacific region developed a harmonized quality system in producing tissue allografts. The methodology was translated in the form of a quality and

procedural manual, which was designed by the RCA Member States to meet the local requirements and at the same time meet the international standards laid down by the European Association of Tissue Banks (EATB) and the American Association of Tissue Banks (AATB).

A review of the curriculum masters course in tissue banking in Mahidol University, Thailand, was undertaken.

The establishment of a regional centre in Singapore to run the training programmes was an outstanding success and proved to be a major development resource for the region. Through this project, Member States benefited from the training and continued growth of radiation and tissue banking in the region.

7. Industry Thematic Sector

Projects in the following four areas were the focus of the inputs for this thematic sector:

- Industrial Applications;
- Nucleonic Control Systems & Nuclear Analytical Systems;
- Non-Destructive Testing and Tomography;
- Radiation Processing; and,
- Tracers and Sealed Source Technology.

Since 1979 this thematic sector has provided the following inputs of training and assistance to the RCA Member States:

- ⇒ 210 RTCs for 2776 participants;
- ⇒ 45 RWs/RMs for 436 participants;
- ⇒ 37 PMs for 513 participants;
- ⇒ 47 Fellowships;
- ⇒ 15 Scientific Visits; and,
- ⇒ 391 Expert missions.

In total there were 50,121 person days of input and the total expenditure on the project to the date of this review was US\$22,240,653

7.1 Overview of the Industrial Applications Projects

The UNDP sponsored RCA projects, which operated between 1979 and 1997 and provided substantial inputs to Member States in the general area of industrial applications of radiation and radioisotopes, comprised four distinct timing phases.

There were two projects operating between 1979 and 1986:

- Industrial Application of Isotopes and Radiation Technology (RCA) - RAS/8/008; and,

- Radioisotopes in Industry (RCA) - RAS/8/011.

These were under the umbrella of the UNDP sponsored project RAS/79/061, which is generally referred to as Phase I of the UNDP Industrial project.

The following four projects were operating between 1987 and 1994 and contributed to the UNDP sponsored project RAS/86/073, known as the Phase II of the UNDP Industrial Project:

- Industrial Applications of Isotopes and Radiation Technology (RCA) - RAS/8/061;
- Radioisotopes in Industry (RCA) - RAS/8/062;
- Training Course on Advanced Methodologies of Isotope Applications (RCA) - RAS/8/063; and,
- Radiation and Isotope Applications in Industry (RCA) - RAS/8/064.

From 1993 there was a follow on UNDP sponsored project, RAS/92/073, and under its umbrella the following four projects became operational:

- Isotopes and Radiation in Industry and Environment (RCA) - RAS/8/068;
- Isotopes and Radiation in Industry and the Environment (RCA) - RAS/8/069;
- Isotopes and Radiation in Industry and the Environment (RCA) - RAS/8/070; and,
- Isotopes & Radiation for Technical. & Environmental. Sustainable Development. (RCA) - RAS/8/071.

Following the completion of the UNDP RAS/92/073, a further UNDP project, RAS/97/030, was commenced in 1997. The following projects supported the work in this area:

- Better Management of Environment and Industrial Growth - Joint UNDP/RCA (RCA) - RAS/8/076;
- Thematic Programme on Advanced Techniques for Industry (RCA) - RAS/8/078; and
- Better Management of the Environment & Industry through Isotope & Radiation Technology (RCA) - RAS/8/080.

In addition to the above, other projects were initiated in this general area but with more specific technology foci. These were in the areas of:

- Nucleonic Control Systems (NCS) and Nuclear Analytical Systems (NAS);
- Non destructive testing (NDT) and Tomography; and,
- Tracers and Sealed Sources.

These four phases are detailed in the following sections.

All thirteen projects covered in the four phases had been completed at the time of this review.

Annex 20 contains the thirteen individual Project Summary Sheets and associated Member State's Participation Charts and Source of Expertise Charts. In addition there are three Summary Charts covering the project activities conducted under the umbrella of the UNDP sponsored Industrial projects Parts I & II (RAS/79/061 and RAS/86/073), RAS/92/073 and RAS/97/030 in the Area of Industrial Applications and three Source Profile Charts illustrating the source of expertise used in the implementation of each of the main aspects.

Implementation of the first of the thirteen projects began in 1979. These projects combined to result in the delivery of a total of 169 RTCs for 2222 MSs participants, 30 RWs/RMs for 196 MSs participants, 27 PMs for 342 MSs participants, 29 Fellowships, 10 S/Vs and 342 Expert missions. There was a total of 42,737 person days input for the participating Member States. The total expenditure for the projects to the time of the review was US\$18,571,457.

7.1.1. Industrial Application of Isotopes and Radiation Technology Phase I & II - RAS/79/061 & RAS/86/073

The following six RCA projects were implemented under the umbrella of Phas I & II of this UNDP project:

- Industrial Application of Isotopes and Radiation Technology (RCA) - RAS/8/008; and,
- Radioisotopes in Industry (RCA) - RAS/8/011.
- Industrial Applications of Isotopes and Radiation Technology (RCA) - RAS/8/061;
- Radioisotopes in Industry (RCA) - RAS/8/062;
- Training Course on Advanced Methodologies of Isotope Applications (RCA) - RAS/8/063; and,
- Radiation and Isotope Applications in Industry (RCA) - RAS/8/064.

The combined objectives were the introduction of isotope and radiation technology through training and demonstration in industries of major economic importance, including minerals, paper, rubber, steel, petrochemicals and fertilizers, with demonstrations to be used as models for plant operation elsewhere. As well as the projects promoted the use of isotope and radiation technology for environmentally sustainable development.

The project activities resulted in the investment, within the region by Governments and the private sector of about \$75 million.

Nucleonic control systems were taken up in the paper, minerals and steel industries. In the area of tracer technology potentially viable tracer groups were established in each participating Member State and had trained in a range of industrial application. Hundreds of people were trained in NDT according to international standards (ISO), through regional or national training courses. Most countries were accepting and introducing the ISO standard for qualification and certification of NDT inspectors. Radiation technology was taken up for application in the areas of radiation sterilizing and radiation curing.

Implementation of the first of the six projects began in 1979. These projects combined to result in the delivery of a total of 117 RTCs for 1417 MSs

participants, 11 RWs/RMs for 50 MSs participants, 7 PMs for 82 MSs participants, 26 Fellowships, 9 S/Vs and 155 Expert missions. There was a total of 30,527 person days input for the participating Member States. The total expenditure for the projects to the time of the review was US\$12,592,767.

7.1.2. The use of Isotopes & Radiation to Strengthen Technology and Support Environmentally Sustainable Development - RAS/92/073

The following four RCA projects were implemented under the umbrella of this UNDP project:

- Isotopes and Radiation in Industry and Environment (RCA) - RAS/8/068;
- Isotopes and Radiation in Industry and the Environment (RCA) - RAS/8/069;
- Isotopes and Radiation in Industry and the Environment (RCA) - RAS/8/070; and,
- Isotopes & Radiation for Technical. & Environmental. Sustainable Development. (RCA) - RAS/8/071.

The overall objective for these projects was to promote the use of isotope and radiation technology for environmentally sustainable development. Participating Member States' capabilities were enhanced in the following areas:

- radiation processing of flue gases, pharmaceuticals and cosmetics;
- radiation chemistry;
- radiation vulcanization of natural rubber latex; decontamination of liquid wastes;
- safety standards; operation, regulatory aspects and inspection of high power industrial radiation facilities; and,
- technical and economical benefits of using radiation technologies.

Member States achieved a sufficient level of development in technologies and techniques promoted by this project, which included NCSs, industrial and environmental applications of tracer and radiation technologies, nuclear analytical techniques and NDT and evaluation, to make the technology transfer for advanced training, expert group activities and CRPs appropriate and effective.

Advanced training activities enhanced the capability of Member States to sustain the above technologies, as shown by the increase in their application, and by advances in R&D, essential for promoting and sustaining the technology transfer to end users.

Implementation of the four projects began in 1993. These projects combined to result in the delivery of a total of 26 RTCs for 403 MSs participants, 13 RWs/RMs for 94 MSs participants, 19 PMs for 232 MSs participants, 0 Fellowships, 0 S/Vs and 151 Expert missions. There was a total of 8,436 person days input for the participating Member States. The total expenditure for the projects to the time of the review was US\$4,802,789.

7.1.3. Better Management of the Environment, Natural Resources and Industrial Growth through Isotope and Radiation Technology – RAS/97/030

The following three RCA projects were initiated under the umbrella of this UNDP project:

- Better Management of Environment and Industrial Growth - Joint UNDP/RCA (RCA) - RAS/8/076;
- Thematic Programme on Advanced Techniques for Industry (RCA) - RAS/8/077; and
- Better Management of the Environment & Industry through Isotope & Radiation Technology (RCA) - RAS/8/080.

These projects had the broad objectives to use isotopes and radiation technology to address problems associated with sustainable human development and in doing so forge technology partnerships with end users, developing links between institutes and implanting relevant technology within national institutes.

In addition to the technical inputs and training, the project had a significant impact on strengthening the co-operation among institutions and end-users of the region, thus facilitating technical co-operation among developing countries (TCDC).

Implementation of the three projects began in 1997. These projects combined to result in the delivery of a total of 26 RTCs for 402 MSs participants, 6 RWs/RMs for 52 MSs participants, 1 PMs for 28 MSs participants, 3 Fellowships, 1 S/Vs and 36 Expert missions. There was a total of 3,774 person days input for the participating Member States. The total expenditure for the projects to the time of the review was US\$1,175,901.

7.2 Overview of the Nucleonic Control Systems & Nuclear Analytical Systems Projects

The following two projects concerned with the general area of Nucleonic Control Systems and Nuclear Analytical Systems Projects have been approved for implementation as part of the RCA Programme:

- Optimization of Mineral Resources Recovery Using Low Radioactivity Portable Nucleonic Gauges (RCA) - RAS/8/089; and,
- Optimization of Materials in Industry Using Online Bulk Analysis Techniques (RCA) - RAS/8/094.

Both projects had been completed at the time of this review.

Annex 21 contains the two individual Project Summary Sheets and associated Member State's Participation Charts and Source of Expertise Charts. In addition it has the Summary Chart covering both Projects in the Area of Nucleonic Control Systems and Nuclear Analytical Systems and the Source Profile Chart for Expertise used in this Area.

Implementation of the first of the two projects began in 2001 and both these projects resulted in the delivery of a total of 4 RTCs for 64 MSs participants, 1 RWs/RMs for 17 MSs participants, 0 PMs, 11 Fellowships, 1 S/Vs and 4 Expert missions. There was a total of 890 person days input for the participating Member

States. The total expenditure for the projects to the time of the review was US\$634,507.

7.3 Overview of the Non-Destructive Testing and Tomography Projects

The following four projects concerned with the general area of Non-Destructive Testing and Tomography have been approved for implementation as part of the RCA Programme:

- Non-Destructive Testing and Evaluation (RCA) - RAS/8/085;
- Advanced Industrial Radiography (RCA) - RAS/8/100;
- Development and Application of Advanced Industrial Radiography and Tomography Techniques (RCA) - RAS/8/105; and,
- Applying Advanced Digital Industrial Radiology and Computed Tomography in Industry and Civil Engineering (RCA) - RAS/8/110.

The first three projects had been completed at the time of this review and RAS/8/110 was active, scheduled for completion in 2011.

Annex 22 contains the four individual Project Summary Sheets and associated Member State's Participation Charts and Source of Expertise Charts. In addition it has the Summary Chart covering all four Projects in the Area of Non-Destructive Testing and Tomography and the Source Profile Chart for Expertise used in this Area.

Implementation of the first of the four projects began in 1999 and so far has resulted in delivery of a total of 9 RTCs for 158 MSs participants, 4 RWs/RMs for 38 MSs participants, 6 PMs for 102 MSs participants, 0 Fellowships, 0 S/Vs and 6 Expert missions. There was a total of 1,725 person days input for the participating Member States. The total expenditure for the projects to the time of the review was US\$798,442.

7.4 Overview of the Radiation Processing Projects

The following six projects concerned with the general area of Radiation Processing have been approved for implementation as part of the RCA Programme:

- Radiation Processing Application for Agrowaste (RCA) - RAS/8/087;
- Upgrading Natural Polymers and Environment Conservation Through Radiation Processing (RCA) - RAS/8/090;
- Modification of Natural Polymers through Radiation Processing (RCA) - RAS/8/096;
- Radiation Technology for Development of Advanced Materials and for Protection of Health and the Environment (RCA) - RAS/8/098;
- Radiation Processing Applications for Health and the Environment (RCA) - RAS/8/106; and,

- Supporting Radiation Processing of Polymeric Materials for Agricultural Applications and Environmental Remediation (RCA) - RAS/8/109.

The first five projects had been completed at the time of this review and RAS/8/109 was active, scheduled for completion in 2011.

Annex 23 contains the six individual Project Summary Sheets and associated Member State's Participation Charts and Source of Expertise Charts. In addition it has the Summary Chart covering all six Projects in the Area of Radiation Processing and the Source Profile Chart for Expertise used in this Area.

Implementation of the first of the six projects began in 1999. These projects have so far resulted in the delivery of a total of 13 RTCs for 238 MSs participants, 6 RWs/RMs for 100 MSs participants, 6 PMs for 87 MSs participants, 0 Fellowships, 0 S/Vs and 6 Expert missions. There was a total of 2,337 person days input for the participating Member States. The total expenditure for the projects to the time of the review was US\$795,029.

