Proposed Project Concepts/Ideas for the RCA Programme 2016-2017

Background

The RCA Government Parties at the 42nd RCA GCM agreed on the timeframe proposed by the Monitoring Committee (MC) for the preparation of the RCA Programme 2016-2017. As agreed, all project concepts for the RCA Programme 2016-2017 were to be submitted to the MC by 1st November 2013 for review and feedback. Annex 1 contains a summary of all the project concepts lodged to the MC before and after the agreed upon deadline and Annex 2 contains the project concepts submitted by the Party Governments.

Proposed actions:

The NRs may review the project concepts received for further discussion at the NRM.

Annex 1

Summary of the RCA Project Concepts Received by the MC for the RCA Programme 2016-2017

#	Project Title	Lead Country
1	Development and upscaling of radiation processed advanced Grafted materials for industrial application and environmental preservation	PHI
2	Elucidating climate change impacts in the marine ecosystem through nuclear and isotopic technologies	PHI
3	Advancing technologies for monitoring and analysis of the extent and impact of radioactive releases from nuclear power plants (NPPs) to Asia-Pacific marine ecosystems	AUL
4	Marine nuclear and isotopic technologies for climate change mitigation	AUL
5	Improving soil fertility, land productivity and land degradation mitigation	AUL
6	Impact of air particulate matter in the RCA Region	NZE
7	Delivering the promise of food irradiation to socio-economic development through strengthening promotion, acceptability and trade	NZE
8	Application of mutation techniques to breed green super crop for sustainable agricultural production	CPR
9	Efficacy of low 131-I dose for thyroid remnant ablation in non-metastatic patients with macroscopic invasion	CPR
10	The preclinical application of transdermal oxygen enzymes on the treatment of skin injuries induced by acute radiation accidents.	CPR
11	The investigation of carbon sink in the wet land of Asia using isotopic techniques	CPR
12	Industrial process monitoring and investigation using advanced radiotracer and sealed source technology	CPR
13	New type of freight vehicle radioactive inspection system.	CPR
14	Application of electron accelerator in irradiation processing	CPR
15	Strengthening food irradiation applications through education and training in RCA Member States	PAK
16	Isotopic Techniques in the Assessment of Groundwater Resources for Sustainable Management.	PAK
17	Diagnosing and optimising industrial processes using radiotracers and sealed-source techniques	PAK
18	Improving management of diabetes mellitus and its complications using nuclear techniques	PAK

#	**Project Title**	**Lead Country**
19	Capacity building in therapeutic applications of unsealed radioactive sources in the management of benign and malign diseases	PAK
20	Distant learning certification for hybrid imaging (PET/CT and SPECT/CT)	PAK
21	Ecosystem management function in view of anthropogenic influence and climate change trend and impact	IND
22	Defining the Precise Role of Hybrid Positron Emission Tomography-Computed Tomography in the management of Infectious and Aseptic Inflammatory disorders	IND
23	Organ contouring using ultrasound image-guidance for treatment plannig in the intracavitary radiotherapy of carcinoma cervix	IND
24	Multicentric trial on chemotherapy (CT) added to palliative radiotherapy (RT) in palliation of advanced carcinoma esophagus	IND
25	Clinical implementation of image-guided radiation therapy (IGRT) and adaptive radiation therapy (ART).	IND
26	Enhancing stereotactic body radiation therapy for frequent cancers in the RCA region	ROK
27	*Improving Soil Fertility, Land Productivity and Land Degradation Mitigation [not reviewed as it was submitted too late]*	*NZE*
	[The concepts of the projects marked like this were not submitted.]	

Annex 2

Project Concepts Submitted by the Party Governments for the RCA Programme 2016-2017

3	**Advancing technologies for monitoring and analysis of the extent and impact of radioactive releases from nuclear power plants (NPPs) to Asia-Pacific marine ecosystems**	**AUL**

Regional Project Concept Template (Category A)

The information contained in this template should be uploaded to the PCMF IT platform by the Chair of the relevant regional cooperative agreement or the NLO of the Member State submitting the concept by **31 May 2012** at the latest. Based on this information the IAEA will assess whether this project concept is in line with the TC quality criteria and requirements. Concepts positively appraised will be further developed into full project documents during the design phase.

Region:	Asia and the Pacific (RCA)		
Regional/Cooperative agreement (if applicable)	RCA	**Priority no. given by regional/cooperative agreement** (for concepts proposed under the auspices of regional cooperative agreements)	
Title	Advancing technologies for monitoring and analysis of the extent and impact of radioactive releases from nuclear power plants (NPPs) to Asia-Pacific marine ecosystems		
Field of activity	(7M) Marine Environment and Coastal Zone Management		
Regional project category[1]	☐ *Transnational* ☐ *Regional standard setting* ***X*** *Capacity building for developing countries* ☐ *Joint TC activities with a regional or international entity*		
Names and contact details of project counterparts and counterpart institutions (starting with the main counterpart)	The following are potential RCA counterparts; Mr Ronald Szymczak (Main/Lead Country Counterpart) Tradewinds 205/4-6 Boorima Place CRONULLA, NSW 2230 AUSTRALIA Tel.: 0061 40 5630425; Fax: 0061 2 93517840 EMail: ron.szymczak@bigpond.com Mr Mohammad Zafrul Kabir Beach Sand Minerals Exploitation Centre Bangladesh Atomic Energy Commission Kalatali P.O. Box 15 COX'S BAZAR 4700 BANGLADESH Tel.: 00880 341 63320; Fax: 00880 341 63347 EMail: zafkab_geoaec@yahoo.com		

[1] See the document entitled "Policy and Procedures for TC Regional Projects" at: http://pcmf.iaea.org/DesktopModules/PCMF/docs/2014_15_Docs/notes/Regional_TC_Project_Policy.pdf.

	Mr Lean Tun Ministry of Industry, Mines and Energy (MIME) 45, Preah Norodom Boulevard Khan Daun Penh PHNOM PENH CAMBODIA Tel.: 00855 23 986359; Fax: 00855 23218634 EMail: tunlean@gmail.com Ms Wen Yu Third Institute of Oceanography State Oceanic Administration (SOA) 184#, Daxue Road 361005 XIAMEN CHINA Tel.: 0086 10 5922195262; Fax: 0086 10 62782658 EMail: yuwen01@tsinghua.org.cn Mr. R.M. Tripathi Head, Health Physics Division, BARC Trombay, Mumbai, 400085 INDIA Tel: 0091-22-25593927 Email: rmt@barc.gov.in Mr Heny Suseno Center for Radiation Safety Technology and Metrology - National Nuclear Energy Agency Marine Radioecology Group, Jl. Lebak Bulus Raya No. 49, Kotak Pos 7043 JKSKL Jakarta Selatan 12070. INDONESIA Tel.: 0062 21 7513906; Fax: 0062 21 7657950 EMail: henis@batan.go.id Mr Mr.Toshihide Fukui Director Radiation Monitoring Division The Secretariat of the Nuclear Regulation Authority 1-9-9 Roppongi, Minato-ku, Tokyo, 106-8450 JAPAN Tel: +81-3-5114-2125; Fax: +81-3-5114-2185 Email: toshihide_fukui@nsr.go.jp Mr Abdul Kadir Ishak Malaysian Nuclear Agency Bangi 43000 KAJANG, Selangor MALAYSIA Tel.: 0060 3 89112000; Fax: 0060 3 89282977 EMail: abdul_kadir@nuclearmalaysia.gov.my Ms Nilar Tin Department of Atomic Energy Ministry of Science and Technology Building No. 21 NAY PYI TAW MYANMAR Tel.: 0095 1 67 404460; Fax: 0095 1 67 404461 EMail: most18@myanmar.com.mm Mr Nikolaus Hermanspahn National Radiation Laboratory 108 Victoria Street CHRISTCHURCH

