



## **Meeting Report**

### **Kick-Off Meeting of RCA-UNDP Project on Electron Beam Applications for Value Addition to Food and Industrial Products and Degradation of Environmental Pollutants in the Asia Pacific region 2-3 May 2013, Hilton Hotel, Phuket, Thailand**

The Kick-Off Meeting of RCA-UNDP Project on Electron Beam Applications for Value Addition to Food and Industrial Products and Degradation of Environmental Pollutants in the Asia Pacific region was held on 2-3 May 2013 at Hilton Hotel in Phuket, Thailand. Among the 23 participants include: Mr. Vichian Vongsmarn, Deputy Secretary-General of Office of Atoms for Peace of Thailand; Mr. Denis Nkala, Regional Coordinator of the UNDP South-South Cooperation Unit; Dr. Ju-woon Lee, Lead Country Coordinator; Mr. Kun-mo Choi, Director of RCARO; and 18 participants from 15 countries such as Australia, China, India, Indonesia, Korea, Malaysia, Myanmar, New Zealand, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, Vietnam and Cambodia. The list of participants is set forth in Annex 1.

#### **1. Opening**

##### **1.1. Opening by Mr. Kun-mo CHOI, Director, RCARO**

Mr. Kun-mo CHOI, Director of RCARO as well as the meeting organizer, declared open the meeting and welcomed the participants. He thanked Mr. Vichian Vongsmarn, Deputy Secretary-General of Office of Atoms for Peace of Thailand for co-hosting the meeting. He also thanked Dr. Ju-woon Lee who is LCC of the project as well as RCARO for all the support provided in organizing and planning the meeting.

He outlined the efforts of RCARO to build partnerships in delivering its mandate and further noted that this project is the third RCA-UNDP partnership project led by RCARO since the first one in 2006. He also stressed the objective of this project and importance of joint endeavours of regional and international communities to ensure the success of the project.

He wished the project a good success and thanked again those who made every support and assistance for the meeting.

##### **1.2. Congratulatory Remarks by Mr. Denis Nkala, Regional Coordinator of the UNDP South-South Cooperation Unit**

On behalf of the United Nations Office for South-South Cooperation, Mr. Denis Nkala, Regional Coordinator, delivered the congratulatory remarks. He thanked RCARO for its invitation to the meeting. He introduced the partnership with the Korean government, so called "The Korean Facility," to offer knowledge and approaches of Korea's recent

development experiences across the globe.

He appreciated RCARO for its successful implementation of the first project and also congratulated for being awarded the second grant with the project which encompasses several sectors. He concluded his remarks by congratulating all the participating countries and RCARO on the launching of the project.

### **1.3. Congratulatory Remarks by Mr. Vichian Vongsmarn, Deputy Secretary-General of the Office of Atoms for Peace of Thailand**

Mr. Vichian Vongsmarn welcomed the participants and thanked the RCARO for organizing the meeting. He wished beneficial outcomes of the project to enhance the level of electron beam technology in the region as well as a productive and successful meeting.

### **1.4. Welcoming Remarks by Dr. Ju-woon LEE, Lead Country Coordinator, Director of Advanced Radiation Technology Institute, Korea Atomic Energy Research Institute**

Dr. Ju-woon LEE welcomed the participants as the LCC of the project and wished every success of the meeting.

### **1.5. Election of Chairpersons and Rapporteurs**

Dr. Suwanmala, the NPC of Thailand, was elected as the chair of the session I while Dr. Ju-woon LEE, Lead Country Coordinator, as the chair of the session II to review the implementation plan of the training courses and work plan for 2013-2015. Dr. Kaushlesh Pansinah Rawat, Dr. Nadeem Akhtar and Ms. Hyun-kyoung Jeon were elected as rapporteurs.

The agenda of the meeting was presented and adopted with no adjustments (Annex 2).

The opening session ended with a group photograph.

### **Session I Overview and country presentations**

The session was chaired by Dr. Phiriyatorn Suwanmala, NPC of Thailand.