7.5 Overview of the Tracers and Sealed Source Technology Projects

The following six projects concerned with the general area of Tracers and Sealed Source Technologies have been approved for implementation as part of the RCA Programme:

- Nucleonic Control Systems and Tracers in Industry (RCA) - RAS/8/078;
- Radiotracers/Sealed Sources/Nucleonic Gauges in Industry (RCA) - RAS/8/086;
- Process Diagnostics and Optimization in Petrochemical Industry (RCA) - RAS/8/091;
- Radioisotope Technology for Natural Resource Exploration and Exploitation (RCA) - RAS/8/099;
- Raising Productivity in the Coal, Minerals and Petrochemical Industries by using Nucleonic Analysis Systems and Radiotracers (RCA) - RAS/8/107; and,
- Diagnosing Industrial Multiphase Systems by Process Visualization using Radiotracers and Sealed Sources (RCA) - RAS/8/111.

The first five had been completed at the time of this review and RAS/8/111 was active, scheduled for completion in 2011.

Annex 24 contains the six individual Project Summary Sheets and associated Member State's Participation Charts and Source of Expertise Charts. In addition it has the Summary Chart covering all six Projects in the Area of Tracers and Sealed Source Technologies and the Source Profile Chart for Expertise used in this Area.

Implementation of the first of the six projects began in 1997. These projects have so far has resulted in the delivery of a total of 15 RTCs for 252 MSs participants, 8 RWs/RMs for 123 MSs participants, 4 PMs for 84 MSs participants, 7 Fellowships, 4 S/Vs and 39 Expert missions. There was a total of 4,157 person

days input for the participating Member States. The total expenditure for the projects to the time of the review was US\$2,239,660.

8. Radioactive Waste Sector

Since 1997 this sector has provided the following inputs of training and assistance to the RCA Member States:

- ⇒ 2 RTCs for 45 participants;
- ⇒ 2 RWs/RMs for 23 participants;
- ⇒ 1 PMs for 12 participants;
- ⇒ 0 Fellowships;
- ⇒ 0 Scientific Visits; and,
- ⇒ 1 Expert mission.

In total there were 770 person days of input and the total expenditure on the project was US\$156,601.

8.1 Overview of the Radioactive Waste Sector

The following project concerned with the general area of radioactive waste had been implemented as part of the RCA Programme:

- Disposal of Radioactive Waste from Non-Power Sources (RCA) - RAS/4/016.

This project had been completed at the time of this review.

Annex 25 contains the individual Project Summary Sheets and associated Member State's Participation Charts and Source of Expertise Charts. In addition it has the Summary Chart covering this project and the Source Profile Chart for Expertise used in the Area of Radioactive Waste.

9. Radiation Protection Sector

Since 1987 this sector has provided the following inputs of training and assistance to the RCA Member States:

- ⇒ 58 RTCs for 930 participants;
- ⇒ 47 RWs/RMs for 556 participants;
- ⇒ 19 PMs for 275 participants;
- ⇒ 0 Fellowships;
- ⇒ 10 Scientific Visits; and,
- ⇒ 48 Expert missions.

In total there were 11,277 person days of input and the total expenditure on the project to the date of this review was US\$5,197,131.

9.1. Overview of the Radiation Protection Sector

The following eight projects concerned with the general area of radioactive waste has been implemented as part of the RCA Programme:

- Strengthening of Radiation Protection Infrastructures (RCA) - RAS/9/006;
- Harmonization of Radiation Protection (RCA) – RAS/9/018;
- Radiation Protection and Networking (RCA) - RAS/0/029;
- Environmental Radiation Monitoring and Regional Database (RCA) - RAS/9/024;
- Harmonization of Radiation Protection, Phase IV (RCA) - RAS/9/029;
- Assessment of Radiological Risks (RCA) - RAS/9/031;
- Radiological Emergency Response (RCA) - RAS/9/032; and,
- Sustainability of Regional Radiation Protection Infrastructure (RCA) - RAS/9/042.

The first seven projects had been completed at the time of this review and RAS/9/042 was active, scheduled for completion in 2011.

Annex 26 contains the individual Project Summary Sheets and associated Member State's Participation Charts and Source of Expertise Charts. In addition it has the Summary Chart covering all eight projects in the Area of Radiation Protection and the Source Profile Chart for Expertise used in this Area.

9.1.1. Strengthening of Radiation Protection Infrastructures (RCA) - RAS/9/006

This RCA project was initiated in 1988 to offer a regional response to some of the radiation protection issues that were raised following the Chernobyl accident. Highlights of the achievements of this project included the development of distance learning materials for radiation protection funded by the Australian Government. Several modules have been prepared and piloted in a few Member States.

Through Japanese funding, a five-year CRP on compiling analogous data for the Asian population was undertaken with participants from ten countries. This resulted in the most comprehensive single set of such data yet compiled. The results were published in 1998 in two volumes as Agency TECDOC-1005. The results have also been provided to the ICRP for use in their efforts to revise the 23-year old Report of the Reference Man Task Group.

9.1.2. Harmonization of Radiation Protection (RCA) – RAS/9/018

The project major achievements were:

- i) assisting most Member States in establishing and upgrading their national regulatory framework and has increased the awareness of the need to meet the milestones of the BSS;

- ii) educating Member States about the accuracy of Secondary Standard Dosimetry Laboratory (SSDL) calibrations through external dosimetry exercises;
- iii) assisting relevant regulatory authority in development of codes of practices for industrial sources of radiation, specially in licensing and inspection;
- iv) providing insights to the need to develop adequate infrastructure for preparedness to radiation incidents;
- v) contributing to understanding of important radiation-related parameters of a Reference Asian Man (RAM); and,
- vi) improving capabilities of the Member States to implement the recommendations of International Commission on Radiological Protection (ICRP), International Commission on Radiation Units and Measurements (ICRU) and the Agency Basic Safety Standards (BSS).

9.1.3. Radiation Protection and Networking (RCA) - RAS/0/029

Under this project, a total of 23 modules of the training modules were developed. 15 modules, that were finalised, were tested with 53 students in seven Member States.

The training materials developed under this project were divided into four parts, namely:

- basic knowledge;
- occupational and environmental radiation protection;
- radiation protection infrastructure; and,
- radiation protection for application in industry and medicine.

Electronic format of the training material were developed in the form of CDROM/diskette. The modules were effective learning tools for the participating students in the RCA Member States and its use led to harmonizing the radiation protection training material within the region. As a result of the project, distance learning material on radiation protection practices have been made available to end users and regulators in industry and environment in RCA Member States.

9.1.4. Environmental Radiation Monitoring and Regional Database (RCA) - RAS/9/024

The project assisted RCA Member States in strengthening the environmental radiation monitoring infrastructures through two intercomparison exercises. These intercomparison exercises provided individual feedback to participating countries on ways of improving environmental radiation monitoring capabilities and establishing a regional database.

9.1.5. Harmonization of Radiation Protection, Phase IV (RCA) - RAS/9/029

This project supported RCA Member States in their continued efforts to develop Radiation Protection Infrastructures to comply with the requirements of Basic Safety Standards on Radiation Protection (International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources -

BSS115). It has enhanced technical capabilities in radiation protection for both regulators and operators of the Member States.

Participation in the activities has also contributed to improved networking and interaction of radiation protection professionals, regulators and operators in the region and has therefore led to enhanced knowledge and experience in radiation protection in the regional context.

9.1.6. Assessment of Radiological Risks (RCA) - RAS/9/031

The project developed the capacity in Member States to assess the consequences of accidental radiological releases in order to take counter measures to minimize the radiation doses to the population. A set of tested and refined training modules were produced for use at the regional level. In addition the national team of Indonesia was able to refine and adapt these modules for use as training materials for both basic and advanced levels of national training, enabling two levels of training, basic or advanced to be supported depending on local conditions and requirements.

9.1.7. Radiological Emergency Response (RCA) - RAS/8/032

The project enhanced the capacity of Member States to respond to radiological emergencies and particularly increased national competency in routine radiological monitoring and decision making based on field data. The shared experiences of the national teams in the field trial conducted under the project contributed to greater awareness of both good practices and areas requiring upgrade. There was continued national and regional improvement in knowledge and experience as a result of the project due to the reinforced contact between national response teams at the field team level.

The project also led to advanced competencies through extended Member State commitment regarding shared regional knowledge and experience.

9.1.8. Sustainability of Regional Radiation Protection Infrastructure (RCA) - RAS/9/042

This project is currently active. A recent project summary is given in the Project Summary Sheet in Annex 26.

10. Research Reactors Utilisation Sector

Since 1985 this sector has provided the following inputs of training and assistance to the RCA Member States:

- ⇒ 20 RTCs for 305 participants;
- ⇒ 14 RWs/RMs for 236 participants;
- ⇒ 11 PMs for 145 participants;
- ⇒ 3 Fellowships;

⇒ 0 Scientific Visits; and,

⇒ 13 Expert missions.

In total there were 5,240 person days of input and the total expenditure on the project to the date of this review was US\$1,471,121.

10.1. Overview of the Research Reactor Utilisation Sector

Projects in the following eight areas were the focus of the inputs for this sector:

- Regional Workshop on Neutron Activation Analysis (RCA) – RAS/1/006;
- Training Course on Use of Reactor Neutron Beam (RCA) – RAS/1/007;
- Research Reactor Utilization (RCA) - RAS/4/011;
- Improving Research Reactor Operation and Utilization (RCA) – RAS/4/019;
- Improvement of Research Reactor Operation and Utilization (RCA) - RAS/4/020;
- Improvement of Research Reactor Operation and Utilization, Phase II (RCA) – RAS/4/022;
- Radioisotope Production and Neutron Beam Applications (RCA) – RAS/4/024; and,
- Adding Value to Materials through Irradiation with Neutrons (RCA) - RAS/4/026.

All eight projects had been completed at the time of this review

Annex 27 contains the individual Project Summary Sheets and associated Member State's Participation Charts and Source of Expertise Charts. In addition it has the Summary Chart covering all eight Projects in the Area of Research Reactor Utilisation and the Source Profile Chart for Expertise used in this Area.

10.1.1. Regional Workshop on Neutron Activation Analysis (RCA) – RAS/1/006

This workshop was delivered in 1985. No details of the objectives or outcomes have been located.

10.1.2. Training Course on Use of Reactor Neutron Beam (RCA) – RAS/1/007

This regional training course was delivered in 1986. No details of the objectives or outcomes have been located.

10.1.3. Research Reactor Utilization (RCA) - RAS/4/011

The project had the objective to assist institutes in Member States operating research reactors to make optimum use of these facilities, including the provision of irradiation services and the production of radioisotopes, and to facilitate

collaboration and co-operation between the institutes concerned. As a result, regional expertise was developed for performing neutronic and thermal hydraulic calculations and for promoting research and commercial applications of research reactors. Some aspects of transient calculations and measurement of reactor parameters were also completed.

10.1.4. Improving Research Reactor Operation and Utilization (RCA) – RAS/4/019

The project sought to bring about qualitative and quantitative improvements in various aspects of research reactor operation and utilization; specifically, to improve information exchange between research reactor personnel of Member States in selected priority areas such as ageing of research reactors, and obsolescence of facilities and components. As a result, participating Member States improved co-ordination and information exchange on common research reactor operation and safety-related problems and achieved additional technical know-how.

10.1.5. Improvement of Research Reactor Operation and Utilization (RCA) - RAS/4/020

The project's objectives were to bring about qualitative and quantitative improvements in various aspects of research reactor operation and utilization; specifically, to improve information exchange between research reactor personnel of Member States in selected priority areas such as ageing of research reactors and obsolescence of facilities and components; and to improve the utilization of research reactors and associated facilities through sharing resources and exchange of experiences in the neutron beam application, in-service inspection techniques, and core management technology.

At the completion of the project Member States were assessed as having gained information and guidance in the need for early and complete project planning to achieve safe and cost-effective decommissioning of nuclear installation. The sharing of RR resources in the region was initiated among RR managers of participating Member States as this was seen to be an efficient way to cope with future RR demands as well as to improve current RR utilization. Details for cooperation in sharing of resources in the area of neutron beam research with Member States were also developed as well as a strategic plan to enable Member States to seek out the most likely customer for their facilities.

10.1.6. Improvement of Research Reactor Operation and Utilization, Phase II (RCA) – RAS/4/022

The project was designed to bring about qualitative and quantitative improvements in various aspects of research reactor operation and utilization; specifically, to improve information exchange between research reactor personnel of Member States in selected priority areas such as supply of radioisotopes (RI), safety assessment, instrumentation and control (I&C) of existing and new research reactors, and measurement of reactor parameters. In general, on completion, the project was reported to have contributed to the exchange of knowledge and expertise in the field of research reactors, including isotope production and

neutron beam applications. The technical meetings and seminar conducted under the project also assessed as helping to establish strong interaction among research reactor scientists/engineers from the participating Member States.

10.1.7. Radioisotope Production and Neutron Beam Applications (RCA) – RAS/4/024

The project had objectives to achieve sustainability in research reactor utilization for isotope production and beam line applications, while ensuring safety in operation. The outcome was reported to have impacts in the fields of medicine, agriculture and industry. Improvements and advances in both isotope production capabilities and beam line applications were reported for individual participating Member States. One Member State was reported as being successful in developing safety assessment capabilities and in the completion of the Safety Analysis Report.