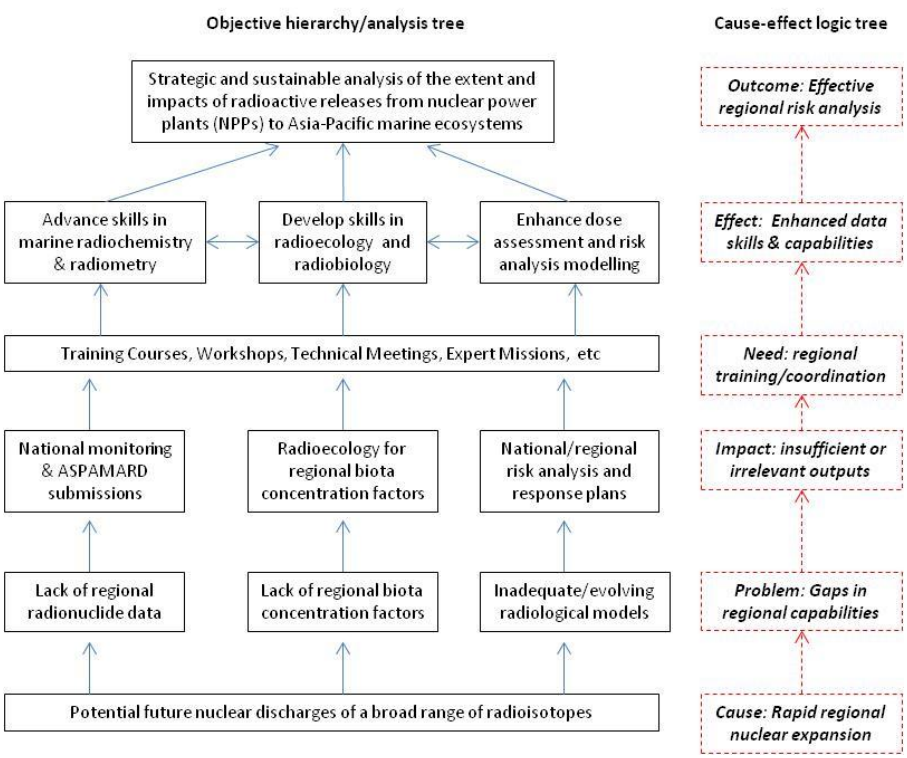
	NEW ZEALAND Tel.: 0064 3 3665059; Fax: 0064 3 3661156 EMail: Nikolaus.Hermanspahn@esr.cri.nz Mr Azhar Mashiatullah Radiation and Isotope Applications Division (RIAD) PINSTECH Pakistan Atomic Energy Commission (PAEC) P.O. Box 1482, Nilore ISLAMABAD PAKISTAN Tel.: 0092 51 9248801 6 3433; Fax: 0092 51 9290275 EMail: mashiatullah@gmail.com; azhar@pinstech.org.pk Mr Yimnang Golbuu Palau International Coral Reef Center (PICRC) P.O. Box 7086 1 M-Dock Road KOROR 96940 PALAU Tel.: 0068 0 4886950 ; Fax: 0068 0 4886951 EMail: ygolbuu@picrc.org Ms Eliza Enriquez Philippine Nuclear Research Institute (PNRI) Commonwealth Avenue, Diliman P.O. Box 213 QUEZON CITY 1101 PHILIPPINES Tel.: 0063 2 9296011; Fax: 0063 2 9201646 EMail: ebenriquez@pnri.dost.gov.ph Dr Daeji Kim Korea Institute of Nuclear Safety (KINS) 19 Gusung-Dong Yusong-Gu P.O. Box 114 DAEJEON 305-338 KOREA, REPUBLIC OF Tel.: 0082 428680855; Fax: 0082 428680563 EMail: kimdj@kins.re.kr Mr Wee Teck Hoo Centre for Radiation Protection and Nuclear Science National Environment Agency (NEA) Environment Building, 3rd Storey, Annex Block 40 Scotts Road SINGAPORE 228231 SINGAPORE Tel.: 0065 6 67319579; Fax: 0065 6 67319585 EMail: Hoo_Wee_Teck@nea.gov.sg Mr Vajira Ariyaratna Waduge Atomic Energy Authority 60/460, Baseline Road Orugodawatta WELLAMPITIYA SRI LANKA Tel.: 0094 11 2533427 ; Fax: 0094 11 2533448 EMail: waduge@aea.ac.lk Ms Suchin Udomsomporn Bureau of Technical Support for Safety Regulation Office of Atoms for Peace (OAP) Ministry of Science and Technology (MOST)

	16 Vibhavadi Rangsit Road Chatuchak BANGKOK 10900 THAILAND Tel.: 0066 2 5620093; Fax: 0066 2 5613013 EMail: suchin@oaep.go.th Mr Nhu Sieu Le Centre for Analytical Techniques and Environmental Monitoring Nuclear Research Institute (NRI) Vietnam Atomic Energy Institute (VINATOM) 01 Nguyen Tu Luc Street P.O. Box 61100 DALAT VIETNAM Tel.: 0084 63 3831013; Fax: 0084 63 3821107 EMail: lenhusieu@yahoo.com The following are potential non-RCA counterparts: Mr Tangata Vaeau Health Protection Manager Ministry of Health P.O.Box 109, Avaru Rarotonga COOK ISLANDS Tel.: 00682 29 110; Mob.: 00682 54 008; Fax: 00682 29 100 Email: tata.vaeau@health.gov.ck Mr Jone Salabuco Radiology Department Colonial War Memorial Hospital Brown Street GPO Box 115 SUVA FIJI Tel.: 00679 3313444; Fax: 00679 3308856 EMail: jsalabuco@govnet.gov.fj Mr Farran Redfern Senior Environment Officer Environment and Conservation Division Ministry of Environment, Lands and Agriculture Development KIRIBATI Tel.: 00686 28 211/28, 00686425/28 000 ; Mobile: 00686 96 444 Email: farranr@environment.gov.ki kaokioki@yahoo.com Mr Abraham Hicking Environmental Protection Authority (EPA) P.O.Box 1322 Majuro 96960 MARSHALL ISLANDS Tel.: 00692 625 3035; Fax: 00692 625 5205 EMail: athicking@gmail.com Mrs Pramoda Pradhan Groundwater Irrigation Division Department of Irrigation (DOI) Jawalakhel 6042 LALITPUR NEPAL Tel: 977 1 5537312 ; Fax: 977 1 5537169 EMail: pramodapradhan@yahoo.com; pramodapradhan@yahoo.com Mr John Korinihona Ministry of Mines, Energy and Rural Electrification

	Eagle Street P.O. Box G37 HONIARA SOLOMON ISLANDS Tel.: 00677 21525; Fax: 00677 25811 EMail: john.korinihona@yahoo.com
Analysis of regional Gap / Problems/needs	*Give an in-depth analysis of the major problems/needs to be addressed by the project, as well as of their causes and effects; and explain how these are linked to regional development plans or frameworks (or equivalent). Refer to past efforts made in addressing these problems/needs, if any, and explain how the current project proposal builds upon them.* *Attach any supporting documents (e.g. texts of regional development plans).* While nuclear power generation has tremendous benefits in meeting the electricity needs of growing populations and also in not contributing to adverse environmental effects associated with the burning of fossil fuels, there are potential risks of planned and unplanned releases of radionuclides to the marine environment that need to be addressed. As of 9 November 2011, there were 433 nuclear power plants in operation world-wide and 65 nuclear power plants under construction. Twenty-one out of the last 27 nuclear power plants connected to the world's energy grid are in Asia and many countries within the Asia-Pacific region are building or planning to build nuclear power plants - China and India alone have built 7 new nuclear power plants in the last 4 years with 26 more under construction. In March 2011 the Fukushima Dai-ichi NPP accident resulted in the largest ever discharge of artificial radioactivity to the marine environments of the Asia-Pacific region. Although approximately 90% of the total discharge occurred prior to May 2011, the discharges continue to the present day and potentially into the future. The marine environments of the Asia-Pacific region have also received artificial radionuclides from a number of other sources, including: global fallout from weapons testing, close-in fallout (e.g. Marshall Islands, Mururoa Atoll), dumped wastes (e.g. Sea of Japan), accidental losses (e.g. SNAP-9A satellite, nuclear-powered vessels, nuclear weapons) and low-level discharges into coastal regions. Past RCA marine projects have focused on the applications of nuclear and isotopic techniques to coastal pollution issues; i.e., RAS/8/080 on Management of Marine Coastal Environment and Its Pollution; RAS/7/011 on Enhancing the Sustainability of the Marine Coastal Environment; RAS/8/095 on Improving Regional Capacity for Assessment, Planning, and Response to Aquatic Environmental Emergencies; RAS/7/016 Establishing a Benchmark for Assessing the Radiological Impact of Nuclear Power Activities on the Marine Environment in the Asia Pacific region; RAS/7/019 on Harmonizing Nuclear and Isotopic Techniques for Marine Pollution Management at the Regional Level; and RAS/7/021 Marine benchmark study on the possible impact of the Fukushima radioactive releases in the Asia-Pacific Region. These projects have provided extensive outputs, leading to the development and strengthening of regional marine monitoring programmes and the establishment of a documented quality management system (QMS) for marine radioactivity monitoring. They have also extended regional capabilities to enable the updating of a regional marine database (ASPAMARD) and to enhance the understanding of the fate and behaviour of key radionuclides, as well as the assessment of risks associated with consumption of radioactively contaminated sea foods. In particular, the QMS developed under project RAS/7/016 QMS provides the basis for reliable and comparable data. Despite the activities of the underway RAS/7/021 project, some RCA member states are still not well equipped to assess the environmental consequences of these nuclear facility discharges, at a regional scale. Particular gaps/needs include, (a) development of more advanced skills for analysis of a broader range of radionuclides potentially associated with various nuclear accident scenarios are lacking – for the most part the RAS/7/021 project only

	addressed the key Fukushima isotopes 137/134-cesium and 131-iodine; (b) more site-specific bio-kinetic (i.e. radioecology) data on concentration factors and food web transfers for bioaccumulation of radionuclides in marine biota endemic to the Asia-Pacific region are necessary for proper dose assessments and risk analyses – several RCA countries are only now developing radioecology laboratories and require future support/training; and (c) dose impact/assessment models are presently under review and refinement (e.g. ICRP, MODARIA initiatives) however only very few RCA MSs participate in these initiatives. It is essential to embrace and pass-on (via training/workshops) these developments to Asia/Pacific countries. Several MSs also identify a lack of knowledge of radiation biology is also hindering effective risk analysis. This proposed project can effectively consolidate and further enhance the investments, achievements, strategic networks and partnerships (e.g. IAEA-NAEL, MODARIA, ICRP, UNSCEAR, etc) developed in the previous RCA marine projects RAS/7/016 and RAS/7/021. RCA Regional Strategic Priorities 2012-2017 have identified the marine environment as a priority area. Further, the proposed project is reflecting the national priorities of the RCA Member States following the radioactive releases from the Fukushima Daiichi nuclear power plant, and hence enjoys existing MS government commitment. The project has great potential for regional and national cooperation, successful implementation and achievement of the stated objectives, as well as an platform for post-Fukushima/on-going ASPAMARD compilations/reports.
Why should it be a regional project?	*Indicate why it is better to address these problems/needs through a regional project (as opposed to a national one).* The marine area which will receive continuing Fukushima discharges encompasses much of the Pacific Ocean. More than 100 new nuclear power plants are expected to be built tin the Asia/pacific region in the next 10 years Thus a continuing harmonised regional approach is essential to optimise and coordinate the application of the skills and resources available in the region to generate monitoring data that is both reliable and directly comparable and exchangeable within the participating Member States. Many skills, expertise and facilities in RCA Member States are currently under development, the opportunity of utilising these to address a real world situation of significant importance and priority, both regionally and nationally, will act as a spur to achieve a high level of expertise and competence in all participating RCA Member States. Additionally this upgrading of skills and competency will provide significant opportunities for TCDC. This project can effectively consolidate and take advantage of the investments, achievements and strategic networks developed in the previous RCA marine projects.
Stakeholder analysis and partnerships	*Describe the stakeholder analysis conducted, specifying all the interested or affected parties, end users, beneficiaries, sponsors and partners identified, with clearly defined roles for each entity.* Principal beneficiaries from this project include: Nuclear regulators, environmental agencies, nuclear power plant operators (existing and future), fisheries departments, marine aquaculture organisations and companies, tourism departments and agencies. Under the RCA Guidelines and Operating Rules each participating Member State forms a National Teams which is responsible for implementation of the project at national level according to the Work Plan. This team includes representatives from the major participant groups, which includes end users. The proposed project will benefit from effective national, regional and international partnerships established in RAS/7/021.