Dr. In-seok OH (Head of Programme Division, RCARO) presented the overview, objectives and benefits of the project including the detailed work plan and administrative guidelines for the project. The roles and responsibilities of major stakeholders of the project were also underlined in his presentation.

Dr. Ju-woon LEE presented the summary and analysis of the country reports on the current status of the Electron Beam Applications for Value Addition to Food and Industrial Products and Degradation of Environmental Pollutants in the participating countries. He highlighted a wide gap in place among participating countries which should be bridged by raising-up facilities, enhancing knowledge and technologies, enriching human resources and promoting inter-regional/international cooperation. The summary table of member states is given in Annex 3.

## **2. Country Presentations**

Participants presented their country report with emphasis on national needs, expectations and contributions for the project. During the presentation, Mr. Denis Nkala raised the issue of public acceptance and safety of the irradiated food. In this regard, Mr. Kun-mo Choi gave an opinion that the IAEA and Member States should exert more efforts to resolve this matter and Dr. Khoo Gek Hoon, Singapore, said that engaging governmental agencies for safety issue will be also useful and necessary. The country reports are summarized as follows:

### **2.1. Australia**

Dr. Richard Bela Banati, Professor, Australian Nuclear Science and Technology Organization, made a presentation:

Currently, in Australia, three Co-60 commercial irradiators are being used for irradiation of herbs, spices, herbal infusions, and fruits. A small scale Co-60 facility is also available at ANSTO for research in Food & Agriculture, Healthcare, and Materials. Domestically, the use of irradiation is limited due to the availability of cheaper chemical treatments. However, the use of chemicals is now under review and has been restricted. This will increase the need for use of radiation technology. Australia now has approval for the phytosanitary use of irradiation for exports, to both domestic and international markets.

Food Standards, Australia New Zealand (FSANZ) regulates the food irradiation in Australia. The Australian Quarantine Inspection Service has established accreditation schemes for irradiation facilities (in Australia and off shore). Australia is also developing a team of qualified auditors for the on and off shore gamma schemes.

Research is also being undertaken in several international collaboration projects funded by the Australian Centre for International Agricultural Research (ACIAR). The future proposed irradiation research include Electron accelerator with target for x-rays to replace ANSTO gamma facility, Variable energies 5-10 MeV, and Food research using high energy photons.

### **2.2. China**

Dr. Xu Zhi Xiong, Deputy Division Director, China Atomic Energy Authority, made a presentation:

More than 200 Electron Beam Accelerators are operating in China in Chemical Industry, Food & Agriculture, Environment, and Equipment Manufacturing. Some of the current achievements include (i) the application of Radiation Processed Hydro-Gels containing natural polymers for environmental remediation, (ii) Commercialization of Radiation-degraded Chitosan and its products are in use in numerous fields like aquaculture, agriculture, and human health, (iii) Treatment of industrial waste water, and (iv) Commercialized Food irradiation.

Chinese Government has a policy of Clean Production, and Energy savings & discharge reductions. Hence, the faster growing EB technology in China will contribute more to pursue this policy. In coming years, China will witness a very high demand of extensive applications of radiation technology in the areas of Food processing, Environment, and Chemical Industry particularly for cables of nuclear power, aviation, marine, urban rail and locomotive transit.

The R&D activities related to radiation technology are also taking place extensively in the areas of Advanced Materials, Environmental Remediation, and Food Irradiation through various Chinese universities and other major research institutes which also serve as a big source of producing the required capable human resource.

Through this project, China expects to commercialize the scientific research results, to improve the economy and efficiency of EB applications, to establish the standards system for radiation-processed products, to train the human resource, and to create public awareness about radiation technology applications.