10.1.8. Adding Value to Materials through Irradiation with Neutrons (RCA) - RAS/4/026

The aim of the project was to improve the utilization of research reactors in the region by enhancing the capability of Member States to produce value added materials using neutron irradiation. Individual Member States reported on advances in the area of Neutron Transmutation Doping (NTD), with two reported to have started commercial scale irradiation of silicon, with well-established linkages to industry.

Member States reported on significant advances in the field of Gemstone Colouration with many starting activities on sizeable scale.

Guidelines on gem coloration and neutron transmutation doping of silicon prepared under this project were to be provided to the participating Member States after they were reviewed by an independent expert.

11. Technical Cooperation among Developing Countries (TCDC) Sector

Since 1984 this thematic sector has provided the following inputs of training and assistance to the RCA Member States:

- ⇒ 32 RTCs for 458 participants;
- ⇒ 14 RWs/RMs for 157 participants;
- ⇒ 25 PMs for 259 participants;
- ⇒ 5 Fellowships;
- ⇒ 5 Scientific Visits; and,
- ⇒ 127 Expert missions.

In total there were 10,264 person days of input and the total expenditure on the project to the date of this review was US\$2,808,964

11.1. Overview of the Technical Cooperation among Developing Countries (TCDC) Sector

Projects in the following six projects were the focus of the inputs for this sector:

- Development of TCDC in Asia and the Pacific (RCA) - RAS/0/015;
- Nuclear Information System (RCA) - RAS/0/19;
- Project Formulation Meetings (RCA) - RAS/0/024;
- Technical Co-operation Among Developing Countries (RCA) - RAS/0/025;
- Management of Technical Cooperation among Developing Countries (RCA) - RAS/0/035; and,
- Management of Technical Cooperation among Developing Countries (RCA) - RAS/0/048.

The first five projects had been completed at the time of this review. RAS/0/048 was still active.

Annex 28 contains the individual Project Summary Sheets and associated Member State's Participation Charts and Source of Expertise Charts. In addition it has the Summary Chart covering all six Projects in the Area of Technical Cooperation among Developing Countries (TCDC) Sector and the Source Profile Chart for Expertise used in this Area.

11.1.1. Development of TCDC in Asia and the Pacific (RCA) - RAS/0/015

The project assisted the developing Member States in the promotion and strengthening of collective self-reliance through the pooling and sharing of technical resources and experience, and in developing complementary capacities in nuclear fields.

Participating Member States acquired knowledge and experience in the application of isotope techniques for external dose evaluation, water resource management, and geothermal energy development, in research reactor safety, design, operation and maintenance, in planning and implementation of a nuclear power project, in technology and utilization of low power research reactors, in safety related environmental monitoring of nuclear facilities, in NDT of NPPs, in techniques for measurement, calibration and radon risk evaluation, in economic benefits of industrial applications of radiation processing, in industrial and environmental application of probabilistic safety assessment, in implementation of Agency basic safety standards, and in the utilization and operation of an international nuclear information system.

11.1.2. Nuclear Information System (RCA) - RAS/0/19

Participating Member States acquired knowledge and experience on the benefits, services and responsibilities of INIS membership, the opportunities and advantages of regional co-operation, and INIS operations. Additional training and exchange of experience were facilitated by the annual INIS liaison officers meetings and expert exploratory missions.

The project improved the capability of the nuclear information centres, increased the number of trained information professionals and enhanced co-operation among the countries in the region. The volume and the quality of the input to the INIS database increased, and information services to scientific, technical and policy making personnel in the participating countries improved.

11.1.3. Project Formulation Meetings (RCA) - RAS/0/024

The Agency supported participating Member State's counterparts in their efforts to increase co-ordination and technical co-operation effectiveness. These activities were concentrated on important regional issues such as clean drinking water, research reactors, industry and the environment, agriculture, clean and energy efficient production processes, and measurement of effectiveness of multi-nutrient supplementation.

As a result of the project, the skills of regional counterparts in project formulation were strengthened and their awareness of regional development issues was enhanced. The participants acquired knowledge and experience in designing project proposals and work plans.

11.1.4. Technical Co-operation Among Developing Countries (RCA) - RAS/0/025

The project promoted technical cooperation among developing countries (TCDC) in the nuclear field within the Members States and with other regions/regional agreements, was approved in 1997.

Under the project, various studies and assignments related to the RCA programme were undertaken, such as, review and update of RCA technology transfers; review of regional resource units (RRUs) in the RCA programme; review of RCA vision; electronic networking and outreach (ENO), including consultation on development of databases and RCA homepage; advise on the techniques and approaches to development of interactive training packages in radiation protection; review and prepare the final drafts of the RCA project proposals for 2001/2002 programme cycle; preparation of RCA annual reports and publications of RCA materials (RCA anniversary booklets and pamphlets).

The project contributed towards establishing a high profile for the RCA programme in the region as a regional resource community and the capability of Member States to manage the RCA programme was enhanced.

11.1.5. Management of Technical Cooperation among Developing Countries (RCA) - RAS/0/035

The main focus of the project was to enhance technical cooperation among developing countries' (TCDC) activities by strengthening the management of the RCA programme. The policy level meetings of the national RCA representatives appointed by the Governments of the RCA Member States led to decisions related to improving the management of the RCA programme. One of the key decisions was the adoption of a medium term strategy for the RCA programme, aimed at improving the socioeconomic impact of the programme through focusing on regional priority areas using clear criteria for project selection.

The project strengthened electronic networking and outreach activities of the RCA programme. The RCA Members Only homepage hosted by Member State Malaysia was restructured to make it user friendly and to contain information related to the projects under implementation. The website, hosted by the RCA Regional Office located in the Republic of Korea, provided information to the general public on RCA activities.

11.1.6. Management of Technical Cooperation among Developing Countries (RCA) - RAS/0/048

The project objectives are to manage technical cooperation among developing countries (TCDC) in the nuclear field within RCA Member States and with other regions/regional agreements; to increase the capability of electronic networking among the Member States to include databases, internet-based distance-learning materials developed previously and to be developed under the RCA programme; to provide support to the management of RCA; and to promote partnership and collaboration with other regional organizations and agreements. The project is still active.

12. Regional Profile Survey of Member States.

The RCA Focal Person sent a Questionnaire (Annex 29) to all National RCA Representatives (NRs) which was designed to assist in understanding the effectiveness of the past project areas and assist in identifying priority areas for the future. The Questionnaire has two main sections: the first is concerned the Member State's experience with projects, their importance as far as national priorities and whether there are new project areas or technologies that should be considered for the RCA programme; the second section is concerned with the national benefits that the NRs regarded as being derived from the RCA projects and their estimation of factors surrounding the sustainability of the transferred technologies at the national level.

On 18 September 2009 the NRs were contacted by the RCA Focal Person and invited to complete the questionnaire and requested to return it to him by 15 November 2009. Nine NRs responded providing responses to the questions on the various thematic areas. Not all thematic areas were addressed by all the NRs and in one case one NR provided two differing opinions on human health priorities. Both responses have been tabulated and utilised.

In the analysis of these responses no implication has been ascribed to either the absence of an overall response from an NR or the absence of specific detailed

responses on particular projects technical areas or thematic sectors. The absence of information has been treated merely as an absence of information and has not been taken as implying that there was some underlying negative factor involved that was being withheld from being reported.

For the benefit of the analyses the responses of the Member States have been treated anonymously.

12.1. Overall Priorities of Member States in the Thematic Sectors / Thematic Areas

12.1.1 Thematic Sector – Agriculture

The input provided on this area by the responding NRs is tabulated below:

MS Response	National Priority (Y,N)* and Importance of the Project Area (Scale of 1-6)							
	1	2	3	4	5	6	7	8
Project Area								
Land use – Soil Erosion	Y, 1	Y, 1	Y, 3	Y, 6	Y, 5	Y, 6	Y, 6	
Land use – Fertilizer uptake	Y,2	Y, 1	Y, 3	Y, 4	Y, 2	Y, 4	Y, 6	
Animal Health and Nutrition		Y, 1	Y, 2	Y, 3	Y, 4	Y, 2	Y, 6	
Animal Reproduction	Y,2	Y, 1	Y, 2	Y, 2	Y, 4	Y, 2	Y, 6	
Mutation Plant Breeding		Y, 1	Y, 1	Y, 1	Y, 1	Y, 3	Y, 6	
Food Irradiation	N,5	Y, 1	Y, 3	Y, 5	Y, 2	Y, 2	Y, 6	

It is clear that the NRs did not use the same methodology when rating the importance of a project area. Some appear to have given a relative rating within a thematic area while others appear to have given a relative rating across the whole RCA programme. Nevertheless it is possible obtain a semi-quantitative indication of the relative importance by calculating the average priority value per country for each of the project areas. However it has to be emphasised that, in the absence of the adoption of a suitable single methodology for the assignment of priorities, the relative rating being used here will only be valid for ranking within a sector and would not be valid for ranking the relative priorities between sectors.

On this basis the relative priorities for the Agriculture Thematic Sector are:

- 1st Priority - Mutation Plant Breeding (Average 2.2)
- 2nd Priority - Animal Reproduction (Average 2.7)

* Y = Yes; N = No/Not yet; 1 = most important; 6 = least important

- 3rd Priority - Animal Health and Nutrition (Average 3.0)
- 4th Priority - Land use – Fertilizer uptake (Average 3.1)
- 5th Priority - Food Irradiation (Average 3.4)
- 6th Priority - Land use – Soil Erosion (Average 4.0)

12.1.2. Thematic Area – Environment

The input provided on this area by the responding NRs is tabulated below:

	National Priority (Y,N)* and Importance of the Project Area (Scale of 1-6)							
MS Response	1	2	3	4	5	6	7	8
Project Area								
Marine and Coastal Environment	Y, 1	Y, 1	Y, 3	Y, 3	Y, 3	Y, 3	Y, 4	Y, 1
Development of Water Resources	Y, 1	Y, 1	Y, 2	Y, 1	Y, 3	Y, 3	Y, 4	Y, 1
Air Pollution	Y, 1	Y, 1	Y, 1	Y, 2	Y, 3	Y, 2	Y, 5	Y, 1

Using the average priority per country as the indicator for relative priority, the priorities for the Environment Thematic Sector are:

- Equal 1st Priority - Development of Water Resources & Air Pollution - Average 2.0
- 3rd Priority - Marine and Coastal Environment

12.1.3 Thematic Sector – Human Health

The input provided on this area by the responding NRs is tabulated below:

	National Priority (Y,N)* and Importance of the Project Area (Scale of 1-6)							
MS Response	1	2	3	4	5	6	7	8
Project Area								
Nuclear Medicine	Y, 1	Y, 1	Y, 2	Y, 1	Y, 2	Y, 1	Y, 6	Y, 1/2
Radiation Oncology	Y, 1	Y, 1	Y, 1	Y, 2	Y, 1	Y, 2	Y, 6	Y, 2/1
Medical Physics	Y, 3	Y, 1	N, 3	Y, 3	Y, 3	Y, 1	Y, 3	Y, 3/1
Radioimmunoassay	N, 5	Y, 2	N, 3	Y, 5	Y, 5	Y, 6	Y, 6	Y, 6/2
Radiation	N,5	Y, 2	N, 3	Y, 4	Y, 3	Y, 1	Y, 6	Y,

Sterilisation of Tissue Grafts									5/2
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Using the average priority per country as the indicator for relative priority, the priorities for the Human Health Thematic Sector are:

- 1st Priority - Radiation Oncology (Average 1.9)
- 2nd Priority - Nuclear Medicine (Average 2.1)
- 3rd Priority - Medical Physics (Average 2.3)
- 4th Priority - Radiation Sterilisation of Tissue Grafts (Average 3.4)
- 5th Priority - Radioimmunoassay (Average 4.4)

12.1.4. Thematic Sector – Industry

The input provided on this area by the responding NRs is tabulated below:

MS Response	National Priority (Y,N)* and Importance of the Project Area (Scale of 1-6)							
	1	2	3	4	5	6	7	8
Project Area								
Industrial applications of Nuclear Tracers and Sealed Sources	Y, 2	Y, 1	Y, 1	Y, 2	Y, 2	Y, 3	Y, 3	
Radiation Processing	N, 5	Y, 1	Y, 1	Y, 1	Y, 1	Y, 1	Y, 3	
Nuclear Gauges and Nucleonic Control Systems	Y, 3	Y, 1	Y, 2	Y, 4	Y, 3	Y, 6	Y, 3	
Non-destructive Testing	N, 3	Y, 1	Y, 1	Y, 3	Y, 1	Y, 1	Y, 3	Y, 1

Using the average priority per country as the indicator for relative priority, the priorities for the Industry Thematic Area are:

- 1st Priority - Non-destructive Testing (Average 1.8)
- Equal 2nd Priority - Radiation Processing & Nuclear Tracers and Sealed Sources (Average 2.0)
- 4th Priority - Nuclear Gauges and Nucleonic Control Systems (Average 3.1)

12.1.5. Other Thematic Areas

The input provided on this area by the responding NRs is tabulated below:

	National Priority (Y,N)* and Importance of the Project Area (Scale of 1-6)							
MS Response	1	2	3	4	5	6	7	8
Project Area								
Energy Planning	N, 6	Y, 1	Y, 1	Y, 1	Y, 1	Y, 1	Y, 1	
Research Reactor Utilisation	Y/N, 4	Y, 1	Y, 2	Y, 2	Y, 2			

Using the average priority per country as the indicator for relative priority, the priorities for these other areas are:

- 1st Priority - Energy Planning (Average 1.7)
- 2nd Priority - Research Reactor Utilisation (Average 2.2)

12.1.6. Recommendations concerning the calculation of priority ranking

As has been shown in the preceding sections, the calculation of the average of the numerical priority assigned by the NRs has been a suitable means of achieving a semi-quantitative ranking of the relative priorities within sectors. This technique has been able to provide a ranking, although it is probable that differences of 0.1 to 0.2 have limited significance. However if NRs were to adopt a standard methodology for assigning priorities for the 2012-2013 RCA Programme, the calculation of rankings would be much more precise and could assist NRs in rapidly achieving objective rankings of priorities and hence facilitate agreement on the make up of the proposals for the 2012-2013 RCA programme.