	The project activities are in a core area of IAEA expertise and the IAEA Environment Laboratories (EL) in Monaco will be a key institution for cooperation, supplying advice and technical support for the project. This proposed project will effectively consolidate and further enhance the investments, achievements, strategic networks and partnerships (e.g. IAEA-NAEL, MODARIA, ICRP, UNSCEAR, etc) developed in the previous RCA marine projects RAS/7/016 and current RAS/7/021.
Overall objective (or developmental objective)	*State the objective to which the project will contribute, and demonstrate its linkage with any regional or broader development goal or priority. It has to be in line with the problems/needs identified.* Specific Objective of the project: *Strategic and sustainable analyses of the extent and impacts of radioactive releases from nuclear power plants (NPPs) to Asia-Pacific marine ecosystems*. This project proposal specifically focuses on the gaps/problems and needs identified and projected by Member States during the mid-term review meeting of the RAS/7/021 project. It addresses future trans-boundary issues, leads to adoption of more-advanced common standards/procedures/guidelines and produces new training materials which can be utilised by Member States. The project directly links to several Millennium Development Goals and the RCA Regional Strategic priorities for 2012-2017 identify the marine environment as a priority area. Further, the proposed project is reflecting the national priorities of the RCA Member States following the radioactive releases from the 2011 Fukushima Daiichi nuclear power plant, and hence enjoys existing national government commitments.
Analysis of objectives	*Draw up an objective tree to highlight the hierarchy of objectives as well as the cause–effect logic that this project is expected to achieve.* The proposed project objective is supported by three (3) sub-objectives; 1. Advance regional skills in marine radiochemistry/radiometry for evaluation of nuclear discharges from nuclear power plants (and other nuclear activities) into the marine environment; 2. Develop regional skills in radioecology and radiobiology studies of radionuclides in marine biota endemic to the Asia-Pacific region; 3. Enhance regional capabilities in dose assessment and risk analysis modelling to make scientific assessments of the monitoring, radioecology/radiobiology data and aid in the development of national countermeasures and environmental response plans. These sub-objectives (outcomes) directly combine and contribute to achievement of the overall objective. They are inter-linked disciplines. The degree of competency in RCA MSs for these disciplines still ranges from *advanced* to *needing development*. This project supported by technical cooperation between the participating developing countries (TDDC) is the most logical strategy to achieve and sustain regional skills, coordination of activities and 'world's best-practice' risk analysis. See an objective hierarchy and cause-effect logic tree diagram below;

	
Role of nuclear technology and the IAEA	*Indicate the nuclear technique that would be used and outline why it is suitable for addressing the problems/needs in question. Is this the only available technique? Does it have a comparative advantage over non-nuclear techniques? What specific role is the IAEA expected to play in the project?* Nuclear technology is an essential component of this project. Advanced radiochemical procedures for sample processing are followed by application of radiometric instrumentation, e.g. gamma spectrometry, alpha/beta spectrometry, liquid scintillation counting (LSC), mass-spectrometry (MS), etc. Non-nuclear techniques are not applicable to the measurement of radionuclides. Radiotracers will be used in radioecology studies. The IAEA is requested to provide assistance in the implementation and monitoring of the project. The IAEA-NAEL in Monaco have specialised expertise, knowledge and equipment in the marine area that may provide additional resources to complement those of the participating Member States. Assistance would be requested from IAEA for the conduct of proficiency tests for this project and in the sourcing and provision of appropriate standards and reference materials.
Project duration	*Indicate a realistic starting date and the number of years required to complete the project. (In the case of projects expected to exceed four years, an assessment will be conducted before the end of the fourth year to decide on the validity of an additional year.)* A four year project duration commencing 01-Jan 2016 is requested to achieve the project objectives.
Requirements for participation	*Indicate the minimum requirements that counterpart institutions in Member States would need to meet in order to participate in this project, and how the fulfilment of these requirements will be verified.* Coordination of national programmes and the formation of National Project Teams is a standard feature of the strategy used for the implementation of RCA projects. Counterpart institutions should be National Nuclear, Marine Science (fisheries/oceanography) or Environmental Management Agencies. Participant countries must have basic capabilities to collect, analyse (via proxy

	is OK) and undertake risk analysis of marine radionuclides. These requirements can be verified against achievements reported in the underway RAS/7/021 project.
Participating Member States	*List the Member States expected to participate in this project that meet the requirements established above. Indicate the role of each Member State in the project.* *Country: AUSTRALIA (AUL) Role: Resource (providing expertise)* *Country: BANGLADESH (BGD) Role: Target (receiving expertise)* *Country: CAMBODIA (KAM) Role: Target (receiving expertise)* *Country: CHINA, PR (CPR) Role: Target (receiving expertise)* *Country: INDIA (IND) Role: Resource or Target ?* *Country: INDONESIA (INS) Role: Target (receiving expertise)* *Country: JAPAN (JPN) Role: Resource (providing expertise)* *Country: KOREA, REBUBLIC OF Role: Resource (providing expertise)* *Country: MALAYSIA (MAL) Role: Target (receiving expertise)* *Country: MYANMAR (MYA) Role: Target (receiving expertise)* *Country: NEW ZEALAND (NZE) Role: Resource (providing expertise)* *Country: PAKISTAN (PAK) Role: Target (receiving expertise)* *Country: PALAU (PLW) Role: Target (receiving expertise)* *Country: PHILIPPINES (PHI) Role: Target (receiving expertise)* *Country: SINGAPORE (SIN) Role: Target (receiving expertise)* *Country: SRI LANKA (SRL) Role: Target (receiving expertise)* *Country: THAILAND (THA) Role: Target (receiving expertise)* *Country: VIETNAM (VIE) Role: Target (receiving expertise)*
Funding and project budget	*Provide an estimate of the total project costs and the funding expected from each stakeholder:*

		Euro	Comment
Government cost-sharing			(to be sent to the IAEA)
Counterpart institution(s)			Extra-budgetary TBA
Other partners			USA
IAEA Technical Cooperation Fund (TCF):	*Fellowships / Scientific visits / Training courses/ Workshops*		
	Experts		
	Equipment		
	TOTAL		€ 900,000

Expected IAEA funding approximately €900,000 over 4 years.

The national projects contributing to and aligned with this regional project will be supported financially by the participating Member State. RCA Member States hosting meetings and workshops will make financial contributions to support local operations

6	**Impact of air particulate matter in the RCA Region**	**NZE**

Regional Project Document Template (Category A)

Project concepts positively appraised should be further developed into full project documents, following the LFA.

Region	Asia and Pacific		
Regional/Cooperative Agreement (if applicable)	RCA	**Priority No. given by Regional/Cooperative Agreement** (for concepts proposed by Regional/Cooperative Agreements)	
Project Title	**<u>Impact of air particulate matter in the RCA region:</u> quantitative identification of air pollution sources impacting on air quality with respect to industrial sources, visibility and cultural heritage objects for air quality managers to better understand and control key air pollution sources**		
Field of Activity	Environment		
Regional Project Category[2]	*Capacity building for developing countries*		
Names and contact details of Counterparts and Counterpart Institutions	Concept proposal discussed and approved at an RCA Meeting in Manila in November 2013 where the majority of the participating countries were present. The majority of RCA countries have participated in previous RCA projects involving air particulate matter pollution and are expected to join this new project to build on and extent the knowledge gained to date to take the project beyond the research phase so the new knowledge can be directly applied by managers and key personnel to reduce the impacts of fine particle pollution. Counterparts actively involved in this new project formulation were: **Dr David Damien Cohen** Institute for Environmental Research; Australian Nuclear Science and Technology Organisation (ANSTO) Locked Bag 2001 KIRRAWEE DC, NSW 2232 AUSTRALIA **Ms Bilkis Ara Begum** Atomic Energy Centre (AECD); Bangladesh Atomic Energy Commission (BAEC) P.O. Box 164, Ranma, 4, Kazi Nazrul Islam Avenue DHAKA 1000 BANGLADESH **Ms Guiying Zhang** China Institute of Atomic Energy (CIAE); China National Nuclear Corp. (CNNC) P.O. Box 275-58, Xinzhen, Fangshan BEIJING 102413 CHINA **Dr Andreas Markwitz** National Isotope Centre; Institute of Geological and Nuclear Sciences (GNS) P.O. Box 31312, 30 Gracefield Road LOWER HUTT NEW ZEALAND **Mr Sanjay Kumar Sahu** Bhabha Atomic Research Centre (BARC); Department of Atomic Energy (DAE) Trombay		