### **2.3. India**

Dr. Kaushlesh Pansinah Rawat, Scientific Officer, Bhabha Atomic Research Center, made a presentation:

In India, two electron beam accelerators (2MeV) are being used for various purposes like EB crosslinking of polyethylene 'O' ring, Degradation of Polytetrafluoroethylene (PTFE), Wastewater treatment, Shelf life extension of meat products (R & D scale), Development of EB crosslinkable formulation for wires and cables, Special grade paper pulp for viscose rayon industry, Color enhancement of precious stones, EB processing of Automobile components, and EB Processing dosimetry. Moreover, six EB accelerators are also in operation in private sector for crosslinking cable insulation and other polymer materials. A 10 MeV EB accelerator is indigenously built and is being tested to take up food irradiation and sterilization of medical products.

In addition to industrial uses, some research work on EB technology is also being done in radiation grafted membranes/ materials, nanocomposites for special applications, sewage sludge & wastewater treatment, and EB dosimetry.

India is also developing its manpower capabilities in radiation technology through its various educational and research institutions.

India expects that the outcome of the joint collaborative studies will be helpful in development of industrial polymer products and enhanced indigenous capability in developing high performance materials, demonstration of sewage sludge and wastewater treatment on semi-pilot scale by using electron beam machine, EB technology availability & adaptability, and Knowledge dissemination amongst the countries.

### **2.4. Indonesia**

Dr. Darmawan Darwis, Head of Center for Application of Isotope and Radiation Technology, BATAN, made a presentation:

The Government of Indonesia has a policy to create new alternatives of energy. Indonesia is one of the biggest producer and exporter of Crude Palm Oil in the world. Hence a large quantity of Oil Palm Empty Fruit Bunch (OPEFB) is produced as a waste which can be converted into biofuel by using EB and Gamma Radiation Technology. In 2011, a preliminary study of degradation of cellulose using Electron Beam has been done.

The R&D on the application of Gamma rays for food is being done since three decades but now Indonesia has also a plan for Application of EB Technology for Food preservation,

particularly mushrooms, cacao, and chili powder to overcome the losses and to reduce the international quarantine barriers.

Their expectation from the project includes exchange of information for the application of EB in Food and environment industries, to enhance the manpower capabilities, and to facilitate a network between the participating institutes.

## **2.5. Korea**

Dr. Ju-woon Lee, LCC and Director of Advanced Radiation Technology Institute, made a presentation:

The Korea government has enacted laws intensively fostering Radiation Technology (RT), and formulated its policies in 2000. Based on the promotion laws of radiation and radioisotope (RI) utilization, Advanced Radiation Technology Institute (ARTI) which is a branch institute of Korea Atomic Energy Research Institute (KAERI) was established in 2006. Also, with a mid- and long-term national plan to promote RT set up in 2011, its 1<sup>st</sup> step is in progress (2012-2016). The mid- and long-term plan contained details such as RT related research project, industrialization, manpower training, expansion of infrastructure, and international cooperation as well as a system which encompass Industry-University-Institute collaboration. ARTI is a unique national research institute specializing in utilization researches for radiation chemistry and biology, radiation fusion technology (RFT), radiation equipments, and 30 MeV cyclotron. RFT is an area of research to develop various application technologies necessary to our real life by studying the reaction characteristics between the high energy ionized radiation (gamma ray, electron beam, X-ray) and certain substances.

Also, researches for developing radiation generating equipment and measuring instruments are in progress in the area of radiation equipment research. ARTI has key facilities including two gamma irradiation facilities, one gammaphytotron facility, one gamma cell for animal study, two electron beam irradiation facilities, one 30 MeV cyclotron facility, and research supporting facilities including breeding farm, mutation breeding center, central instrument analyzing laboratory, animal testing center, and RI-Biomics center. These facilities are being shared with Industry-University-Institute, and lead the advancement of national RT. ARTI is actively promoting the commercialization and practical application of research outcomes.