12.2. Benefits to Member States from Projects in the various Thematic Sectors and Areas

12.2.1 Thematic Sector – Agriculture

The inputs on this thematic sector provided by the responding NRs are tabulated below:

MS Response	1	2	3	4	5	6	7	9
Existence of a National Programme?								
Soil Erosion					Y	Y		
Fertiliser Uptake					Y	Y		
Animal Health					Y	Y		
Plant Breeding		Y		Y	Y	Y		
Food Irradiation	N	Y	Y	Y	Y	Y		N
General Area		Y					Y	
Availability Trained Human Resources?								
Soil Erosion					ND	ND		
Fertiliser Uptake					ND	ND		

Animal Health					A	A		
Plant Breeding		A		A	ND	A		
Food Irradiation	A	A	ND	A	ND	ND		A
General Area		A					A	
Availability Physical Infrastructure?								
Soil Erosion					A	A		
Fertiliser Uptake					A	A		
Animal Health					A	A		
Plant Breeding		A		A	A	UD		
Food Irradiation	N	A	UD	A	A	UD		A
General Area		A					A	
Existence of Protocols, Guidelines or Standards								
Soil Erosion					Y	Y		
Fertiliser Uptake					Y	Y		
Animal Health					Y	Y		
Plant Breeding		Y		Y	Y	Y		
Food Irradiation	Y	Y	Y	Y	Y	Y		Y
General Area		Y					Y	
Existence of National Societies / Professional Bodies?								
Soil Erosion					Y	Y		
Fertiliser Uptake					Y	Y		
Animal Health					Y	Y		
Plant Breeding		Y		Y	Y	Y		
Food Irradiation	N	Y	Y	Y	Y	N		N
General Area		Y					Y	
End users identified? Involved?								
Soil Erosion					Y, Y	Y, ?		
Fertiliser Uptake					Y, Y	Y, ?		
Animal Health					Y, Y	Y, ?		
Plant Breeding		Y, ?		Y, ?	Y, Y	Y, Y		
Food Irradiation	Y, N	Y, ?	Y, ?	Y, Y	Y, Y	Y, N		Y, Y
General Area		Y, ?					Y, ?	
Has the MS benefited from the project?								
Soil Erosion					Y	Y		
Fertiliser Uptake					Y	Y		
Animal Health					Y	Y		
Plant Breeding		EB		Y	Y	Y		
Food Irradiation	Y	Y	Y	Y	Y	Y		Y
General Area		EB					Y	

Y – Yes; N – No / Not Available; A – Available; B – Beneficial; EB – Extremely beneficial; NA – Not applicable; NB – Not beneficial; ND – Needs further development; UD – Under Development; ? – no response provided.

The overall responses for this Thematic Sector provide positive indicators on the performance of the projects and the technical situation at the national level. All Member States have reported that they have benefited from the projects. In general they have the support infrastructure of national programmes, national societies / professional bodies and the existence of protocols, guidelines or standards. Linkages have been identified to end users and half report that they have involvement with them. The main area of need appears to be the availability of trained human resources and some physical infrastructure is under development.

12.2.2 Sector - Energy

The inputs on this sector provided by the responding NRs are tabulated below:

MS Response	1	2	3	4	5	6	7	8
Existence of a National Programme?					Y	N	Y	
Availability Trained Human Resources?					ND	ND	ND	
Availability Physical Infrastructure?					UD	UD	A	
Existence of Protocols, Guidelines or Standards					NA	NA	Y	
Existence of National Societies / Professional Bodies?					N	Y	Y	
End users identified? Involved?					Y, Y	Y, Y	Y, Y	
Has the MS benefitted?					Y	Y	Y	

Y – Yes; N – No / Not Available; A – Available; B – Beneficial; EB – Extremely beneficial; NA – Not applicable; NB – Not beneficial; ND – Needs further development; UD – Under Development; ? – no response provided.

Although there were only three responses from the Member States for this Sector, they did provide overall positive indicators on the performance of the projects and the technical situation at the national level. All Member States have reported that they have benefited from the projects. In general they have limited support infrastructure of national programmes, national societies / professional bodies and

the existence of protocols, guidelines or standards; notwithstanding all report linkages to and involvement with end users. The main area of need appears to be the availability of trained human resources and physical infrastructure is under development.

12.2.3. Thematic Sector - Environment

The inputs on this thematic sector provided by the responding NRs are tabulated below:

MS Response	1	2	3	4	5	6	7	8	9
Existence of a National Programme?									
Air Pollution	Y			Y	Y	Y	Y		Y
Fresh Water Resources	Y		Y	Y		Y	Y		
Marine and Coastal Environment	Y		Y	Y	Y	Y	Y		
General Area		Y						Y	
Availability Trained Human Resources?									
Air Pollution	A			A	ND	A	ND		A
Fresh Water Resources	A		A	ND		ND	ND		
Marine and Coastal Environment	A		ND	ND	ND	ND	ND		
General Area		A						A	
Availability Physical Infrastructure?									
Air Pollution	A			UD	A	A	A		A
Fresh Water Resources	A		A	A		UD	A		
Marine and Coastal Environment	A		A	UD	A	UD	A		
General Area		A						A	
Existence of Protocols, Guidelines or Standards									
Air Pollution	Y			Y	Y	Y	Y		Y
Fresh Water Resources	Y		NA	Y		Y	Y		
Marine and Coastal Environment	NA		Y	NA	N	Y	Y		
General Area		Y						Y	
Existence of National Societies / Professional Bodies?									

Air Pollution	Y			Y	N	Y	Y		Y
Fresh Water Resources	Y		Y	Y		N	N		
Marine and Coastal Environment	Y		Y	Y	N	N	N		
General Area		Y						Y	
End users identified? Involved?									
Air Pollution	Y, ?			Y, Y	Y, N	Y, Y	Y, Y		Y, Y
Fresh Water Resources	Y, ?		Y, Y	Y, ?		Y, Y	Y, Y		
Marine and Coastal Environment	Y, ?		Y, ?	Y, Y	Y, Y	Y, Y	Y, Y		
General Area		Y, ?						Y, ?	
Has the MS benefited from the project?									
Air Pollution	Y			Y	Y	Y	Y		Y
Fresh Water Resources			Y	Y		Y	Y		
Marine and Coastal Environment			Y	Y	Y	Y	Y		
General Area		Y						Y	

Y – Yes; N – No / Not Available; A – Available; B – Beneficial; EB – Extremely beneficial; NA – Not applicable; NB – Not beneficial; ND – Needs further development; UD – Under Development; ? – no response provided.

The overall responses for the Environment Thematic Sector provide positive indicators on the performance of the projects and the technical situation at the national level. All Member States have reported that they have benefited from the projects. In general they have the support infrastructure of national programmes, two thirds have national societies / professional bodies and ~80% have protocols, guidelines or standards. All report linkages to end users and almost two thirds report that they have involvement with them. Almost half have identified the main area of need to be the availability of trained human resources and some physical infrastructure is under development is about one fifth of the responses.

12.2.4. Thematic Sector – Human Health

The inputs on this thematic sector provided by the responding NRs are tabulated below:

MS Response	9	2	3	4	5	6	7	8
Existence of a National Programme?								
Cancer			Y	Y	Y	Y		Y
Joint & Bone								

Disorders								
Medical Physics			N	Y		Y	Y	
Nuclear Medicine Imaging	Y	Y	Y		Y	Y		Y
RIA						Y		
Tissue Grafts					Y	Y		
General Area		Y						
Availability Trained Human Resources?								
Cancer			A	ND	ND	ND		ND
Joint & Bone Disorders								
Medical Physics			ND	A		ND	ND	
Nuclear Medicine Imaging	A	A	ND		ND	ND		A
RIA						ND		
Tissue Grafts					A	ND		
General Area		A						
Availability Physical Infrastructure?								
Cancer			UD	UD	UD	A		A
Joint & Bone Disorders								
Medical Physics			A	UD		UD	UD	
Nuclear Medicine Imaging	A	A	UD		A	UD		A
RIA						UD		
Tissue Grafts					A	A		
General Area		A						
Existence of Protocols, Guidelines or Standards								
Cancer			Y	Y	Y	Y		Y
Joint & Bone Disorders								
Medical Physics			NA	Y		Y	Y	
Nuclear Medicine Imaging	Y	Y	N		Y	Y		N
RIA						Y		
Tissue Grafts					Y	Y		
General Area		Y						
Existence of National Societies / Professional Bodies?								
Cancer			Y	Y	Y	Y		Y
Joint & Bone Disorders								

Medical Physics			Y	Y		N	N	
Nuclear Medicine Imaging	Y	Y	Y		Y	N		Y
RIA						N		
Tissue Grafts					Y	Y		
General Area		Y						
End users identified? Involved?								
Cancer			Y, ?	Y, Y	Y, N	Y, Y		Y, ?
Joint & Bone Disorders								
Medical Physics			Y, ?	Y, Y		Y, Y	Y, ?	
Nuclear Medicine Imaging	Y, Y	Y, Y	Y, ?		Y, ?	Y, Y		Y, ?
RIA						Y, Y		
Tissue Grafts					Y, ?	Y, Y		
General Area		Y, Y						
Has the MS benefited from the project?								
Cancer			Y	Y	N	Y		Y
Joint & Bone Disorders								
Medical Physics			Y	Y		Y	Y	
Nuclear Medicine Imaging	Y	Y	Y		Y	Y		NA
RIA						Y		
Tissue Grafts					Y	Y		
General Area		Y						

Y – Yes; N – No / Not Available; A – Available; B – Beneficial; EB – Extremely beneficial; NA – Not applicable; NB – Not beneficial; ND – Needs further development; UD – Under Development; ? – no response provided.

The overall responses for the Human Health Thematic Sector provide positive indicators on the performance of the projects and the technical situation at the national level. All Member States have reported that they have benefited from the projects. In general they have the support infrastructure of national programmes, ~80% have national societies / professional bodies and a large majority have protocols, guidelines or standards. All have been identified linkages to end users and almost half report that they have involvement with them. The main area of need reported by ~60% appears to be the availability of trained human resources and half report some physical infrastructure is under development.

12.2.5. Thematic Sector - Industry

The inputs on this thematic sector provided by the responding NRs are tabulated below:

MS Response	1	2	3	4	5	6	7	8
Existence of a National Programme?								
NAS & NCS					Y	Y	N	
NDT & Tomography	Y		Y	Y	Y	Y	Y	Y
Radiation Processing		Y		Y	Y	Y		
Tracers and Sealed Sources	Y	Y	Y	Y	Y	Y	Y	
General Area								
Availability Trained Human Resources?								
NAS & NCS					A	A	ND	
NDT & Tomography	A		ND	ND	A	A	ND	ND
Radiation Processing		A		ND	A	ND		
Tracers and Sealed Sources	A	A	ND	A	A	ND	ND	
General Area								
Availability Physical Infrastructure?								
NAS & NCS					A	A	N	
NDT & Tomography	A		UD	UD	A	A	UD	UD
Radiation Processing		A		A	A	UD		
Tracers and Sealed Sources	A	A	UD	A	A	UD	A	
General Area								
Existence of Protocols, Guidelines or Standards								
NAS & NCS					Y		Y	
NDT & Tomography	Y		N	Y	Y	Y	Y	Y
Radiation Processing				Y	Y	N		
Tracers and Sealed Sources	Y	Y	N	Y	Y	N	Y	
General Area								
Existence of National Societies / Professional Bodies?								
NAS & NCS					Y	N	N	
NDT & Tomography	Y		Y	Y	Y	Y	Y	Y
Radiation Processing		Y		N	Y	Y		

Tracers and Sealed Sources	N	Y	N	Y	N	Y	N	
General Area								
End users identified? Involved?								
NAS & NCS					Y, Y	Y, ?	Y, N	
NDT & Tomography	Y, L		Y, Y	Y, Y	Y, Y	Y, ?	Y, Y	Y, ?
Radiation Processing		Y, ?		Y, Y	Y, Y	Y, Y		
Tracers and Sealed Sources	Y, ?	Y, ?	Y, ?	Y, ?	Y, ?	Y, Y	Y, Y	
General Area								
Has the MS benefited from the project?								
NAS & NCS					Y	Y	NA	
NDT & Tomography			Y	Y	Y	Y	Y	Y
Radiation Processing		Y		Y	Y	Y		
Tracers and Sealed Sources	Y	Y	Y	Y	Y	Y	Y	
General Area								

Y – Yes; N – No / Not Available; A – Available; B – Beneficial; EB – Extremely beneficial; L – Limited; NA – Not applicable; NB – Not beneficial; ND – Needs further development; UD – Under Development; ? – no response provided.