[2] Policy and Procedures for TC Regional Projects

	MUMBAI, Maharashtra 400 085 INDIA **Ms Muhayatun SANTOSO** Center for Application of Nuclear Science and Technology; National Nuclear Energy Agency (BATAN) Jl. Tamansari 71 BANDUNG 40132 INDONESIA **Ms Shamsiah Abdul Rahman** Malaysian Nuclear Agency (Nuclear Malaysia) Bangi Komplex; Selangor Darul Ehsan 43000 KAJANG, Selangor MALAYSIA **Mr Dagva Shagjjamba** National University of Mongolia P.O. Box 46/789, Ikh Surguuliin ULAANBAATAR 210646 MONGOLIA **Ms Moe Myitzu** Department of Atomic Energy; Ministry of Science and Technology Building No. 21 NAY PYI TAW MYANMAR **Ms Shahida Waheed** Chemistry Division; Directorate of Science, Pakistan Institute of Nuclear Science and Technology (PINSTECH); Pakistan Atomic Energy Commission (PAEC) P.O. Nilore, ISLAMABAD 45650 PAKISTAN **Mr Lim Jongmyoung** Korea Atomic Energy Research Institute Daedukdaero 1045 Yuseong-Gu 305-353 DAEJEON KOREA, REPUBLIC OF **Ms H. Mohottige Nirosha Lakmali Handagiripathira** Atomic Energy Authority 60/460, Baseline Road; Orugodawatta WELLAMPITIYA SRI LANKA **Mr Bac Thu Vuong** Institute for Nuclear Science & Technology 179 Hoang Quoc Viet 10559 HANOI 5t-160 VIETNAM

SECTION-1: PROJECT BACKGROUND AND JUSTIFICATION

Regional Gap / Problem / Need Analysis	RAS/07/023 focused on characterisation and identification of possible sources, whereas the new program will extend to urban/ populated areas with quantitative identification of sources impacting on air quality with respect to industrial sources, visibility and cultural heritage objects and the relationship between major components, light scattering and visibility for air quality managers to better understand and control key air pollution sources.

	It is envisaged that this strategic shift in project objectives from the current to the new program will both extent and enhance the sustainability of local air particulate matter monitoring by carefully considering the needs of the Member States regarding pollution management in urban regions, human health orientated end-users, human capability development and phasing in of new end-users from a different community. It will identify and fill key gaps in the current knowledge related to fine particles and key sources and in many instances will for the first time in any Asian cities link fine particles with visibility. It reflects both the maturing state of air pollution studies globally and within the Asia region as well as the trends towards pushing research outcomes into the pollution management and control arena. RCA programs in air particulate matter research have created new capabilities related to nuclear technologies in the RCA region which are much sought after by end-users operating in the environmental sector. This new program will expand these capabilities while building on the already strong foundations provided by existing knowledge and recent databases that have been generated by previous RCA projects. For the first time it will focus on the key pollution components and link data obtained by nuclear methods to light scattering and visibility problems in major Asian cities and urban regions. After all visibility is what the majority of the public use to assess air pollution on a daily basis. To-date, RCA air pollution programs have critically delivered new nuclear analytical technology to the region and interpretation of air particulate data to many end-users, filling significant gaps in local knowledge. Much care has been taken to integrate new members into the projects, to up-skill technical and scientific staff and to transfer the data to local governments and other decision making institutions. The data are used by end-users to understand the sources and relative contributions of fine and coarse particulate matter to air pollution and also for reporting on the environment and setting air pollution goals and standards commensurate with current international standards and worlds best practice. Some key success stories: • Raised awareness of usefulness of nuclear analytical techniques in environmental science; • Use of data from the program for policy programs and air pollution management for reporting on the state of environment; • Strong nuclear analytical technology transfer in environmental science; • World-first regional database on fine and coarse air particulate matter in Australasia (A-PAD1) spanning at least 5 successive years; • World-first regional database for source fingerprints (A-PAD2); • Established high end-user activities providing input funding that exceeds the program funding; • Regional Resource Units assisting Member States with nuclear analytical services; • High quality results pointing to excellent QA/QC were published in more than 20 international publications. • Participation of up to 16 Member States; • Enhanced sustainability of air particulate monitoring by involving new members to the IAEA from the RCA region, such as Nepal. • Significant training of personnel in complex techniques associated with the application of nuclear techniques to air pollution studies. Of strategic importance are also issues that need to be tackled from lessons learned: deficiencies are incomplete documentation of nuclear analytical technology, including air sampling, data interpretation and most importantly documentation on best reporting practices. The latter has been identified as the most important issue for some countries significantly limiting the uptake of the technical program outcomes by end-users. The new program will also strive for closer connection between the RCA and other groups. In fact, considering that air travels globally, an interregional approach would be most desirable, for example by considering data from ARCAL and AFRA, if available.

Why should it be a regional project?	Air pollution is a global phenomenon with air travelling between countries in a few days and around the globe in a few weeks. Pollution emitted from one source can easily cross international borders and impact any place it travels through. Typical examples most relevant to the Asian region include emissions from coal fired power stations, windblown dust from major desert regions in China and Mongolia, Asian Brown Clouds (ABC) and anthropogenic biomass burning for logging. Industrial pollution produced in central Asia can travel to islands in the Pacific. Also natural sources, such as sand storms from the deserts of China and Mongolia can rapidly travel to Korea and Japan (and have even been monitored in North America) causing yellow dust to reach dangerous levels for humans resulting in respiratory problems and a variety of other health problems. Further burning of large forested areas in Sumatra and Borneo for logging affects air quality in Singapore and Malaysia on an annual basis. Bush fires emit enormous amounts of particulate matter that travel thousands of kilometres and can affect people that have pre-existing heart or lung conditions. Identifying these sources at the origin and at the polluted site is pivotal in developing mitigation strategies. This program therefore depends on sampling of air particulate matter across the RCA region.
Stakeholder Analysis and Partnerships	The air particulate matter program enjoys strong end-user engagement. The data that is produced by the program is used by end-users (typically environmental government agencies) in many countries for reporting the state of the environment, to make changes in legislation such as introducing standards or refining standards (for example for PM2.5) and prohibiting the use of lead in petrol and banning the use of two stroke motor vehicles (in Bangladesh for example). RCA programs operating in the air particulate matter space have plenty of evidence of strong end-user engagement. At the last review meeting in Manila in November 2013, end-users were identified in EPAs and government, academia, industry, medical and others. Reported number are: • EPAs and government agencies: 36 • Academia: 15 • Industry: 6 • Medical and others: 4 These end-users will to continue to work with national counterparts in the new program. New end-user groups working in cultural heritage targeted specifically in objective 3 will be added. There is a great mix of what end-users provide to the program. Some provide safe access to sites or running of equipment (power and man power to change filters) while others prefer to pay for services directly.
Overall Objective (or Developmental Objective)	Quantification of key sources of urban air particulate matter pollution in major cities across the RCA region with focus on: 1. The impacts of local industries, coal burning for power production, manufacturing, motor vehicles etc. on fine particle Emissions in these air sheds add to transboundary air pollution. Sampling of air particulate matter in highly polluted areas adding value to the program by providing quantitative information on impact of air particulate matter pollution in highly populated urban regions and associated socio-economic aspects. 2. Relationships between fine particle composition (Black Carbon, sulphates, soil and others) and light scattering and visibility along already proven USA IMPROVE program lines to assist in the identification of health and socio-economic aspects of air particulate matter and providing information to pollution managers on the key components affecting visibility in major cities and to the global climate change community on

	critical elements related to fine particle pollution and visibility. 3. First investigation of impacts of fine particulate matter pollution on cultural heritage objects which may include indoor air pollution measurements in museums or outdoors next to significant cultural heritage sites establishing new end-user groups associated with the preservation of cultural heritage. First steps where made in the current program to investigate air particulate matter pollution at cultural heritage sites by shifting samplers from urban areas to cultural heritage sites. Good examples of this can be visited in Sri Lanka and Pakistan. Other countries such as India and Indonesia have also shown a great interest in moving their samplers to cultural heritage sites.
Objectives analysis	Objective 1 focuses on impact of local and regional industries on urban air sheds and their movement in time. This objective uses data collected in previous programs and adds new data to the mix to identify industrial sources of air particulate matter unambiguously. We have established the world-first database on fine air particulate matter covering 2003 – 2008. Stage 2 of the database called APAD is considering data from 2008 – 2012. Stage 3, which will be completed by RAS/07/023 will have the world first database on sources of air particulate matter in Australasia. Objective 1 will have a very good database to work with to be able to complete the complicated task of assigning concentration numbers to industrial sources. Established end-users need this information to move their reporting and regulatory requirements forward (quantum step). It has been estimated that globally 2.1M people a year die prematurely due to fine particle air pollution. Indeed, it can be stated that in many countries (including Australia for example) more people die prematurely from air pollution than are killed on the roads each year by motor vehicles. Objective 2 uses a special fraction of APAD (only few selected elements) to link fine particulate matter composition to light scattering and visibility measurements. Visibility is often one of the first visible signs of air pollution. The public is very concerned when visibility levels drop below 5 km because of potential health reasons. This happens quite often in many heavily populated Asian cities with relatively high fine particulate pollution loads compared to world standards. Visibility impairment impacts many different areas such as tourism, air travel, quality of life etc. One study in British Columbia estimates that a single poor visibility event in the lower Fraser Valley results in a loss of revenue of $9M. This objective provides the link between particle matter composition and visibility – an enormously interesting relationship particularly for regulatory body and reporting agencies. Transboundary air pollution will also play a major role here on high pollution events. Objective 3 in the program investigates the impact of fine particulate matter pollution on cultural heritage objects which may include indoor air pollution measurements in museums. Fine particulate matter especially from diesel and carbonaceous sources is very harmful to cultural heritage objects. That applies to both, in-door and out-door. Emissions cause deposition including aesthetical and chemical consequences (e.g. corrosion). It is important to link air particulate matter pollution to cultural heritage objects in the RCA region to raise awareness and to even identify the sources that are culprits. Transboundary air pollution is also contributing to such effects. End-users will appreciate the wealth of information that is given to them to develop mitigation strategies as well as better understanding the problem in general. The review meeting in Manila identified 13 countries that are either interested in this objective or that have already started working towards building a database of fine and coarse particulate matter by having moved samplers to important cultural heritage locations.
Role of nuclear technology and IAEA	No other technique can compete with nuclear analytical technology to provide information on elemental composition of fine air particulate matter with such high sensitivity and fast analysis times. Participants in the program will either use XRF, which is becoming increasingly popular amongst Member States due to its relative inexpensiveness or the well-established ion beam analysis technique (such as PIXE and PIGE). A minority of the Member States may also use NAA for analysing

	filters. The IAEA is important in the program to facilitate access to facilities and equipment, to support expert missions when problems arise in measurements, analysis and source apportionment and also to increase awareness in usefulness of nuclear analytical technology by providing expert missions to regional workshops and meetings the use of RRUs can help to fill gaps in the databases when unexpected problems arise with local nuclear analytical systems. Progress needs to be rigorously determined at review meetings to help to achieve objectives, milestones and outputs.