## **2.6. Malaysia**

Dr. Zulkafli Ghazali, Principal Research Officer, Malaysian Nuclear Agency, made a presentation:

The existing radiation facilities at Nuclear Malaysia include two Co-60 plants, an EB Accelerator, a UV Irradiation System and a High Powered UV-fusion Lamp. It was also reported that various companies in Malaysia have been using electron beam accelerators for irradiation of industrial products such as tires, wires & cables and medical devices. Malaysia has also participated in various IAEA supported CRPs on radiation processing that include natural polymers and nano material. Over a period of years Nuclear Malaysia have conducted research work that utilized electron beam processing on natural and synthetic polymers. These work has developed many useful and potential products like 'Oligochitosan' and "Electrospun Polymer Nanofiber based natural Rubber". Products such as oligochitosan, sago hydrogel, chitosan hydrogel and radiation crosslinkable flame retardant compound are now being commercialized by local industry. It has been pointed out that there is a lot of potential

of electron beam processing in food related industries for example food irradiation (preservation/pasteurization etc.) in Malaysia. The industry needs in depth information about the technology and thus more promotional activities, trainings, technical information on standards & regulatory are necessary. Participation in workshops/regional training courses on EB applications and knowledge sharing with member countries is therefore highly recommended.

## **2.7. Myanmar**

Dr. Lei Lei Oo, Director, Ministry of Science and Technology, made a presentation: Currently, there is only one Gamma radiation facility available in Myanmar which is being used for the research activities like mutation breeding, food preservation, sterilization etc. It also provides irradiation services for Food and Industrial products on a small scale. Myanmar is an exporter of agriculture and food products and wants the application of EB technology, on a large scale, for food safety, agricultural & industrial products, and environmental pollutants. Hence, in order to enhance the application of radiation technology, it needs infrastructure and human resource development through training courses, workshops and consultancies. Myanmar expects from this project to help in achieving its goals.

## **2.8. New Zealand**

Dr. Andreas Markwitz, Head, Institute of Geological and Nuclear Sciences, made a presentation:

In New Zealand, the Electron Beam Annealer is being operated by “GNS Science” for Industrial products development. These computer-controlled Annealers are built by GNS and are being used by various companies in New Zealand since many years. Currently the projects are underway in the Titanium Industry-*surface hardening and surface engineering*, and Environment Sensor Industry.

## **2.9. Pakistan**

Dr. Nadeem Akhtar, Principal Scientist, Optics Laboratories, made a presentation:

Pakistan is an agricultural country and produces a tremendous variety of food but due to the lack of using modern techniques and very limited units of food processing units, huge post harvest losses occur. So the use of Radiation Technology on a large scale will definitely reduce these losses. Currently, there is no Electron Beam facility available in the country, however only two institutes use Co-60 gamma radiation for R&D and commercial food irradiation on a very limited scale. Pakistan has also participated in various IAEA CRPs on food irradiation.

In addition to this, Pakistan faces a lot of problems regarding environmental pollution and sterilization of healthcare products and needs to introduce the Radiation Technology to overcome these problems. Some R&D work is also being done on value addition of polymers by radiation. Hence there is a huge potential for application of Electron Beam Radiation in the country. A small scale EB processing units are also under consideration, but at present, Pakistan needs a trained manpower for EB Technology and around 18 EB machines to be used in Food, environment and healthcare industries.

## **2.10. Philippines**

Dr. Neil Raymund Guillermo, Supervising Science Research Specialist, Philippine Nuclear Research Institute, made a presentation:

There are only two companies in Philippines that are using Electron Beam technology for commercial purposes, whereas no facility is currently available for R&D activities. However, the establishment of an EB facility, to be provided by EB Tech Korea, is in progress to meet the country's R&D requirements in different areas like wires and cables cross-linking, medical product sterilization, meat product decontamination, etc. A detailed Plan has been chalked out to get maximum benefits, once the EB facility is established. To execute this plan, Philippines needs experienced manpower and technical expertise to handle EB Technology, and also to involve various research institutes and other stakeholders in the industry including the media for creating public awareness. Moreover, some operational requirements include dosimeters and dosimetry calibration services, additional carts for the cart conveyor, under beam handling system for wires, cables and heat shrinkable sheets and materials.