The overall responses for the Industry Thematic Sector provide positive indicators on the performance of the projects and the technical situation at the national level. All Member States have reported that they have benefited from the projects. In general they have the support infrastructure of national programmes, ~75% have national societies / professional bodies and ~80% have protocols, guidelines or standards. All have been identified linkages to end users and over half report that they have involvement with them. The main area of need reported by ~60% appears to be the availability of trained human resources and half report some physical infrastructure is under development.

12.2.6 Sector – Research Reactors

The inputs on this sector provided by the responding NRs are tabulated below:

MS Response	1	2	3	4	5	6	7	8
Existence of a National Programme?		Y			Y			
Availability Trained Human Resources?		A			ND			

Availability of Physical Infrastructure?		A			A			
Existence of Protocols, Guidelines or Standards		Y			NA			
Existence of National Societies / Professional Bodies?		Y			Y			
End users identified? Involved?		Y, N			Y, ?			
Has the MS benefitted?		Y			Y			

Y – Yes; N – No / Not Available; A – Available; B – Beneficial; EB – Extremely beneficial; NA – Not applicable; NB – Not beneficial; ND – Needs further development; UD – Under Development; ? – no response provided.

Although there were only two responses from the Member States for this research reactor sector, they did provide overall positive indicators on the performance of the projects and the technical situation at the national level. Both Member States have reported that they have benefited from the projects. In general they have support infrastructure of national programmes and national societies / professional bodies. They report linkages to and involvement with end users. The main area of need for one of them appears to be the availability of trained human resources.

12.3. Sustainability Issues

The inputs on sustainability issues were provided by the responding NRs in Section 2b of the Questionnaire and are tabulated in the sections below for each Thematic Sector or area.

12.3.1 Thematic Sector – Agriculture

MS Response	1	2	3	4	5	6	7	9
Are there additional needs in human resources development?								
Soil Erosion					Y	Y		
Fertiliser Uptake					Y	Y		
Animal Health					Y	Y		
Plant Breeding		Y		Y	Y	Y	Y	
Food Irradiation	Y	Y	Y	Y	Y	Y		N
General Area							Y	

Are there additional needs in physical infrastructure?								
Soil Erosion					Y	Y		
Fertiliser Uptake					Y	Y		
Animal Health					Y	Y		
Plant Breeding		N		Y	Y	Y	Y	
Food Irradiation	N	Y	N	Y	Y	Y		N
General Area							Y	
Is more technical assistance required?								
Soil Erosion					N	Y		
Fertiliser Uptake					Y	Y		
Animal Health					Y	Y		
Plant Breeding		N		Y	Y	Y	Y	
Food Irradiation	N	Y	Y	Y	Y			N
General Area							Y	
Is assistance required for development of Protocols, Guidelines or Standards?								
Soil Erosion					Y	N		
Fertiliser Uptake					Y	N		
Animal Health					Y	Y		
Plant Breeding		N		Y	Y		Y	
Food Irradiation	N	Y	Y	Y	Y	Y		N
General Area							Y	
Is there a shortage of trained staff in this area?								
Soil Erosion								
Fertiliser Uptake								
Animal Health					Y	Y		
Plant Breeding					Y	Y	Y	
Food Irradiation					Y			
General Area							Y	
Is there sufficient national training to maintain project skills and expertise?								
Soil Erosion								
Fertiliser Uptake								
Animal Health					N	N		
Plant Breeding								
Food Irradiation								
General Area								
Is there sufficient national funding?								
Soil Erosion					N			
Fertiliser Uptake						N		
Animal Health						N		
Plant Breeding				N			N	
Food Irradiation						N		
General Area						N		

Y – Yes; N – No / Not Available; A – Available; B – Beneficial; EB – Extremely beneficial; NA – Not applicable; NB – Not beneficial; ND – Needs further development; UD – Under Development; ? – no response provided.

12.3.2 Sector - Energy

MS Response	1	2	3	4	5	6	7	8
Are there additional needs in human resources development?					Y	Y	Y	
Are there additional needs in physical infrastructure?					N	Y	N	
Is more technical assistance required?					Y	Y	Y	
Is assistance required for development of Protocols, Guidelines or Standards?					N	N		
Is there a shortage of trained staff in this area?					Y	Y		
Is there sufficient national training to maintain project skills and expertise?								
Is there sufficient national funding?								

Y – Yes; N – No / Not Available; A – Available; B – Beneficial; EB – Extremely beneficial; NA – Not applicable; NB – Not beneficial; ND – Needs further development; UD – Under Development; ? – no response provided.

12.3.3. Thematic Sector - Environment

MS Response	1	2	3	4	5	6	7	8	9
Are there additional needs in human resources development?									
Air Pollution	N			Y	Y	Y	Y	Y	N
Fresh Water Resources	N		Y	Y		Y	Y		
Marine and Coastal Environment	N		Y	Y	Y	Y			
General Area		Y					Y		
Are there additional needs in physical infrastructure?									
Air Pollution	N			Y	Y	Y	Y	N	N
Fresh Water Resources	N		Y	Y		Y	Y		
Marine and Coastal Environment	Y		Y	Y	N	Y			
General Area		N					Y		
Is more technical assistance required?									
Air Pollution	N			Y	Y	Y	Y	Y	N
Fresh Water Resources	N		Y	Y		Y	Y		
Marine and Coastal Environment	Y		Y	Y	Y	Y			
General Area		N					Y		
Is assistance required for development of Protocols, Guidelines or Standards?									
Air Pollution	N			N	Y	Y	N	N	N
Fresh Water Resources	N		N	Y		Y	N		
Marine and Coastal Environment	N		Y	Y	N	Y			
General Area		Y					N		
Is there a shortage of trained staff in this area?									
Air Pollution					Y				
Fresh Water Resources									
Marine and Coastal Environment					Y	Y			
General Area									

Is there sufficient national training to maintain project skills and expertise?									
Air Pollution									
Fresh Water Resources									
Marine and Coastal Environment									
General Area									
Is there sufficient national funding?									
Air Pollution							N		
Fresh Water Resources							N		
Marine and Coastal Environment						N			
General Area							N		

Y – Yes; N – No / Not Available; A – Available; B – Beneficial; EB – Extremely beneficial; NA – Not applicable; NB – Not beneficial; ND – Needs further development; UD – Under Development; ? – no response provided.

12.3.4. Thematic Sector – Human Health

MS Response	9	2	3	4	5	6	7	8
Are there additional needs in human resources development?								
Cancer			Y	Y	Y	Y	Y	Y
Joint & Bone Disorders								
Medical Physics			Y	Y		Y	Y	
Nuclear Medicine Imaging	N	Y	Y		Y	Y		Y
RIA						Y		
Tissue Grafts					Y	Y		
General Area							Y	
Are there additional needs in physical infrastructure?								
Cancer			Y	Y	Y	Y	Y	Y
Joint & Bone Disorders								
Medical Physics			N	Y		Y	Y	

Nuclear Medicine Imaging	N	N	Y		Y	Y		N
RIA						Y		
Tissue Grafts					Y	Y		
General Area							Y	
Is more technical assistance required?								
Cancer			Y	Y	Y	Y	Y	Y
Joint & Bone Disorders								
Medical Physics			Y	Y		Y	Y	
Nuclear Medicine Imaging	N	N	Y		Y	Y		Y
RIA						Y		
Tissue Grafts					Y	Y		
General Area							Y	
Is assistance required for development of Protocols, Guidelines or Standards?								
Cancer			Y	N	Y		Y	N
Joint & Bone Disorders								
Medical Physics			N	Y		Y	Y	
Nuclear Medicine Imaging	N	N	Y		Y	Y		N
RIA						Y		
Tissue Grafts					N	Y		
General Area							Y	
Is there a shortage of trained staff in this area?								
Cancer						Y		Y
Joint & Bone Disorders								
Medical Physics				Y		Y		
Nuclear Medicine Imaging		Y	Y		Y	Y		Y
RIA								
Tissue Grafts								
General Area								
Is there sufficient national training to maintain project skills and expertise?								
Cancer						N		
Joint & Bone Disorders								
Medical Physics								

Nuclear Medicine Imaging								
RIA								
Tissue Grafts								
General Area								
Is there sufficient national funding?								
Cancer						N	N	N
Joint & Bone Disorders								
Medical Physics							N	
Nuclear Medicine Imaging						N		
RIA								
Tissue Grafts						N		
General Area							N	

Y – Yes; N – No / Not Available; A – Available; B – Beneficial; EB – Extremely beneficial; NA – Not applicable; NB – Not beneficial; ND – Needs further development; UD – Under Development; ? – no response provided.

12.3.5. Thematic Sector - Industry

MS Response	1	2	3	4	5	6	7	8
Are there additional needs in human resources development?								
NAS & NCS					Y	N	Y	
NDT & Tomography	Y		Y	Y	N	Y	Y	Y
Radiation Processing				Y	Y	Y		
Tracers and Sealed Sources	Y		Y	Y	Y	Y		
General Area		Y						
Are there additional needs in physical infrastructure?								
NAS & NCS					N	Y	Y	
NDT & Tomography	Y		N	Y	N	Y	Y	Y
Radiation Processing				Y	Y	Y		
Tracers and Sealed Sources	Y		N	Y	N	Y		
General Area		Y						

Is more technical assistance required?								
NAS & NCS					Y	N	Y	
NDT & Tomography	Y		Y	Y	Y	Y	Y	Y
Radiation Processing				Y	Y	Y		
Tracers and Sealed Sources	Y		N	Y	Y	Y		
General Area		N						
Is assistance required for development of Protocols, Guidelines or Standards?								
NAS & NCS					Y		Y	
NDT & Tomography	Y		Y	Y	N	Y	Y	Y
Radiation Processing				Y	N	N		
Tracers and Sealed Sources	N		N	Y	N	Y		
General Area		N						
Is there a shortage of trained staff in this area?								
NAS & NCS								
NDT & Tomography	Y			Y		Y		
Radiation Processing								
Tracers and Sealed Sources			Y	Y		Y		
General Area								
Is there sufficient national training to maintain project skills and expertise?								
NAS & NCS								
NDT & Tomography								
Radiation Processing								
Tracers and Sealed Sources								
General Area								
Is there sufficient national funding?								
NAS & NCS								
NDT & Tomography								
Radiation Processing				N				
Tracers and Sealed Sources				N				

General Area								
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Y – Yes; N – No / Not Available; A – Available; B – Beneficial; EB – Extremely beneficial; L – Limited; NA – Not applicable; NB – Not beneficial; ND – Needs further development; UD – Under Development; ? – no response provided.

12.3.6 Sector – Research Reactors

MS Response	1	2	3	4	5	6	7	8
Are there additional needs in human resources development?		Y			Y			
Are there additional needs in physical infrastructure?		N			Y			
Is more technical assistance required?		N			Y			
Is assistance required for development of Protocols, Guidelines or Standards?		N			N			
Is there a shortage of trained staff in this area?					Y			
Is there sufficient national training to maintain project skills and expertise?								
Is there sufficient national funding?								

Y – Yes; N – No / Not Available; A – Available; B – Beneficial; EB – Extremely beneficial; NA – Not applicable; NB – Not beneficial; ND – Needs further development; UD – Under Development; ? – no response provided.

12.3.7. Review of the Responses to Section 2b in the Questionnaire

Many of the responses are directly linked to the answers provided in Section 2a and are therefore specific to a particular Member State. However there are some general trends and features of a more general nature that can be drawn from the responses. Almost all responding Member States indicate that they have additional human resource development requirements. In a number of cases this is linked to requests for additional technical assistance in the form of awards of scientific visits or fellowships. A large majority also have indicated that they require assistance with a range of procurement from spare parts to consumables through to major equipment. Although this would appear to be a national responsibility, there is often no corresponding link in the questionnaire by the respondents that this is due to insufficient funding support at the national level. Staff shortages have been identified but it is not clear if these are linked to a shortage of funds or to insufficient available training/education programmes.

These requests for procurement and for scientific visits or fellowships fall outside of the provisions of the RCA programme. However the nature of the responses would seem to indicate that this aspect was not fully appreciated.

A number of the responses request assistance in the promotion of the technologies with either end users or with other Government Departments or Ministries to make them more aware of the nuclear technologies and their advantages.

12.3.8 Gaps and Weaknesses in the RCA Programme

The review of the responses to the questionnaire has revealed that there are some generic gaps or weaknesses in the design of the past RCA projects. The following gaps and weaknesses have been identified by the consultant and it is recommended that consideration be given to addressing these deficiencies when the projects are being designed for the 2012-2013 RCA programme.

The questionnaire responses have clearly shown that the MSs have significant human resource development needs that are not being met by the training programmes in the projects. It would seem that there should be greater consideration given to the exact training needs of all the participating MSs and more consultations between the PLCC, the IAEA TO, the RCA Focal Person and the project design team to ensure that the training events have the required training programme to meet all the participating MSs needs and that the training materials meet the needs, not just for a regional training event, but also for follow up national training programmes being conducted by the MSs as part of their contribution to the overall project effort.