SECTION-2: PROJECT DESCRIPTION

Project Specific Objective (Outcome in the LFM)	1. Measureable uptake of quantitative information on impact of air particulate matter pollution in highly populated urban regions and associated socio-economic aspects by end-users. 2. Information uptake of the key components affecting visibility in major cities by end-users (data used in reporting and policy making). 3. New fine air particulate matter end-users in cultural heritage.
Performance Indicator(s)	1. Strong end-user base across the RCA Member States that use fine particulate matter data in reports on the environment and consideration in policy decisions (target more than 10 countries). 2. More than 5 reports on sources and source apportionment of impact of air particulate matter pollution in highly populated urban regions considering associated socio-economic aspects. 3. First use of results linking visibility to particulate matter pollution by end-users in reports or media stories (target 3 releases). 4. First new cultural heritage end-user base established in air particulate matter research evidenced by advise sought by end-users from national representatives. 5. Publication of results in the open literature (target 5 publications).
Project Logical Framework Matrix	Refer to appendix A.
Physical Infrastructure and Human Resources	Member States operating in the field of air particulate matter pollution have trained personnel (human resources) that can change filters, analyse the filters with local nuclear technology wherever available and interpret the data in terms of source identification and apportionment. This project builds on expertise that has been established by previous programs operating in the air pollution space. Many countries have invested in nuclear analytical technique for air pollution measurements. Samplers are also available; however some new samplers are required due to aging of key equipment, some of which is now more than 10 years old. Also new equipment like nephelometers may have to be purchased to address new aspects of the program related to visibility. Provisions are made to cover incidental repair costs of samplers and black carbon measuring devices which in many cases are also over 10 years old. RRUs are well established in the program and are capable of handling requests made by Member States to fill gaps in the database.
Safety and Regulatory Infrastructure	Member States have safety and regulatory infrastructures in place as well as procedures and standards in collecting sample and analysing filters with nuclear analytical techniques.
Requirements for Participation	Participants in the program need to actively work with relevant end-users in this space to ensure sustainability of program objectives. The current list of end-users provides evidence that this is the case. Building a new end-user base in cultural heritage will be the challenge for the national project coordinators, a challenge they will be prepared for by attending proposed training courses.
Participating Member States	**All RCA Member States** **Resource Countries** Australia Mongolia New Zealand

	Indonesia
Other considerations, e.g. environment, gender	Tools learned in this program in analysis of particulate matter and source apportionment can be transferred to other areas of environmental sciences. As an example, water particulate matter can be treated similarly to air particulate matter in order to identify sources of particulate matter pollution in streams and rivers. New Zealand has just started a new project on this by analysing water samples using knowledge gained from previous air pollution programs.
Project duration	This project is designed to be completed by the end of the funding cycle.
Funding and project budget	to be completed

		Euro	Comment
Government cost-sharing			
Counterpart Institution(s)			
Other partners			
IAEA TCF:	*FE/SV/TC/WS*		
	Experts		
	Equipment		
	TOTAL		

SECTION-3: IMPLEMENTATION ASPECTS

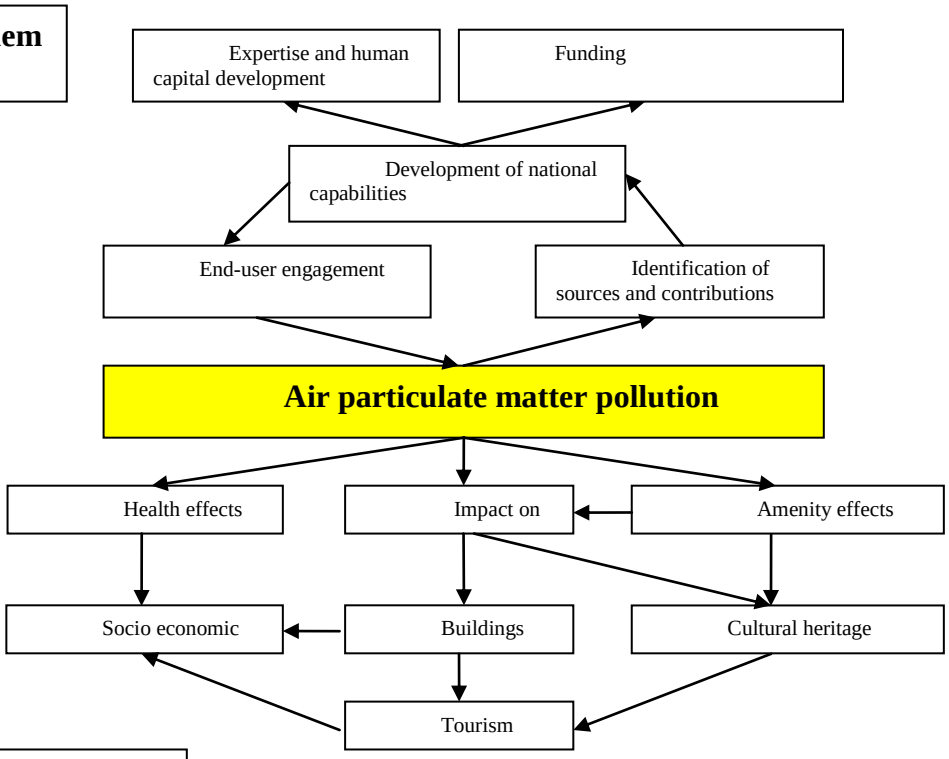
Implementation Strategy	National project coordinators and their teams will implement the project and interact with end-users to ensure uptake of data for reporting and for governmental purposes. National project coordinators are responsible for progress reporting as well as communication with the lead country coordinator and their national representatives. Member States have capital and human capabilities needed for this project. Year 1 will see the project formulation meeting refining the work plans and starting program work on objective 1 from day 1 – sampling polluted air in urban areas in conjunction with end-users and needs identified by the end-users. Objective 2 will commence in Q2/Q3 in the first year with a Regional training course on visibility and fine particulate matter sources in RCA Member States. At this training course, data from the previous project will be used for first analyses. Later in the year, the first Regional Meeting on cultural heritage and applicability of nuclear analytical techniques including end-users will take place. This meeting will ensure that end-users have been identified by Q3 by the national project coordinators. International expert will raise an awareness of the usefulness of nuclear analytical techniques for tackling air particulate matter pollution related impacts on cultural heritage. The program will be in full swing in Year 2. In this final year of the program a Regional training course on database for sources will be conducted in Q2/Q3. This will see the data being available for analysis by the data coordinator. The data coordinator will publish the new source database for fine particulate matter in heavily populated urban areas around Asia. Nuclear analytical techniques will be applied throughout the program to identify sources and their contributions to air particulate matter. This will happen at national level and under certain circumstances also by using RRU services. Expert missions to National Seminars for information transfer of project objectives to end-users will ensure that objectives and outcomes are met.The impacts of local industries, coal burning for power production, manufacturing, motor vehicles etc. on fine particle urban air sheds using nuclear analytical technologies and visibility linked to air particulate matter composition will be published by end-users in reports and via academic publication thought the program.

Monitoring and Reporting	Fine and coarse particulate matter will be monitored with GENT samplers at each individual country. This will complete the establishment of the baseline for the sources in the RCA region in the database. National project coordinators are trained in using the sampling equipment to high perfection. Filters are commercially available for this project. National project coordinators and their national project teams will take the lead in implementing the project locally. The lead country coordinator will lead the project from the onset and provide reports to the RCA secretariat via the national representative, particularly the annual report for the national representative meeting. The RCA chair will monitor progress of the project. The technical officer will provide technical evaluation of the project. To ensure that the lead country coordinator has sufficient information about progress, a 6 monthly report is provided by the national project coordinators.
Risk Management	Predecessors of RAS07023 have provided evidence that this project will also be successfully implemented. Success stories have been published at high level as well as in academic publications. Samplers were run to satisfaction by the national project teams. The database on fine and coarse particulate matter in RCA region was completed on time. Progress reported for RAS07023 in respect to the source database also produces confidence that objectives and outcomes set for this program will be achieved. RRUs have been seamlessly providing data to fill gaps in the database when countries were in need of services due to access or technical issues at nuclear analytical facilities. The national project coordinators are well trained in filter changing, handling the samplers, black carbon analysis, nuclear analysis as well as source apportionment and source contribution analysis. Countries have established well running sampling sites. Experts are available in the region to address individual problems on a daily basis. In fact experts from the region are also successfully attending national workshops contributing to increased awareness of the need to identify sources from man-made sources. Overall managerial and technical risks are low. End-users are well established in the program in respect to objectives 1 and 2. Objective 3 requires a new end-user group to join the program. Successful contact has already been made by several national project coordinators. Pakistan and Sri Lanka have already shifted their sampler to the Lahore and Kandi sites respectively in agreement with the country's cultural heritage end-user. Risks associated with uptake of data and results by end-user from environmental agencies and councils are low. The major risk of the program is the need for end-users focused on cultural heritage. This risk will be managed by targeted national seminars, a regional workshop that involves end-users and expert missions using experts in cultural heritage already identified by the IAEA in Vienna.