Philippines expects from this project to enhance its human resource capabilities, and to have a forum for information sharing & expert opinions, training materials, courses and workshops on EB technology.

Philippines is also willing to contribute to this project in terms of providing linkages and assistance to the member states and offering its EB facility for trainings and demonstrations.

## **2.11. Singapore**

Ms. Khoo Gek Hoon, Director for Post-Harvest Technology Department of Agri. Food & Veterinary Authority, presented the country report for Singapore. Key issues discussed are as follows:

Currently, in Singapore, electron beam (EB) technology is used in the industrial sector for applications such as tempering of cables, curing of printing media on packaging materials, vaporizing of materials in ingot form for deposition onto aircraft parts and precision welding of aircraft components. There is limited application of radiation technology on food products in the food industry mainly due to the inadequate financial resources for EB facility establishment and lack of knowledge and expertise in the application of EB technology on food products. Nonetheless, an existing regulatory framework exists for the control of irradiated food products.

Singapore recognizes the potential of application of EB technology on food products and expects that this project will enable it to develop the required expertise through transfer of knowledge, enhanced research activities and training courses. Building up the requisite technical capability will also facilitate Singapore in exploring the extension of EB application beyond the realm of the food industry, i.e. such as in environment remediation.

## **2.12. Sri Lanka**

Dr. Wickramanayake, Director, Atomic Energy Authority, made a presentation:

The current activities in Sri Lanka regarding Radiation Technology include radiation processing of natural polymer for applications in agriculture, and mutation breeding by irradiation of plant seeds. The establishment of multipurpose gamma irradiator is in progress.

A feasibility study has also been conducted to establish an EB Service center in Sri Lanka. The potential areas for EB applications are Wire & Cable Industry, Tyre Industry, Environmental Pollution control, and Food Irradiation. Sri Lanka needs to get know how of EB technology through trainings, expert assistance, collaboration, and technology transfer. It also expects to establish an EB facility with a medium energy for research and demonstration in the country.

### **2.13. Thailand**

Dr. Phiriyatorn Suwanmala, Senior Nuclear Scientist, Thailand Institute of Nuclear Technology, made a presentation:

In Thailand, the Radiation Technology is being used for R&D work in the areas of Medical & Public Health, Biotechnology & Agriculture, Material Science and Industry, Natural Resources & Environment etc. Currently, one EB and three Co-60 facilities are available in Thailand. The Gamma Radiations are used for medical examination & diagnosis, radiotherapy, sterilization, vaccine preparation, crop improvement, pests' control, food irradiation, gemstone irradiation, isotope hydrology, etc while the EB Technology is only being used at Gems Irradiation Center (GIC) for value addition of gemstones through irradiation. Some research has also been done to study the effect of Electron Beam on the properties of Herbs.

Thailand is amongst the world's leading producers and exporters of Concentrated Natural Rubber Latex and Latex Products. The application of EB Technology for vulcanization of natural rubber latex will give a competitive edge to the Thai industry. Thailand also needs a new EB and an X-Ray facility by 2016 for irradiation of agriculture products for export purpose.

They expect that this project will be helpful to overcome environmental problems, value addition to food and other industrial products and to establish a network amongst the scientists.

### **2.14. Vietnam**

Dr. Tran Khac An, Director, Research and Development Center for Radiation Technology, made a presentation:

The Vietnam Government made a detailed plan in 2011 to develop Application of Radiations in industry and other technical and economic sectors by 2020. They have planned to establish 03 irradiation centers and an organization for the development of Applications of Radiation Technology. Currently there are only two accelerators being used by two companies for irradiation of food, gemstones and sterilization of healthcare products. Vietnam has also participated in two IAEA Research Contracts related to radiation technology. Their expectation from this project is to enhance the understanding about Radiation technology for irradiation of Food, Gemstones, healthcare products, cables and heat shrinkable materials, wastes and nano composite materials.