The responses have also indicated a significant level of weakness in the availability of physical infrastructure in some MSs, which could adversely affect the long term sustainability of the technologies in those countries. It is not part of the RCA Programme to provide MSs with resources to address such deficiencies. However the RCA did establish Regional Resource Units (RRUs) some years ago to assist MSs that did not have the required physical infrastructure available to them to enable them to participate more fully in projects. It would seem that greater consideration should be placed on the needs of all the participating MSs as far as access to physical infrastructure is concerned for the successful implementation of a project. The PLCC, the IAEA TO, the RCA Focal Person

and the project design team should ensure that the design of project activities include provision for MSs to access appropriate levels of support from RRUs.

There has been a number of well documented instances in the questionnaire responses where project progress has been inhibited because of insufficient resources to provided support for awareness and promotion activities to key stakeholders. Such barriers have been identified and the overall project design needs to take account of such needs in particular MSs.

While not addressed specifically in the questionnaire responses, it has been apparent that there is insufficient TCDC embodied in the design of the past RCA projects and much greater use needs to be made of this valuable resource, which ought to be incorporated into the basic design of the project. Again this will require thorough researching of the needs of the participating MSs and cooperation between the PLCC, the IAEA TO, the RCA Focal Person and the project design team to achieve effective outcomes.

13. Conclusion

The RCA Programme has delivered significant benefits to the participating MSs. The 119 projects identified in TCPRIDE have delivered the following inputs of training and assistance to the Member States:

- ⇒ 502 RTCs for 8,245 participants;
- ⇒ 191 RWs/RMs for 2,236 participants;
- ⇒ 173 PMs for 2,773 participants;
- ⇒ 124 Fellowships;
- ⇒ 64 Scientific Visits; and,
- ⇒ 1,033 Expert missions.

In total there were 134,167 person days of input and the total expenditure on the programme was US\$59,259,923. This programme has been delivered to the MSs with a focus on 119 projects grouped into nine thematic areas/sectors and 23 technical areas. The MSs have strongly responded that these projects have benefited them and the end of project reports have many examples of the strong outputs and outcomes that such projects can generate. Continuation of this impressive record will require discipline from the MSs in their direction of their priorities to set up the form of the future programme. The establishment of a regional profile for the RCA is a contribution to this task. However a good and effective programme will need to be based on well-targeted and well-designed projects that meet the MSs needs and aspirations and have real and quantifiable outputs and outcomes.

This report provides detailed analyses of both the projects and the MSs' responses to their experiences of the benefits of the projects as well as issues surrounding project sustainability and priorities, which will be considered by the Working Group, scheduled to meet at the IAEA Headquarters in Vienna, 20 to 26 February 2010.

Annex 1

Time Frame for the Development of the Regional Technology Profile

11 September 2009	Approval by 38 th RCA GCM of recommendations concerning the preparation of a Regional Technical Profile.
18 September 2009	Distribution of Questionnaire by RCA Focal Person to National RCA Representatives.
27-30 October 2009	Consultations between RCA Focal Person and Dr John Easey on report structure.
15 November 2009	Date requested by the RCA Focal Person for the return of completed Questionnaires by NRs.
7 December 2009 – 29 January 2010	Contract Period for preparation of Regional Profile by Dr John Easey.
25- 29 January 2010	Consultations between RCA Focal Person and Dr John Easey on finalising the report.
29 January 2010	Distribution of Dr Easey's report to Members of the Working Group for the Development of RCA Strategic Priorities 2012 – 2017.
22-26 February 2010	Working Group Meeting for the Development of RCA Strategic Priorities 2012 – 2017.

Annex 2

MISSION REPORT DR JOHN EASEY

PROJECT AND TASK NUMBER: RAS/0/048 04

27-30 OCTOBER 2009

IAEA, VIENNA, AUSTRIA

MISSION REPORT DR JOHN EASEY

PROJECT AND TASK NUMBER: RAS/0/048 04

DUTY STATION: IAEA, VIENNA, AUSTRIA

DUTY PERIOD: 27-30 OCTOBER 2009

Objective

The purpose of the mission was to collect and compile the information required to carry out drafting the RCA regional profile from reports, other documents and databases available in the Agency and through consultations with the RCA Focal Person to collect the information required to draft the regional profile, which will be done under a home-based assignment.

Outcomes

In discussions with the RCA Focal Person, Mr Mahendra Prinath Dias, Asia and the Pacific Section 1, Division for Asia and the Pacific, Department of Technical Cooperation, it was concluded that there were 119 past and current RCA projects that needed to be evaluated to provide the comprehensive review of the inputs that had been made to the RCA through the projects implemented by the Technical Cooperation programme. Because of the large volume of information that contained in the records held by the IAEA and others, it was concluded that it was important for the key data to be captured and reported upon in a simple format that could be readily reviewed and if possible and suitable presented in a graphical format.

Draft templates for reporting was prepared by the consultant as an example using information taken from all the RCA projects involving water resources. This comprised the following:

1. Project Summary Sheet (Annex 1) which contained the following information:
 - Project Title & Number
 - Implementation Period
 - Project Lead Country
 - Budget (US\$)

- Objectives
 - Listed Participating Member States and Institutes
 - Implementation Achievements – regional events, expert missions, etc.
 - Technological Achievements
 - Additional Notes
2. A chart showing the participation of each RCA Member State in project meetings, technical meetings/workshops and regional training events (Annex 2).
 3. A chart showing the expertise of each RCA Member State that had been utilised in providing training course lecturers, expert missions and the hosting of scientific visits or fellowships (Annex 3).
 4. A summary sheet for all projects carried out in the same technical area (Annex 4).
 5. A chart summarising the expertise provided by the RCA Member States for each of projects in the same technical area (Annex 5).

The major source of the project data was agreed to be the relevant Full Project Status Report (FPSR) and if necessary the information would be supplemented with additional data from TCPRIDE or other information available to the RCA Focal Person. Because of some inconsistencies in the information contained in the FPSR, the following adjustments and assumptions were made to provide a more consistent basis for the overall analysis:

- The start date was taken as the year in which the first activity was implemented rather than the 1st year of approval.
- The project completion date was taken as the year in which the last activity was implemented rather than the date when the project administrative work was completed.
- The list of the Recipient Institutes and Counterparts also details the participating Member States. However the Member States listed with implementation data does not always match this and so this has been separately collated for each project and further analysed in terms of participation in regional training events, regional meeting and workshops and project review and management meetings, since these represent distinct

categories of involvement for the Member States. If a Member State has participated in one or more of a project's regional training events, regional meeting and workshops or project review and management meetings it has been classified as "participating". However if the only input to a project by a Member State has been the provision of lecturing staff, expert assistance or the hosting of Fellows or Scientific visits then this has not been classified as "participation" since this is no more than has been done by the non-RCA countries providing technological input.

- Expert missions carried out by staff of participating Institutes in RCA Member States have been credited to the Member States and not their nationality, if there is difference. Missions carried out by nationals of RCA Member States while serving as IAEA staff are not credited to their country but their status when serving as IAEA technical officers is noted in the project summaries.
- When regional meetings, workshops and project review and management meetings have been hosted by Member States, there are often no formally documented details of the contribution or the participation by the host. For the purposes of these analyses it has been assumed that one person from the host country participated.
- When regional training courses have been hosted by Member States, there are some instances where there are no formally documented details of participation from the host country in either the training event or in the lecturing and instruction tasks. For the purposes of these analyses it has been assumed that one person from the host country participated in each role.
- For the purposes of calculating the input to Member States from regional training courses, the number of working days for the course has been used rather than the difference between the start and finish date. For all other events the time given in the FPSR is taken as the input.

Conclusion

It was agreed that the draft templates designed by the consultant would be used as the basis for the compilation of the data on the RCA projects and it would provide the

specific information recommended by the Working Group on Extending the RCA Medium Term Strategy:

- Compile the following information on or each current and past project:
 - Project title
 - Implementation period
 - Budget
 - Objectives
 - Project achievements
- Prepare a short summary of the main achievements of each project area.
- For each project area prepare a table summarizing the details of participation of the Member States in regional events.

The consultant is available to carry out the task of carrying out the analysis for all of the RCA projects in the period mid November 2009 to mid January 2010 and to present the report in the form of a CD. He is also available to attend the planned Meeting of the Working Group in late February 2010. At this time he will also carry out additional tasks to identify the gaps in each project area that need to be addressed as well as provide information on the current trends in each project area.

Annex 3

Listing of Active and Completed RCA Projects on TCPRIIDE at 15 November 2009

Active

- Management of Technical Cooperation among Developing Countries (RCA) - RAS/0/048.
- Improvement of Crop Quality and Stress Tolerance for Sustainable Crop Production Using Mutation Techniques and Biotechnology - RAS/5/045
- Novel Applications of Food Irradiation Technology for Improving Socioeconomic Development (RCA) – RAS/5/046.
- Enhancing Sanitary and Phytosanitary Treatment of Regional Products for Export by Irradiation (RCA) – RAS/5/050.
- Strengthening Medical Physics through Education and Training (RCA) - RAS/6/038.
- Strengthening Clinical Applications of PET in RCA Member States (RCA) - RAS/6/049.
- Improving Image Based Radiation Therapy for Common Cancers in the RCA region (RCA) – RAS/6/053.⁺
- Characterization and Source Identification of Particulate Air Pollution in the Asian Region (RCA) - RAS/7/015.
- Establishing a Benchmark for Assessing the Radiological Impact of Nuclear Power Activities on the Marine Environment (RCA) - RAS/7/016.
- Harmonizing Nuclear and Isotopic Techniques for Marine Pollution Management at the Regional Level (RCA) - RAS/7/019.
- Assessing Trends in Freshwater Quality Using Environmental Isotopes and Chemical Techniques for Improved Resource Management (RCA) – RAS/8/108.
- Supporting Radiation Processing of Polymeric Materials for Agricultural Applications and Environmental Remediation (RCA) - RAS/8/109.
- Applying Advanced Digital Industrial Radiology and Computed Tomography in Industry and Civil Engineering (RCA) - RAS/8/110.
- Diagnosing Industrial Multiphase Systems by Process Visualization using Radiotracers and Sealed Sources (RCA) - RAS/8/111.
- Sustainability of Regional Radiation Protection Infrastructure (RCA) - RAS/9/042.

⁺ Although this project was amongst the projects approved for the 2009 – 2011 TC cycle, it does not commence implementation until 2010 and therefore was not covered in this review.

Completed

- Regional/WASP Users Workshop (RCA) - RAS/0/012.
- Energy and Nuclear Power Planning (RCA) - RAS/0/013.
- Development of TCDC in Asia and the Pacific (RCA) - RAS/0/015.
- Nuclear Information System (RCA) - RAS/0/19.
- Nuclear Power Planning (RCA) - RAS/0/021.
- Public Acceptance and Trade in Irradiated Food (RCA) – RAS/0/022.
- Energy, Electricity and Nuclear Power Planning (RCA) - RAS/0/023.
- Project Formulation Meetings (RCA) - RAS/0/024.
- Technical Co-operation Among Developing Countries (RCA) - RAS/0/025.
- Comparative Assessment of Electricity Generation Options (RCA) - RAS/0/028.
- Radiation Protection and Networking (RCA) - RAS/0/029
- Role of Nuclear Power and Other Energy Options in Mitigating Greenhouse Gas Emissions (RCA) - RAS/0/033.
- Management of Technical Cooperation among Developing Countries (RCA) - RAS/0/035.
- Role of Nuclear Power and Other Energy Options in Competitive Electricity Markets (RCA) - RAS/0/038.
- Tracing Future Sustainable Paths through Nuclear and Other Energy Options (RCA) - RAS/0/041.
- Formulation of Sustainable Energy Development Strategies in the Context of Climate Change (RCA) - RAS/0/045.
- Regional Workshop on Neutron Activation Analysis (RCA) – RAS/1/006.
- Training Course on Use of Reactor Neutron Beam (RCA) – RAS/1/007.
- Nuclear Instrument Maintenance (RCA) - RAS/4/008.
- Research Reactor Utilization (RCA) - RAS/4/011.
- Disposal of Radioactive Waste from Non-Power Sources (RCA) - RAS/4/016.
- Improving Research Reactor Operation and Utilization (RCA) – RAS/4/019.
- Improvement of Research Reactor Operation and Utilization (RCA) - RAS/4/020.
- Improvement of Research Reactor Operation and Utilization, Phase II (RCA) – RAS/4/022.