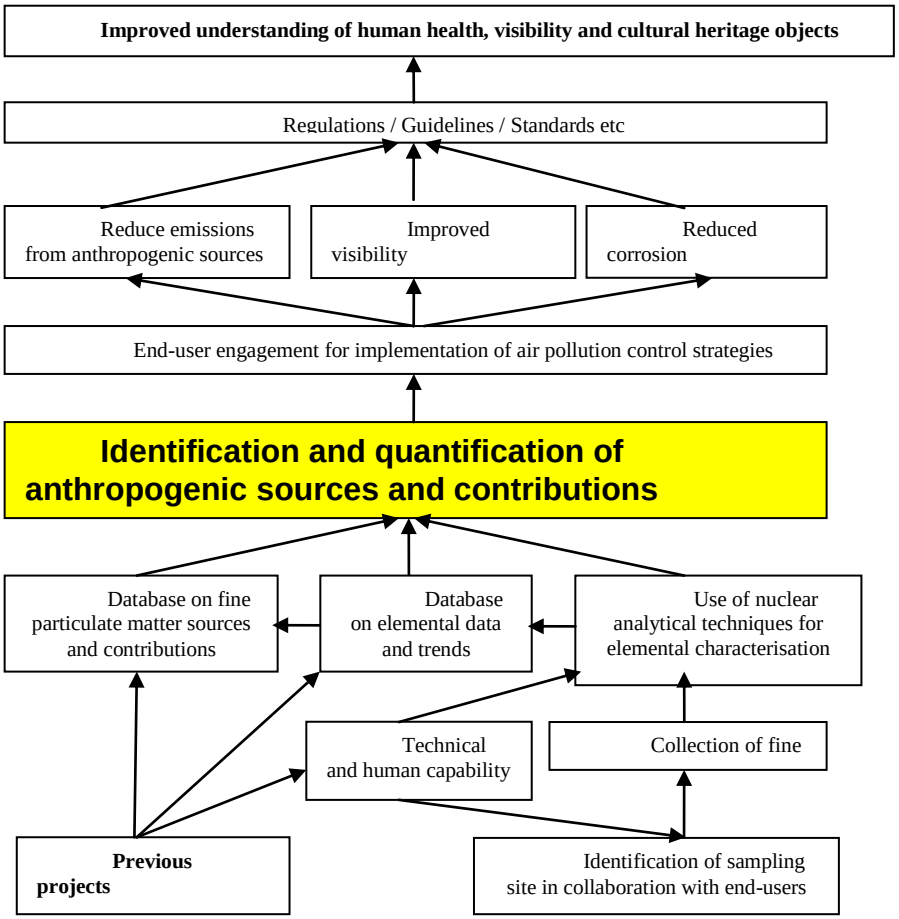
SECTION-4: WORKPLAN

Project Workplan	Refer to Appendix B.

Problem Tree



Objective Tree



Appendix A: Logical Framework Matrix (LFM) template

Design Elements	Narrative Description	Indicators	Means of Verification	Assumptions
Overall Objective	Improved understanding of human health, visibility and cultural heritage objects	Improvement in source reduction of fine particulate matter related to health issues (also applies to cultural heritage objects) and visibility by the end of project.	New Data on fine particulate matter and visibility available at end of project.	Baseline database available before start of project. Health and visibility statistics available. Key Cultural heritage issues identified
Outcome (Specific Project Objective)	1. Assessment of impacts of local industries, coal burning for power production, manufacturing, motor vehicles etc. on fine particle urban air sheds using nuclear analytical technologies. 2. New Relationships between fine particle composition (Black Carbon, sulphates, nitrates, soil and others) and light scattering and visibility established. 3. Impacts of fine particulate matter pollution on cultural heritage objects identified.	1. Anthropogenic sources of fine air particulate matter identified and information shared with end-users by December 17. Information disseminated at national seminars by December 17. 2. Reports on relationships by national project coordinators by end or project. 3. Reports by national project coordinators by the end of project.	1. National databases on fine particulate matter and end-users initiated by December 2016. Also national seminars organized by December 2017. 2. Relationships between sources and light scattering and visibility established at training courses during 2017. 3. Results of nuclear analytical techniques reported by national project coordinators at the end of project.	1. Member States actively sampling air particulate matter in polluted urban areas, nuclear analytical techniques available, source apportionment human capability available and end-users working in the project 2. Fine particle composition available, National team member attend training, IEX available for training courses 3. Sampling at cultural heritage sites, nuclear analytical analysis, source apportionment capabilities, regional meeting organised, IEXs available
Outputs	0. Project team operational 0.1 project team and updated work plans 0.2 final project meeting 0.3 six monthly progress reports and annual LCC report 1. National Seminars for information transfer of project objectives to end-users	0. 0.1 National team established, work plans available 0.2 Final project meeting announced 0.3 Reports submitted six monthly to lead country coordinator. LCC report to national representative	0. 0.1 List of national teams and work plans report 0.2 Final project report 0.3 National reports used by lead country coordinator in annual progress report 1. National seminars reported by	0. 0.1 National counterparts able to provide national teams 0.2 Member States able to host meeting, IEX able to attend meeting 0.3 Continuous sampling

Design Elements	Narrative Description	Indicators	Means of Verification	Assumptions
	2. Relationship between visibility and fine particulate matter sources in RCA Member States identified 3. Applicability of nuclear analytical techniques for cultural heritage studies 4. Tools for populating database and results extracted from database 5. Gaps in fine particulate matter database filled by RRU services in case of equipment breakdown and urgency 6. Database of fine particulate matter source from anthropogenic sources in urban areas in the RCA region 7. Fine filters loaded with air particulate matter 8. Manuals for GENT samplers and sites selection, XRF and IBA analysis of air particulate matter	1. National seminars announced by national project coordinators 2. Regional training course announced 3. Regional meeting on air particulate matter and visibility 4. Regional training course announced and database established by end of project 5. RRU services 6. Database structure announced by data coordinator 7. NAT data reported to data coordinator 8. Contracts with international experts	national project coordinator 2. Expert mission reports 3. Meeting report 4. Expert mission reports and availability of draft database after the course 5. Reports available after completion of RRU services 6. Database available by end of project 7. Data included in database 8. Manual published as TEC books	and analysis of data (incl source apportionment) by national project coordinator. Lead country coordinator established. 1. National counterparts able to organise national seminars 2. Member States able to host course and experts able to attend course 3. Member states able to host meeting, experts able to attend meeting and end-user attracted to meeting 4. Member States able to host course, experts able to attend, database in 'pre-draft' structure before the course 5. RRU able to undertake task, IAEA able to organise contracts 6. Data coordinator available and data available to coordinator 7. Support needed for fine and coarse air filters (samplers operate with both simultaneously) and minor repairs. 8. IEX available for preparation of manuals
Activities	0. 0.1 project teams assembled by national project coordinator. Planning meeting	0. 0.1 National teams announced. Planning meeting announced	0. 0.1 National teams established by January	0. 0.1 Member States have human capability to

Design Elements	Narrative Description	Indicators	Means of Verification	Assumptions
	0.2 Project evaluation and reporting of success stories and lessons learned 0.3 six monthly progress reports by national project coordinators and annual lead country coordinator progress reports 1. National seminars 2. Regional training course on visibility and fine particulate matter sources in RCA Member States 3. Sampling of air particulate matter at cultural heritage sites. NAT for elemental analysis. Source identification. Source apportionment. Transfer of data and source apportionment information to end-users 4. Sampling of air particulate matter in polluted urban air sheds. NAT for elemental analysis. Source identification. Source apportionment. Transfer of data and source apportionment information to end-users from environmental agencies. Data transfer to data coordinator and data coordinator to assemble database 5. Gaps identified by data coordinator and national project teams. 6. Assembling of database 7. Samplers operating throughout the project and filters are collected weekly 8. Preparation of manuals	0.2 Final project meeting announced 0.3 Reports submitted 1. National seminars announced 2. Training course announced 3. Sampling, use of NATs, source identification and apportionment and end-user engagement reported in 6 monthly progress reports. Regional training course 4. Sampling, use of NATs, source identification and apportionment and end-user engagement reported in 6 monthly progress reports. Regional training course. Data coordinator progress reports during the project. 5. RRU services and procurements identified 6. Data base structure announced at planning meeting and progress 6 monthly progress reports by data coordinator 7. Data reported to data coordinator 8. Manual structures announced by Q4 2016	2016. Planning meeting report 0.2 Final project meeting report 0.3 Progress reports received 1. Participation reported to LCC 2. IEX training course reports 3. Progress reports and IEX training course reports 4. Progress reports and IEX training course reports and data base available at end of project 5. RRU services and procurements implemented 6. Database available at end of project. 7. Data included in database 8. Manuals available in draft status by Q1 2017	contribute to national teams. Member States able to host planning meeting 0.2 Member States able to host meeting. IEX available. 0.3 Sampling of air particulate matter weekly in urban areas and cultural heritage sites, nuclear analytical techniques available for measurements, source apportionment capability in Member States 1. National project team member available to attend seminars 2. Member States able to host training course 3. Sampling equipment operational, NAT available, trainer man power in source identification and apportionment, end-users interested in cultural heritage studies. Member States able to host regional training course. 4. Sampling equipment operational, NAT available, trainer man power in source identification and apportionment, end-users interested in anthropogenic

Design Elements	Narrative Description	Indicators	Means of Verification	Assumptions
				air pollution studies. Member States able to host regional training course. Data coordinator available. 5. RRUs available and funding available from IAEA for RRU services, scientific visits and procurements 6. Data coordinator available for project and timely submission of data to database coordinator from national project coordinators. 7. Human man power at national level and broken equipment 8. IEX identified