### **2.15. Cambodia**

Dr. Danh Serey, Deputy Director, Ministry of Environment, made a presentation:

The Radiation Technology is something new for Cambodia who became member of IAEA in



2009. It faces challenges in so many areas like environment, food and agriculture, human resource development, etc. The environmental problems include lack of water resource management and supply of safe drinking water. Cambodia is an exporter of fish and seafood products but faces some hurdles due to some contamination issues. The country has no sufficient human resource capabilities in the area of Radiation Technology. They also face problems in radioactive waste management, particularly while handling the spent sources in hospitals and labs. In fact, Cambodia wants application of EB technology for food irradiation, agriculture and livestock and environment so that it could help them to overcome all these problems. It plans to establish more educational and research institutes in the field of nuclear technology and seeks help of IAEA and other donor agencies.

## **Session II Implementation plan of the training courses and review of 2013-2015 work plans (Chair: Dr. Ju-woon LEE, LCC)**

The session was chaired by Dr. Ju-woon Lee, LCC of the project.

### **3. Implementation plan of the training courses and review of 2013-2015 work plans**

He presented the implementation plan of the training courses and 2013-2015 work plans. All participants discussed the matters related to the training courses and workplans for 2013-2015 years. He presented the training material content, probable dates/venue for training course, qualification of the trainee for all three major category of training and outputs and outcomes of the project.

Taking note of the issue on public acceptance and safety of food irradiation raised by Dr. Nkala, he stressed again the importance of the issue and mentioned that the curriculum of the training course will be modified including the concerned matter.

At his presentation, Dr. Lee indicated a wide technical gap existing among the participating countries and suggested organizing two workshops instead of having an annual review meeting in 2013 to narrow the gap among the countries with/without EB facilities. The suggestion was welcomed by most of the participants, while a participant of New Zealand hoped to have an annual review meeting as planned. In this regard, RCARO, from the managerial point of view, pointed out the budget problem and suggested having only one workshop for the countries with no EB facility.

RCARO also raised the issue of the importance of submitting progress reports by the participants. The followings were concluded and recommended after detailed discussions on the training courses and work plan for 2013. The contents and curriculum of the training courses are given in Annex 4.

## **Conclusions**

### **1. Implementation Plan of the Training Courses**

- This training course is intended for those who are practically work for the technology development and establishing the system of their countries after finishing the course (train the trainers' course)

#### **• Expert meeting for training material**

- Organized/prepared by the LCC
- **Contents of the training material, Curriculum**
  - The contents and curriculum of training material were agreed by the most of the participants.
  - Participant from Malaysia suggested adding grafting topic related to food packaging.
  - Training materials will be uploaded on the RCARO website.
- **Qualification of the participants**
  - Need to have a Master's degree but may be relaxed to graduation for some country
  - Over 3-5 years of R&D experience or work experience in the related field
  - The experience in gamma technology can also do
- **Date and venue**
  - 19-23 August and 7-11 October in Jeongup, Korea
- **Establishment of an expert network**
  - RCARO website will be used for the expert network.
  - Project documents, list of the experts and national documents by the participants will be uploaded.

## **2. Review of Work Plan for 2013-2015**

- **Submission of progress reports and national work plan**
  - National workplan by 18 May 2013, Progress report by the first week of June 2013
  - Progress/annual reports should be reported to RCARO twice every year: end of June and end of December
- **Venue and date for annual meeting**
  - Decided by the RCARO with priorities given to Philippines, Cambodia, Myanmar
  - 21-22 November 2013 (2 days)
- **Outputs and outcomes of the project**
  - Most Participating countries are able to understand and utilize electron beam technologies for value addition to food and industrial products and degradation of environmental pollutants in the Asia Pacific region.
  - Expected specific outputs are training course protocols, training courses and workshops, technical consultations and a regional network of experts and facilities.
  - Elevation of potential relating to processing of food and industrial products and the treatment of pollutants using electron beam technology by means of two progress/annual reports, training course reports, training course protocol, survey feedback from the participants

China, Malaysia, New Zealand and Vietnam showed their willingness to share their expertise for this project along with technology donor countries like Australia, India and Korea.