- Radioisotope Production and Neutron Beam Applications (RCA) – RAS/4/024.
- Adding Value to Materials through Irradiation with Neutrons (RCA) - RAS/4/026.
- Improving Food Irradiation Process Control and Acceptance (RCA) – RAS/5/020.
- Increasing the Capabilities of Common Grain Legumes (RCA) – RAS/5/021.
- Irradiation as Sanitary & Phytosanitary Food Treatment (RCA) – RAS/5/034.
- Improving Animal Productivity and Reproductive Efficiency (RCA) - RAS/5/035.
- Mutational Enhancement for Genetic Diversity in Rice (RCA) - RAS/5/037.
- Restoration of Soil Fertility and Sustenance of Agricultural Productivity (RCA) - RAS/5/039.
- Enhancement of Genetic Diversity in Food, Pulses, and Oil Crops and Establishment of Mutant Germplasm Network (RCA) - RAS/5/040
- Production of Foot and Mouth Disease Antigen and Antibody ELISA Reagent Kit (RCA) - RAS/5/041.
- Application of Food Irradiation for Food Security, Safety, and Trade (RCA) - RAS/5/042.
- Sustainable Land Use and Management Strategies for Controlling Soil Erosion and Improving Soil and Water Quality (RCA) - RAS/5/043.
- Integrated Approach for Improving Livestock Production Using Indigenous Resources and Conserving the Environment (RCA) - RAS/5/044.
- TC on Brachytherapy of the Uterus Cancer (RCA) - RAS/6/006.
- Train-the-Trainers on Data Processing in Radioimmunoassay (RCA) - RAS/6/010.
- Radioimmunoassay of Thyroid Hormones (RCA) - RAS/6/011.
- TC on Radioimmunoassay and Its Clinical Applications (RCA) - RAS/6/012.
- Use of Computers in Technetium-99m Imaging (RCA) -RAS/6/016.
- Radioimmunoassay for Hepatitis B Diagnosis (RCA) - RAS/6/018.
- Strengthening Nuclear Medicine in RCA Member States (RCA) - RAS/6/022.
- Quality Assurance in Radiation Therapy (RCA) - RAS/6/027.
- Nuclear Medicine Applications (RCA) - RAS/6/028.

- Distance-assisted Training for Nuclear Medicine Technicians (RCA) - RAS/6/029.
- Distance Education in Radiation Oncology (RCA) - RAS/6/033.
- LDR and HDR Brachytherapy in Treating Cervical Cancer (RCA) - RAS/6/035.
- Management of Liver Cancer Using Transarterial Radioconjugate Therapy (RCA) - RAS/6/036.
- Use of Radiosynovectomy in the Management of Patients Suffering from Painful Joint Disorders (RCA) - RAS/6/039.
- Improvement in Quality of Radiotherapy for Frequent Cancers in the Region (RCA) - RAS/6/040.
- Preventing Osteoporosis and Promoting Bone Mass in Asian Populations Using a Food-based Approach (RCA) - RAS/6/041.
- Tumour Imaging Using Radioisotopes (RCA) - RAS/6/042.
- Application of High-Precision 3D Radiotherapy for Predominant Cancers in the RCA region (RCA) - RAS/6/048.
- Radiation Sterilization of Tissue Grafts (RCA) - RAS/7/003.
- Quality Assurance in Radiation Sterilization of Tissue Graft (RCA) - RAS/7/008.
- Enhancing the Sustainability of the Marine Coastal Environment (RCA) - RAS/7/011.
- Diagnosing Osteoporosis Using Nuclear Techniques (RCA) - RAS/7/012.
- Improved Information about Urban Air Quality Management (RCA) - RAS/7/013.
- Industrial Application of Isotopes and Radiation Technology (RCA) - RAS/8/008.
- Radioisotopes in Industry (RCA) - RAS/8/011.
- Isotope Hydrology Workshop and Seminar Support (RCA) – RAS/8/059.
- Industrial Applications of Isotopes and Radiation Technology (RCA) - RAS/8/061.
- Radioisotopes in Industry (RCA) - RAS/8/062.
- Training Course on Advanced Methodologies of Isotope Applications (RCA) - RAS/8/063.
- Radiation and Isotope Applications in Industry (RCA) - RAS/8/064.
- Marine Contaminant and Sediment Transport (RCA) - RAS/8/065.
- Isotopes and Radiation in Industry and Environment (RCA) - RAS/8/068.
- Isotopes and Radiation in Industry and the Environment (RCA) - RAS/8/069.

- Isotopes and Radiation in Industry and the Environment (RCA) - RAS/8/070.
- Isotopes & Radiation for Technical. & Environmental. Sustainable Development. (RCA) - RAS/8/071.
- Better Management of Environment and Industrial Growth - Joint UNDP/RCA (RCA) - RAS/8/076.
- Thematic Programme on Advanced Techniques for Industry (RCA) - RAS/8/077.
- Nucleonic Control Systems and Tracers in Industry (RCA) - RAS/8/078.
- Better Management of the Environment & Industry through Isotope & Radiation Technology (RCA) - RAS/8/080.
- Isotopic and Related Techniques to Assess Air Pollution - Joint UNDP/RCA (RCA) - RAS/8/082.
- Management of Marine Coastal Environmental Pollution (RCA) - RAS/8/083.
- Isotope Use in Managing and Protecting Drinking Water (RCA) – RAS/8/084.
- Non-Destructive Testing and Evaluation (RCA) - RAS/8/085.
- Radiotracers/Sealed Sources/Nucleonic Gauges in Industry (RCA) - RAS/8/086.
- Radiation Processing Application for Agrowaste (RCA) - RAS/8/087.
- Optimization of Mineral Resources Recovery Using Low Radioactivity Portable Nucleonic Gauges (RCA) - RAS/8/089.
- Upgrading Natural Polymers and Environment Conservation Through Radiation Processing (RCA) - RAS/8/090.
- Process Diagnostics and Optimization in Petrochemical Industry (RCA) - RAS/8/091.
- Investigating Environment and Water Resources in Geothermal Areas (RCA) – RAS/8/092.
- Use of Isotopes in Dam Safety and Dam Sustainability (RCA) – RAS/8/093.
- Optimization of Materials in Industry Using Online Bulk Analysis Techniques (RCA) - RAS/8/094.
- Improving Regional Capacity for Assessment, Planning, and Response to Aquatic Environmental Emergencies (RCA) - RAS/8/095.
- Modification of Natural Polymers through Radiation Processing (RCA) - RAS/8/096.
- Isotope Techniques for Groundwater Contamination Studies in Urbanized and Industrial Areas (RCA) – RAS/8/097.

- Radiation Technology for Development of Advanced Materials and for Protection of Health and the Environment (RCA) - RAS/8/098.
- Radioisotope Technology for Natural Resource Exploration and Exploitation (RCA) - RAS/8/099.
- Advanced Industrial Radiography (RCA) - RAS/8/100.
- Assessing Trends in Freshwater Quality Using Environmental Isotopes and Chemical Techniques for Improved Resource Management (RCA) – RAS/8/104.
- Development and Application of Advanced Industrial Radiography and Tomography Techniques (RCA) - RAS/8/105.
- Radiation Processing Applications for Health and the Environment (RCA) - RAS/8/106.
- Raising Productivity in the Coal, Minerals and Petrochemical Industries by using Nucleonic Analysis Systems and Radiotracers (RCA) - RAS/8/107.
- Strengthening of Radiation Protection Infrastructures (RCA) - RAS/9/006.
- Harmonization of Radiation Protection (RCA) – RAS/9/018.
- Environmental Radiation Monitoring and Regional Database (RCA) - RAS/9/024.
- Harmonization of Radiation Protection, Phase IV (RCA) - RAS/9/029.
- Assessment of Radiological Risks (RCA) - RAS/9/031.
- Radiological Emergency Response (RCA) - RAS/9/032.

Annex 4

Standard Project Summary Sheet Format

Project Title & Number:	
Implementation Period:	
Project Lead Country:	
Budget (US\$):	
Objectives:	
Listed Participating Member States and Institutes:	
Implementation Achievements:	<u>Regional Training</u> No. Events: Participating MSs: Total No. MSs Participants: Input to MSs: Person days Hosts: Lecturers: MSs – ; Others -
	<u>Regional Meetings/Workshops</u> No. Events: Participating MSs: Total No. Participants: MSs(); Others: Input to MSs: Person days Hosts:
	<u>Project Related Meetings</u> No. Events: Participating MSs: Total No. Participants: MSs(); Others: Input to MSs: Person days Hosts:

	<u>Fellowships</u>
	Total No. Awards: Recipient MSs: Total Input: Person days Hosts:
	<u>Scientific Visits</u>
	Total No. Awards: Recipient MSs: Total Input: Person days Hosts:
	<u>Experts</u>
	No. Missions: Recipient MSs: Total Input: Person days No. Experts: MSs – ; Others –
Technological Achievements:	
Additional Notes:	

Annex 5

Listing of Projects that were not originally part of the RCA programme during 1990 to 1995.

Project	Comments
Marine Contaminant and Sediment Transport (RCA) - RAS/8/065	This project was funded through extrabudgetary contributions from the USA. At that time RCA Member States rejected it being part of the RCA Programme as they wished to adhere to the principle that non-RCA Member States should not fund RCA projects. In consequence the project was run as a non-RCA regional East Asia Pacific TC Project but it was administered by the RCA Coordinator as part of his wider duties.
Regional/WASP Users Workshop (RCA) - RAS/0/012	These were part of a series of ad hoc RTCs run by the then TC, Training Courses Section for the East Asia Pacific region. They did not formally constitute part of the RCA programme as they were not subject to the RCA processes and procedures. There were administered by the RCA Coordinator as part of his wider duties.
Regional Workshop on Neutron Activation Analysis (RCA) – RAS/1/006	
Training Course on Use of Reactor Neutron Beam (RCA) – RAS/1/007	
Training Course on Brachytherapy of the Uterus Cancer (RCA) - RAS/6/006	
Train-the-Trainers on Data Processing in Radioimmunoassay (RCA) - RAS/6/010	
Training Course on Radioimmunoassay and Its Clinical Applications (RCA) - RAS/6/012	

Annex 6

Animal Health and Production Projects

- Improving Animal Productivity and Reproductive Efficiency (RCA) - RAS/5/035
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Production of Foot and Mouth Disease Antigen and Antibody ELISA Reagent Kit (RCA) - RAS/5/041
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Integrated Approach for Improving Livestock Production Using Indigenous Resources and Conserving the Environment (RCA) - RAS/5/044.
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Summary Chart covering all three Projects in the Area of Animal Health and Production
- Source Profile Chart for Expertise used in RCA Animal Health and Production Projects

Annex 7

Food Irradiation Projects

- Improving Food Irradiation Process Control and Acceptance (RCA) – RAS/5/020
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart
- Public Acceptance and Trade in Irradiated Food (RCA) – RAS/0/022
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart
- Irradiation as Sanitary & Phytosanitary Food Treatment (RCA) – RAS/5/034
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart
- Application of Food Irradiation for Food Security, Safety, and Trade (RCA) - RAS/5/042
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart
- Novel Applications of Food Irradiation Technology for Improving Socioeconomic Development (RCA) – RAS/5/046
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart
- Enhancing Sanitary and Phytosanitary Treatment of Regional Products for Export by Irradiation (RCA) – RAS/5/050
 - Project Summary Sheet
 - Member State’s Participation Chart

- Summary Chart covering all six Projects in the Area of Food Irradiation
- Source Profile Chart for Expertise used in RCA Food Irradiation Projects

Annex 8

Plant Breeding Projects

- Increasing the Capabilities of Common Grain Legumes (RCA) – RAS/5/021
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart
- Mutational Enhancement for Genetic Diversity in Rice (RCA) - RAS/5/037
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart
- Enhancement of Genetic Diversity in Food, Pulses, and Oil Crops and Establishment of Mutant Germplasm Network (RCA) - RAS/5/040
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart
- Improvement of Crop Quality and Stress Tolerance for Sustainable Crop Production Using Mutation Techniques and Biotechnology - RAS/5/045
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart
- Summary Chart covering all four Projects in the Area of Plant Breeding
- Source Profile Chart for Expertise used in RCA Plant Breeding Projects

Annex 9

Soils and Land Use Projects

- Restoration of Soil Fertility and Sustenance of Agricultural Productivity (RCA) - RAS/5/039
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Sustainable Land Use and Management Strategies for Controlling Soil Erosion and Improving Soil and Water Quality (RCA) - RAS/5/043
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Summary Chart covering both Projects in the Area of Soils and Land use
- Source Profile Chart for Expertise used in RCA Soils and Land Use Projects

Annex 10

Energy Projects

- Regional/WASP Users Workshop (RCA) - RAS/0/012
 - Project Summary Sheet
 - Member State’s Participation Chart
- Energy and Nuclear Power Planning (RCA) - RAS/0/013
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart
- Nuclear Power Planning (RCA) - RAS/0/021
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart
- Energy, Electricity and Nuclear Power Planning (RCA) - RAS/0/023
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart
- Comparative Assessment of Electricity Generation Options (RCA) - RAS/0/028
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart
- Role of Nuclear Power and Other Energy Options in Mitigating Greenhouse Gas Emissions (RCA) - RAS/0/033
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart
- Role of Nuclear Power and Other Energy Options in Competitive Electricity Markets (RCA) - RAS/0/038
 - Project Summary Sheet
 - Member State’s Participation Chart

- Source of Expertise Chart
- Tracing Future Sustainable Paths through Nuclear and Other Energy Options (RCA) - RAS/0/041
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Formulation of Sustainable Energy Development Strategies in the Context of Climate Change (RCA) - RAS/0/045
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Summary Chart covering all nine Projects in the Area of Energy
- Source Profile Chart for Expertise used in RCA Energy Projects

Annex 11

Air Pollution Projects

- Improved Information about Urban Air Quality Management (RCA) - RAS/7/013
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Isotopic and Related Techniques to Assess Air Pollution - Joint UNDP/RCA (RCA) - RAS/8/082
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Characterization and Source Identification of Particulate Air Pollution in the Asian Region (RCA) - RAS/7/015.
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Summary Chart covering all three Projects in the Area of Air Pollution
- Source Profile Chart for Expertise used in RCA Air Pollution Projects