Appendix B: Workplan template

(OUTPUT /) **Activities**	**Responsibility (MS, IAEA, Others)**	**Inputs (e.g. FE, SV, EX, PR, TRC, meeting, cash)**	**Funding Source (IAEA, Govt. Cost-Sharing, MS, Other)**	**Quantity (Q)**	**Rate (R) (see table in next page for IAEA inputs)**	**Budget (=QxR)**	**Start**	**End**
Output 0: (Standard for all TC projects) **PROJECT MANAGEMENT TEAM OPERATIONAL**								
0.1 …Setting-up project team, update project workplan (CP, team in MS)	MS	Meeting IEX	IAEA	13 3	3,000 5,000	39,000 15,000	Q1 2016	Q2 2016
0.2 …Conducting final project meeting	MS	Meeting IEX	IAEA	13 3	3,000 5,000	39,000 15,000	Q4 2017	Q4 2017
0.3 …Preparing and submitting PPARs (every six months) and annual progress report by LCC	MS		MS	0	0	0		
Output 1: (From the LFM)								
National Seminars for information transfer of project objectives to end-users	MS	IEX	IAEA	3	5,000	15,000	Q2 2016	Q3 2017
Output 2: (From the LFM)								
Regional training course on visibility and fine particulate matter sources in RCA Member States	IAEA	RTC IEX	IAEA	13 2	3,500 5,000	45,500 10,000	Q2 2016	Q3 2016
Output 3: (From the LFM)								
Regional Meeting on cultural heritage and applicability of nuclear analytical techniques including end-users	IAEA	RWS IEX	IAEA	20 2	3,000 5000	60,000 10,000	Q3 2016	Q4 2016
Output 4: (From the LFM)								
Regional training course on database for sources	IAEA	RTC IEX	IAEA	13 2	3,000 5,000	45,500 10,000	Q2 2017	Q3 2017
Output 5 (from LFM)								
Gaps in fine particulate matter database filled by RRU services in case of equipment breakdown and urgency	MS + IAEA	MS SV	IAEA	4 3	25,000 9,000	25,000 9,000	Q2 2016 Q1 2016	Q3 2017 Q3 2017
Output 6 (from LFM)								

Fine particulate matter database of sources of local industries, coal burning for power production, manufacturing and motor vehicles	IAEA	IEX	IAEA	2	5,000	10,000	Q1 2016	Q4 2017
Output 7 (from LFM)								
Operating samplers	MS + IAEA	MS	MS and IAEA	1	10,000	10,000	Q1 2016	Q4 2017
Output 8 (from LFM)								
Documentation of best practise for (1) sampler operation, installation and site selection (2) IBA and XRF analysis of air particulate matter	IAEA	IEX	IAEA	3	3,000	9,000	Q2 2016	Q3 2016

INDICATIVE PLANNING RATES FOR IAEA TC INPUTS[3]:

Input	Short name	Basis	Time-Unit	Rate (Euros)
International Expert (includes IAEA staff)	**IEX**	1 person	Week	5000
Regional Meeting / Workshop	**RWS**	1 participant	Week	3000
Regional Training Course	**RTC**	1 participant	Week	3500
Fellowship	**FE**	1 person	Month	5400
Scientific Visit	**SV**	1 person	Week	3000

- Notes for the project planning meeting in Q1/Q2 2016:
  - Participation in this project: This project can't afford to carry any Member State who is not up to the task and already has a country database, NAT experience and PMF knowhow as this project is not starting at ground zero.
  - Visibility: Countries should consider to co-locate their samplers with nephelometer systems to measure bscat and therefore relate the data produced by objective 2 to visibility directly.
  - Project focus and cultural heritage: This programme focuses on activities in objectives 1 and 2 where participants from all Member States have indicated a need at the review meeting in Manila in November 2013. It is expected that only some countries will participate in objective 3. Countries have been preliminarily identified at the review meeting in Manila. They have expressed a strong need for research in this area and shown a great interest in co-locating samplers with cultural heritage objects.

[3] These rates provide rough level granularity for preliminary budget estimation of TC inputs. Required detail during the PCMF entry stage later in the year may vary.

Reply to advisory committee feedback on draft RCA project concept #6 (air pollution)

Andreas Markwitz
Lower Hutt, 07 February 2014

Dear RCA programme advisory committee,

Thank you very much for your valuable feedback on the project concept proposal #6, which was helpful in preparing the project draft.

In the light of the comments, problem and objective trees were added to clarify the structure of the proposal and to show that the 3-objective approach is focussed. Objectives 1 and 2 are closely interlinked and can also be seen as one activity with two outcomes. For clarity of outcomes, this activity has been 'split' into two objectives. Objective 3 is also interlinked with objectives 1 and 2 considering that end-users from environmental agencies will benefit from the data and results as much as end-users focussing on cultural heritage aspects. Objective 3 saves cost by avoiding duplication of sampling and analysis.

Again, thank you very much for your constructive feedback.

Regards,
Andreas Markwitz
GNS Science, Lower Hutt, New Zealand

7	**Delivering the promise of food irradiation to socio-economic development through strengthening promotion, acceptability and trade**	**NZE**

Regional Project Document Template (Category A)

Project concepts positively appraised should be further developed into full project documents, following the LFA.

Region	Asia and Pacific		
Regional/Cooperative Agreement (if applicable)	RCA	**Priority No. given by Regional/Cooperative Agreement** (for concepts proposed by Regional/Cooperative Agreements)	
Project Title	**Fulfilling the Promise of Food Irradiation to Socio-economic Development through Strengthening Promotion, Acceptability and Trade.**		
Field of Activity	24 – Food Safety		
Regional Project Category[4]	*Capacity building for developing countries*		
Names and contact details of Counterparts and Counterpart Institutions	Concept endorsed by an RCA Meeting in Kuala Lumpur in October 2013 where all participating countries were present. The majority of RCA countries have participated in previous projects involving food irradiation and are expected to join the new project. Counterparts actively involved in this project formulation were: **Mr Peter B Roberts** Radiation Advisory Services 31 Wyndrum Avenue Lower Hutt New Zealand Tel: 0064 4 5699455 Email: radservicesxtra.co.nz **Ms. Zenaida M. De Guzman** Atomic Research Division, Philippine Nuclear Research Institute Diliman, Quezon City Philippines Fax: +932-9259211 Email: ***zmdeguzman@pnri.dost.gov.ph*** **Ms ZubaidahIrawati Koenari** Centre for Application of Isotopes and Radiation Technology (PATIR) National Nuclear Energy Agency (BATAN) Radiation Processing, Food irradiation, 41 Jalan Lebak Bulus Raya No.49 P.O. Box 7002 JAKARTA, Selatan 12070 INDONESIA Tel.: 006221 769 0709 Fax: 0062 21 751 3270 E-mail: irakoenari@yahoo.com **Ms Zainon Othman** Malaysian Nuclear Agency Ministry of Science, Technology and Innovation Research & Technology Development, Agrotechnology & Bioscience Bangi 43000 KAJANG, Selangor		

[4] Policy and Procedures for TC Regional Projects

	MALAYSIA Tel.: 0060 3 89202097 Fax: 0060 3 89201099 EMail: zainon@nuclearmalaysia.gov.my **Ms Meixu Gao** Institute for Application of Atomic Energy; Chinese Academy of Agricultural Sciences (CAAS) P.O. Box 5109, 2 Yuanmingyuan West Road BEIJING 100094 CHINA EMail: meixugao@263.net

SECTION-1: PROJECT BACKGROUND AND JUSTIFICATION

Regional Gap / Problem / Need Analysis	Food irradiation has many applications but socio-economic development in the region is not benefiting from them fully because the process is underutilized by the food trade. A major barrier to greater utilization is the perception of the food trade (retailers, particularly, and food producers) that consumers will not buy irradiated foods. Evidence from recent commercial successes will be used to demonstrate to key personnel in the food trade that this belief is unfounded and to develop new strategies for commercialization of irradiated food in all participating Member States (MSs). In several MSs, the new strategies will add market 'pull' to irradiation industry 'push' for commercialization of irradiated foods through new partnership arrangements between the participating institutions and key industry champions. Collaborative studies of market trials will demonstrate that consumers will purchase irradiated food and provide useful information on labelling issues and economics. Stimulating greater interest through food-trade partnerships will promote irradiated food allowing it to fulfil its socio-economic potential in the region. Radiation processing successfully treats foods to sanitize, disinfest or extend shelf-life. The potential for irradiated foods to contribute to improved health, food security and economic growth is substantial and has been underpinned by previous RCA projects. However, irradiation has not become a well-established method of food processing with only 800,000 tonnes approximately of food treated in the region and 1 million tonnes world-wide. Previous projects (RAS5046 and 5050) established the regulatory basis and potential benefits of food irradiation. They provided considerable capacity to support commercial efforts to correctly and safely treat foods (including. protocols, standards and regulatory frameworks used by food safety and phytosanitary officials in many countries to approve and regulate food irradiation). With the regulatory basis in place it is now time to reach out to the food industry and engage them more actively. An approved RCA project (RAS5071) aims to assist climate change initiatives in MSs by informing international and government agencies and scientists involved in climate change activities about the technical benefits of food irradiation. The proposed project differs from RAS5071 in both its purpose and target (commercialization and the food trade) and will require different resources, informational materials, strategies and delivery mechanisms. Major outcomes of the proposed project will be new strategies in all participating MSs to encourage collaboration between the Counterpart Institutions and key industry stakeholders and, in at least 6 MSs, completed partnership arrangements involving combined marketing trials and strategies for greater commercialization. The decontamination of spices, control of sprouting of bulbs and tubers and phytosanitary treatment of fresh produce are the main and increasing commercial applications of food irradiation in the region. Spices are treated in China and several other MSs, garlic in China and sprout-inhibited potatoes are still sold in Japan. In the last 5 years, trade in irradiated fresh produce from at least 4 Member States (India, Pakistan, Thailand and Vietnam) to the US has been initiated.