## **Recommendations**

- All participating countries should implement all aspects of respective work plan and timely submit precise progress reports to the RCARO.

- Countries with no EB facilities are requested to pursue opportunities of setting up facilities, therefore a workshop for the policy making bodies is recommended for the countries with no EB facilities with enhanced budgetary allocation from RCARO/UNDP

#### **4. Closing and Wrap-up**

Director of RCA Regional Office expressed his appreciation for the fruitful outcomes of the meeting and contribution of NPCs through their active involvement during the meeting. All participants appreciated RCARO for its excellent arrangement.

- Annex 1. List of Participants
- Annex 2. Agenda of the Meeting
- Annex 3. Summary table of member states
- Annex 4. Contents and Curriculum of the training courses

Annex 1

### List of participants

	Country	Name	Organization & Contact details
1	Australia	Dr. Richard Bela Banati	Professor Australian Nuclear Science and Technology Organization Tel: +61 408121362 Email: <a href="mailto:rib@ansto.gov.au">rib@ansto.gov.au</a>
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## Annex 2

### **KICK-OFF MEETING of RCA-UNDP project on Electron Beam Applications for Value Addition to Food and Industrial Products and Degradation of Environmental Pollutants in the Asia Pacific region**

**2-3 May 2013, Hilton Phuket Arcadia Resort & Spa, Phuket, Thailand**

## **PROGRAMME**

### **2 May 2013**

09:30- 10:00	<b>Registration</b>
10:00 - 10:30	<b>Opening Session (Chair: RCARO)</b> <ul style="list-style-type: none"> <li>- Opening Remarks by Mr. Kun-mo CHOI, Director, RCARO</li> <li>- Congratulatory Remarks by Mr. Denis NKALA, Regional Coordinator, South-South Cooperation &amp; Country Support(Asia-Pacific), UNDP</li> <li>- Congratulatory Remarks by Mr. Vichian VONGSMARN, Deputy Secretary-General, Office of Atoms for Peace of Thailand</li> <li>- Welcoming Remarks by Dr. Ju-woon LEE, Director of Advanced Radiation Technology Institute (ARTI), Korea Atomic Energy Research Institute, Lead Country Coordinator(LCC)</li> </ul>
10:30 - 11:00	Introduction of participants Designation of Chairperson and Rapporteurs Adoption of agenda
11:00 -11:30	Group Photo and Coffee break
<b>Session I</b>	<b>Overview and country presentations (Chair: Dr. Phiriyatorn Suwanmala, NPC of Thailand)</b>
11:30-12:00	Overview of the project and objective of the meeting (Dr. In-seok OH, Head of programme division, RCARO)
12:00 - 12:30	Summary and analysis of country reports on the current status of the Electron Beam Applications for Value Addition to Food and Industrial Products and Degradation of Environmental Pollutants in the participating countries (Dr. Ju-woon LEE, LCC)
12:30 - 13:45	Lunch break
Country Presentations (10-15 min presentations followed by a 5 min discussion) Presentations with emphasis on <ul style="list-style-type: none"> <li>- National needs, expectations and contributions for the project</li> </ul>	
13:45 - 15:45	Presentations (Australia, China, India, Indonesia, Malaysia, Myanmar, New Zealand, Korea)
15:45 - 16:15	Coffee break

- 16:15 - 18:15      Presentations (Pakistan, Philippines, Singapore, Sri Lanka, Thailand, Vietnam, Cambodia)
- 18:15 -              Dinner hosted by the Director, RCARO (venue: Sails Restaurant in the Hotel)

### **3 May 2013**

#### **Session II              Implementation plan of the training courses and review of 2013-2015 work plans (Chair: Dr. Ju-woon LEE, LCC)**