Annex 12

Fresh Water Resources Projects

- Isotope Hydrology Workshop and Seminar Support (RCA) – RAS/8/059
 - Project Summary Sheet
- Isotope Use in Managing and Protecting Drinking Water (RCA) – RAS/8/084
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart
- Investigating Environment and Water Resources in Geothermal Areas (RCA) – RAS/8/092
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart
- Use of Isotopes in Dam Safety and Dam Sustainability (RCA) – RAS/8/093
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart
- Isotope Techniques for Groundwater Contamination Studies in Urbanized and Industrial Areas (RCA) – RAS/8/097
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart
- Assessing Trends in Freshwater Quality Using Environmental Isotopes and Chemical Techniques for Improved Resource Management (RCA) – RAS/8/104
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart

- Assessing Trends in Freshwater Quality Using Environmental Isotopes and Chemical Techniques for Improved Resource Management (RCA) – RAS/8/108
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart
- Summary Chart covering all seven Projects in the Area of Fresh Water Resources
- Source Profile Chart for Expertise used in RCA Fresh Water Resources Projects

Annex 13

Marine and Coastal Environment Projects

- Marine Contaminant and Sediment Transport (RCA) - RAS/8/065
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Management of Marine Coastal Environmental Pollution (RCA) - RAS/8/083
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Enhancing the Sustainability of the Marine Coastal Environment (RCA) - RAS/7/011
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Improving Regional Capacity for Assessment, Planning, and Response to Aquatic Environmental Emergencies (RCA) - RAS/8/095
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Establishing a Benchmark for Assessing the Radiological Impact of Nuclear Power Activities on the Marine Environment (RCA) - RAS/7/016
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Harmonizing Nuclear and Isotopic Techniques for Marine Pollution Management at the Regional Level (RCA) - RAS/7/019
 - Project Summary Sheet
 - Member State's Participation Chart

- Summary Chart covering all six Projects in the Area of Marine and Coastal Environment
- Source Profile Chart for Expertise used in RCA Marine and Coastal Environment Projects

Annex 14

Cancer Projects

- TC on Brachytherapy of the Uterus Cancer (RCA) - RAS/6/006
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Nuclear Medicine Applications (RCA) - RAS/6/028
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Distance Education in Radiation Oncology (RCA) - RAS/6/033
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- LDR and HDR Brachytherapy in Treating Cervical Cancer (RCA) - RAS/6/035
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Management of Liver Cancer Using Transarterial Radioconjugate Therapy (RCA) - RAS/6/036
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Improvement in Quality of Radiotherapy for Frequent Cancers in the Region (RCA) - RAS/6/040
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Application of High-Precision 3D Radiotherapy for Predominant Cancers in the RCA region (RCA) - RAS/6/048
 - Project Summary Sheet

- Member State’s Participation Chart
- Source of Expertise Chart
- Summary Chart covering all seven Projects in the Area of Cancer
- Source Profile Chart for Expertise used in RCA Cancer Projects

Annex 15

Joint and Bone Disorders Projects

- Use of Radiosynovectomy in the Management of Patients Suffering from Painful Joint Disorders (RCA) - RAS/6/039
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Diagnosing Osteoporosis Using Nuclear Techniques (RCA) - RAS/7/012
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Preventing Osteoporosis and Promoting Bone Mass in Asian Populations Using a Food-based Approach (RCA) - RAS/6/041.
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Summary Chart covering all three Projects in the Area of Joint and Bone Disorders
- Source Profile Chart for Expertise used in RCA Joint and Bone Disorders Projects

Annex 16

Medical Physics Projects

- Strengthening Medical Physics through Education and Training (RCA) - RAS/6/038
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Summary Chart covering all three Projects in the Area of Medical Physics
- Source Profile Chart for Expertise used in RCA Medical Physics Projects

Annex 17

Nuclear Medicine Imaging Projects

- Nuclear Instrument Maintenance (RCA) - RAS/4/008
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Use of Computers in Technetium-99m Imaging (RCA) -RAS/6/016
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Strengthening Nuclear Medicine in RCA Member States (RCA) - RAS/6/022
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Distance-assisted Training for Nuclear Medicine Technicians (RCA) - RAS/6/029
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Tumour Imaging Using Radioisotopes (RCA) - RAS/6/042
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Strengthening Clinical Applications of PET in RCA Member States (RCA) - RAS/6/049
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Summary Chart covering all three Projects in the Area of Nuclear Medicine Imaging

- Source Profile Chart for Expertise used in RCA Nuclear Medicine Imaging Projects

Annex 18

Radioimmunoassay Projects

- Train-the-Trainers on Data Processing in Radioimmunoassay (RCA) - RAS/6/010
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Radioimmunoassay of Thyroid Hormones (RCA) - RAS/6/011
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- TC on Radioimmunoassay and Its Clinical Applications (RCA) - RAS/6/012
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Radioimmunoassay for Hepatitis B Diagnosis (RCA) - RAS/6/018
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Summary Chart covering all three Projects in the Area of Radioimmunoassay
- Source Profile Chart for Expertise used in RCA Radioimmunoassay Projects

Annex 19

Tissue Graft Projects

- Radiation Sterilization of Tissue Grafts (RCA) - RAS/7/003
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Quality Assurance in Radiation Sterilization of Tissue Graft (RCA) - RAS/7/008
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Summary Chart covering both Projects in the Area of Tissue Grafts
- Source Profile Chart for Expertise used in RCA Tissue Grafts Projects

Annex 20

Industrial Applications Projects

Industrial Application of Isotopes and Radiation Technology Phase I & II -
RAS/79/061 & RAS/86/073

- Industrial Application of Isotopes and Radiation Technology (RCA) - RAS/8/008
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Radioisotopes in Industry (RCA) - RAS/8/011
 - Project Summary Sheet
 - Source of Expertise Chart
- Industrial Applications of Isotopes and Radiation Technology (RCA) - RAS/8/061
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Radioisotopes in Industry (RCA) - RAS/8/062
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Training Course on Advanced Methodologies of Isotope Applications (RCA) - RAS/8/063
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Radiation and Isotope Applications in Industry (RCA) - RAS/8/064
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Summary Chart covering all six Projects in the UNDP Industrial Projects RAS/79/061 & RAS/96/073

- Source Profile Chart for Expertise used in the UNDP Industrial Projects RAS/79/061 & RAS/96/073

The use of Isotopes & Radiation to Strengthen Technology and Support Environmentally Sustainable Development - RAS/92/073

- Isotopes and Radiation in Industry and Environment (RCA) - RAS/8/068
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Isotopes and Radiation in Industry and the Environment (RCA) - RAS/8/069
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Isotopes and Radiation in Industry and the Environment (RCA) - RAS/8/070
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Isotopes & Radiation for Technical. & Environmental. Sustainable Development. (RCA) - RAS/8/071
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Summary Chart covering all four Projects in the UNDP Industrial Project RAS/92/073
- Source Profile Chart for Expertise used in the UNDP Industrial Project RAS/92/073

Better Management of the Environment, Natural Resources and Industrial Growth through Isotope and Radiation Technology – RAS/97/030

- Better Management of Environment and Industrial Growth - Joint UNDP/RCA (RCA) - RAS/8/076
 - Project Summary Sheet
 - Member State's Participation Chart

- Source of Expertise Chart
- Thematic Programme on Advanced Techniques for Industry (RCA) - RAS/8/078
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Better Management of the Environment & Industry through Isotope & Radiation Technology (RCA) - RAS/8/080
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Summary Chart covering all three industry related projects in the UNDP Industry and Environment Project RAS/97/030
- Source Profile Chart for Expertise used in the three industry related projects in the UNDP Industry and Environment Project RAS/97/030

Annex 21

Nucleonic Control Systems & Nuclear Analytical Systems Projects

- Optimization of Mineral Resources Recovery Using Low Radioactivity Portable Nucleonic Gauges (RCA) - RAS/8/089
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Optimization of Materials in Industry Using Online Bulk Analysis Techniques (RCA) - RAS/8/094
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Summary Chart covering both Projects in the Area of Nucleonic Control Systems & Nuclear Analytical Systems
- Source Profile Chart for Expertise used in RCA Nucleonic Control Systems & Nuclear Analytical Systems Projects

Annex 22

Non-Destructive Testing & Tomography Projects

- Non-Destructive Testing and Evaluation (RCA) - RAS/8/085
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Advanced Industrial Radiography (RCA) - RAS/8/100
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Development and Application of Advanced Industrial Radiography and Tomography Techniques (RCA) - RAS/8/105
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Applying Advanced Digital Industrial Radiology and Computed Tomography in Industry and Civil Engineering (RCA) - RAS/8/110
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Summary Chart covering all four Projects in the Area of Fresh Water Resources
- Source Profile Chart for Expertise used in RCA Fresh Water Resources Projects

Annex 23

Radiation Processing Projects

- Radiation Processing Application for Agrowaste (RCA) - RAS/8/087
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Upgrading Natural Polymers and Environment Conservation Through Radiation Processing (RCA) - RAS/8/090
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Modification of Natural Polymers through Radiation Processing (RCA) - RAS/8/096
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Radiation Technology for Development of Advanced Materials and for Protection of Health and the Environment (RCA) - RAS/8/098
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Radiation Processing Applications for Health and the Environment (RCA) - RAS/8/106
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Supporting Radiation Processing of Polymeric Materials for Agricultural Applications and Environmental Remediation (RCA) - RAS/8/109
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart

- Summary Chart covering all six Projects in the Area of Radiation Processing
- Source Profile Chart for Expertise used in RCA Radiation Processing Projects

Annex 24

Tracers & Sealed Source Technology Projects

- Nucleonic Control Systems and Tracers in Industry (RCA) - RAS/8/078
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Radiotracers/Sealed Sources/Nucleonic Gauges in Industry (RCA) - RAS/8/086
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Process Diagnostics and Optimization in Petrochemical Industry (RCA) - RAS/8/091
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Radioisotope Technology for Natural Resource Exploration and Exploitation (RCA) - RAS/8/099
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Raising Productivity in the Coal, Minerals and Petrochemical Industries by using Nucleonic Analysis Systems and Radiotracers (RCA) - RAS/8/107
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Diagnosing Industrial Multiphase Systems by Process Visualization using Radiotracers and Sealed Sources (RCA) - RAS/8/111
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart

- Summary Chart covering all six Projects in the Area of Fresh Water Resources
- Source Profile Chart for Expertise used in RCA Fresh Water Resources Projects

Annex 25

Radioactive Waste Projects

- Disposal of Radioactive Waste from Non-Power Sources (RCA) - RAS/4/016
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Summary Chart covering the Project in the Area of Radioactive Waste
- Source Profile Chart for Expertise used in RCA Radioactive Waste Projects

Annex 26

Radiation Protection Projects

- Strengthening of Radiation Protection Infrastructures (RCA) - RAS/9/006
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Harmonization of Radiation Protection (RCA) – RAS/9/018
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Radiation Protection and Networking (RCA) - RAS/0/029
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Environmental Radiation Monitoring and Regional Database (RCA) - RAS/9/024
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Harmonization of Radiation Protection, Phase IV (RCA) - RAS/9/029
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Assessment of Radiological Risks (RCA) - RAS/9/031
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Radiological Emergency Response (RCA) - RAS/8/032
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart

- Sustainability of Regional Radiation Protection Infrastructure (RCA) - RAS/9/042
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Summary Chart covering all eight Projects in the Area of Radiation Protection
- Source Profile Chart for Expertise used in RCA Radiation Protection Projects

Annex 27

Research Reactor Utilisation Projects

- Regional Workshop on Neutron Activation Analysis (RCA) – RAS/1/006
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart
- Training Course on Use of Reactor Neutron Beam (RCA) – RAS/1/007
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart
- Research Reactor Utilization (RCA) - RAS/4/011
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart
- Improving Research Reactor Operation and Utilization (RCA) – RAS/4/019
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart
- Improvement of Research Reactor Operation and Utilization (RCA) - RAS/4/020
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart
- Improvement of Research Reactor Operation and Utilization, Phase II (RCA) – RAS/4/022
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart

- Radioisotope Production and Neutron Beam Applications (RCA) – RAS/4/024
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart
- Adding Value to Materials through Irradiation with Neutrons (RCA) - RAS/4/026
 - Project Summary Sheet
 - Member State’s Participation Chart
 - Source of Expertise Chart
- Summary Chart covering all eight Projects in the Area of Research Reactor Utilisation
- Source Profile Chart for Expertise used in RCA Research Reactor Utilisation Projects

Annex 28

Technical Cooperation among Developing Countries (TCDC) Projects

- Strengthening of Radiation Protection Infrastructures (RCA) - RAS/9/006
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Harmonization of Radiation Protection (RCA) – RAS/9/018
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Radiation Protection and Networking (RCA) - RAS/0/029
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Environmental Radiation Monitoring and Regional Database (RCA) - RAS/9/024
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Harmonization of Radiation Protection, Phase IV (RCA) - RAS/9/029
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Assessment of Radiological Risks (RCA) - RAS/9/031
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Radiological Emergency Response (RCA) - RAS/8/032
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart

- Sustainability of Regional Radiation Protection Infrastructure (RCA) - RAS/9/042
 - Project Summary Sheet
 - Member State's Participation Chart
 - Source of Expertise Chart
- Summary Chart covering all eight Projects in the Area of Radiation Protection
- Source Profile Chart for Expertise used in RCA Radiation Protection Projects

Annex 29

Member States Questionnaire