- 09:00 - 10:30      Discussion on the matters related to the training courses
- Expert meeting for training material
  - Contents of the training material
  - Curriculum
  - Qualification of the participants
- 10:30 -10:45      Coffee break
- 10:45 - 12:00      Discussion on the activities related to 2013-2015 work plans
- Venue and tentative dates for RTCs and progress review meeting
  - Submission of progress reports and national work plan
  - Establishment of an expert network
  - Outputs and outcomes of the project
- 12:00 - 13:30      Lunch break
- 13:30 - 18:00      Wrap-up discussion and adoption of the meeting report
- 18:00                Closing Remarks by the Director RCARO





## Annex 3

**Current Status of the member states in the fields of E-beam irradiation technology and other radiation technology**

Country	National Policy/ Work Plan	Number of E-beam irradiators			Major R&D group			R&D Project of RT			HRD Program	R&D Budget (\$/2012)	Size of Market (\$/2011)
		Inst.	Univ.	Indu.	Inst.	Univ.	Indu.	AM	ER	FI			
Australia	?									O	?	?	?
Cambodia	O										O		
China	O				O	O		O	O	O	O		
India	O	4		6	O			O	O	O	O	50,000	10 M
Indonesia		2		4	O			O		O	O	15,000	
Malaysia		3		9	O			O	O	O			
Myanmar													
New Zealand		?			O			O	O				
Pakistan	?				O			O	O	O	?		
Philippines	?	1			O			O	O	O			
Korea, Rep.	O	3	1	8	O			O	O	O	O	6 M	7,300 M
Singapore	O	1	2	3	O	O		O	O				
Sri Lanka	O				O			O	O	O	O		
Thailand		1	1		O			O		O			
Vietnam	O	1		1	O			O	O	O	O		

Abbreviation; Ins.: Institute, Univ.: University, Indu.: Industry, RT: Radiation Technology, HRD: Human Resources Development, AM: Advanced Materials, ER: Environment Remediation, FI: Food Irradiation

## Contents and Curriculum of the training course

### Advanced Materials

Year	Curriculums	Time (Day)	Venue
2013	Basic radiation chemistry	0.5	ARTI
	Dosimetry	0.5	ARTI
	Radiation curing	1.0	ARTI
	Experimental application	1.5	ARTI
	Technical visit	1.0	EB Tech
2014	Advanced radiation chemistry	0.5	ARTI
	Radiation crosslinking	0.5	ARTI
	Carbon composites	1.0	ARTI
	Experimental application	1.5	ARTI
	Technical visit	1.0	KAERI
2015	Experimental application of Electron Beam for electronic devices	1.0	ARTI
		1.5	ARTI
	Experimental application for hydrogels	1.0	ARTI
	Experimental design Skill	1.0	ARTI
	Technical visit		EB Tech

### Environmental Remediation

Year	Curriculums	Time (Day)	Venue
2013	Basic radiation biology and chemistry	0.5	ARTI
	Radiation sterilization	0.5	ARTI
	Waste water treatment	1.0	ARTI
	Experimental application	1.5	ARTI
	Technical visit	1.0	EB Tech
2014	Radiation biology & chemistry	0.5	ARTI
	Soil treatment	0.5	ARTI
	Radio hydrolysis	1.0	ARTI

	Practical application of MEB	1.5	ARTI
	Technical visit	1.0	KAERI
2015	Air pollution control	1.0	ARTI
	Experimental application for soil and waste water	1.5	ARTI
		1.0	ARTI
	Experimental Design Skill	1.0	ARTI
	Technical visit		EB Tech

### **Food Irradiation**

<b>Year</b>	<b>Curriculums</b>	<b>Time (Day)</b>	<b>Venue</b>
2014	Experimental food chemistry	0.5	ARTI
	Food microbiology	0.5	ARTI
	Food rheology	1.0	ARTI
	Food chemistry & Safety evaluation	0.5	ARTI
	Experimental application (Dosimetry)	1.0	ARTI
	Technical visit	1.0	EB Tech