	Australia exports irradiated fruits to two countries in the region. New Zealand has imported fruit from Vietnam on a trial basis and routinely imports irradiated fruit from Australia. However, volumes of irradiated fruit traded are still only a few thousand tonnes annually. Irradiation is also being used to ensure the microbiological safety of meat products. Commercial examples include spicy chicken legs in China, a fermented pork sausage product in Thailand and seafood in Vietnam. These commercial successes lead to an expectation that commercialisation of food irradiation should be expanding rapidly throughout the region. However, this is not the actual situation and irradiated foods have faced many barriers including lack of awareness among consumers, the food industry and other stakeholders, fears of radioactivity, capital investment costs and labelling issues. Previous projects have included some activities to reduce these barriers. The recent commercial successes in the region, especially in fresh produce (detailed above), plus evidence from the USA, has led to a re-evaluation of the main barrier to progress. Evidence from the marketplace now demonstrates that most consumers purchase irradiated food when it is offered at retail outlets. Consumer resistance is not as significant an issue as previously believed and the fears of retailers are mis-placed. RCA Member States have now identified the main barrier to progress as the perception within the broader food industry (producers and, particularly, retailers) that consumers will accept irradiated foods. Many food producers, traders and retailers are conservative and reluctant to adopt any new technology. The food industry still has only a limited understanding of irradiated foods and of the recent successes in creating new markets. There is a 'disconnect' between the food trade and the food irradiation industry that is a substantial barrier to commercial uptake of the technology. The proposed project is the first RCA food irradiation project to target specifically retailers and key food producers based on recently gathered information about retail sales of irradiated food and actual consumer reaction. The project is targeted towards creating a regional strategy to promote food irradiation to the food industry. The marketing partnerships between industrial stakeholders that are a focus of the second year of the project are innovative in the region. The collaborative marketing trials will generate new data and information on consumer acceptance and food sales that will be credible to the food trade. It will also provide information on the economic cost of irradiation, the application of the regulations (including labelling), and also serve to stimulate more interest in the technology. The project will support RCA member states and help them develop their strategic approach. The development of these new stakeholder partnerships will ensure that the increases in the amount of irradiated food traded and irradiation facilities operating in the region are sustainable. Influencing key decision makers within the retail trade and major food producers should unblock the barriers to greater application of food irradiation technology This will create new opportunities for the rich agricultural resources in the region and unlock the full socio-economic potential of the technology, specifically its ability to improve health and provide sustainable agricultural, industrial and economic growth.
Why should it be a regional project?	Previous projects have built regulatory capacity, promulgated know-how and technical competence. However; few MSs in the region irradiate substantial volumes of food commercially. China (garlic, spices, spicy chicken legs) and Viet Nam (spices, seafood and other high value foods) account for almost 90% of the irradiated food produced in the region. Most countries treat small volumes of various products for specific purposes and markets; in some MSs quantities remain at a semi-commercial scale. A few countries do not irradiate food on a commercial level but have legislation that allows it.

	Some individual MSs have started to promote irradiated foods (notably Australia, Indonesia, Malaysia, Pakistan, the Philippines and New Zealand). However, a greater emphasis on the wider food industry is required to support these initiatives and to assist other MS in developing a successful commercial environment and to progress these initiatives rapidly. A regional project is an efficient means of collaboration and will provide a regional impetus for the increased commercialization of irradiated food, building on the capacity already present and promoting a sustainable market. It will provide a boost to MS in the early stages of adopting the technology and regional collaboration will greatly assist those already engaging their food industry by helping them support each other. The varied experiences of commercialization in Member States will have a synergistic effect on project resources and strengthen approaches and strategies at national and regional levels. The capacities of countries technically advanced in the commercial application of food irradiation can be used to address the needs of less advanced countries. A broad approach is necessary to target beneficiaries in the food trade, which is now globalized in its scope and thinking. Sharing of information on how different existing markets for irradiated food have been developed, the barriers encountered and the response of industry and consumer in different countries will be valuable in identifying future trade opportunities. A regional project is therefore an appropriate vehicle for this project. More immediately, regionally organised activities will permit the devising of a harmonised strategy to increase the use of food irradiation. Through such activities, it is intended that a regional approach to greater partnership between irradiation processors and the food industry will be generated. This will sustain the momentum gained from the past RCA investments and achievements and lead to expanded commercialization and trade development of irradiated food for domestic and export use in the region. The Asia Pacific Region is home to nearly 60% of the world's population, and generates roughly about 25% of the global GDP. As recognized in RCA priorities, there is a need to improve health, access to a healthy diet and to generate sustainable development in largely agricultural economies has been recognised in countless national and regional planning documents. A project involving increased use of a technology that contributes to food safety, food security and to increased trade has significant regional implications.
Stakeholder Analysis and Partnerships	The radiation processing industry (International Irradiation Association or iiA) has expressed interest in assisting as a key stakeholder representing the interests of food irradiation facilities world-wide. Cooperation is highly likely since irradiation facility owners will have a new product stream requiring treatment and it is envisaged that they will welcome this initiative to boost trade in irradiated food products. A recent iiA meeting in November 2013 highlighted the need for new initiatives on food irradiation, but noted that linkages with the food trade had not been made. Counterpart institutions in RCA countries already have links with the food sector, food control authorities and irradiation facilities. The project will apply these stakeholder relationships in order to maximize the likelihood of success. Counterpart institutes are in a position to act as an 'honest broker' between the different industry sectors. Ultimate end users are the consumers of the region, who will have a safer and more secure food supply, and food traders who will be able to expand their markets overseas for fresh produce. Food producers will gain new and more secure opportunities to sell their produce and food retailers will have the opportunity to offer either different foods, safer foods or foods that would normally be out of season. Government agencies involved in trade and food importers will have another option available to meet increasingly stringent trade and quarantine requirements in importing countries.

	Support from national governments will include coordination of national project activities across health, agriculture and trade sectors and the collection and dissemination of information required and gained during the project. Also, because the project is expected to create new partnerships between R&D institutes, food irradiation facility owners and key personnel within the food trade, it is expected that participants will host events to bring together key stakeholders with the purpose of forging agreements and initiating "marketing partnership studies". The partnerships will be brokered by National Project Coordinators and their staff, assisted by their national government. The in-kind contributions of this type can only be estimated at this time. Support is also expected through the RCA Regional Centre and IAEA Collaboration centre based in KAERI/ARTI, Republic of Korea.
Overall Objective (or Developmental Objective)	Improvements to human health, food security and phytosanitary treatments used for trade in agricultural commodities important to Member States through greater commercial use of food irradiation and increased retail trade in irradiated food.
Objectives analysis	A "received wisdom" that consumers will reject irradiated foods is long-standing and widespread but is now demonstrably a mis-understanding of consumer opinion surveys and campaigns by some food activists. This has led to retailers being extremely reluctant to consider stocking irradiated foods and to a 'knock-on' effect that food producers believe there is no market for irradiated products. This has resulted in little growth in irradiated food volumes in the last decade and, therefore, its potential benefits have been limited. However, the successes of the last decade have made clear that most consumers do not reject irradiated foods outright and no consumer backlash occurs when they are sold at retail. This project will build on the various successes of commercial food irradiation and devise strategies at regional and national levels to demonstrate to key food industry personnel that consumer rejection of irradiated foods is a myth. Strategies will include developing greater partnership between the irradiation industry and the food trade, to promote mutual understanding of issues such as limited shelf-life, seasonality, temperature control and the food supply chain. A problem tree and objective tree are attached.
Role of nuclear technology and IAEA	Radiation processing, a peaceful application of nuclear technology, involves exposing food commodities to ionizing radiation under controlled conditions. The process is increasingly accepted by authorities in many countries because of its potential to improve food safety, contribute to a reduction in post harvest food losses and provide an alternative method for phytosanitary treatments of traded foods that is better for the environment and human health. The technique is an alternative method to the use of methods that involve chemical treatments and residues or heat treatment methods. The IAEA is expected to provide funding, project management and technical support for the implementation of the project and organizational arrangement of the different events. It is envisaged that the IAEA will play significant role as capacity builder and provide support and an operational platform for networking of scientists, professionals and food industry representatives in the region. This will include project meetings, technical presentations, stakeholder meetings, expert missions and seminars.

SECTION-2: PROJECT DESCRIPTION

Project Specific Objective (Outcome in the LFM)	A measurable improvement in positive attitudes towards irradiated foods among food retailers, producers and consumers together with a sustainable increase in irradiated food volumes traded and in food irradiation facilities treating commercial volumes in the region.

Performance Indicator(s)	More favourable attitudes of retailers and food producers will be measured by comparative before and after surveys. Trade increases will be measured using data on trade volumes kept by export/import authorities. Data gathered at a national level in the first quarter of the project will be amalgamated into regional figures and compared with similar data 12 months after project completion with the objective of at least a 50% increase. Volumes of irradiated food treated for sanitary purposes will also be obtained from irradiation facility owners and licensing authorities with the same time frame and targeting a 20% increase. The impact on improved health-care will be estimated using literature figures that show that each 10% increase in the volume of target foods irradiated results in a possible 2.5% decrease in the deaths, illnesses and costs associated with foodborne disease. These estimates are available in developed and those developing countries with reasonable health statistics. Advice will be sought on translating this to some MSs that are less developed. Another specific indicator will be the publication of an article in a major food trade journal that details market/consumer reaction studies to irradiated food in at least 6 MSs.
Project Logical Framework Matrix	Attached as Appendix A.
Physical Infrastructure and Human Resources	Existing physical and human resources will be adequate for the project since the project involves gathering and utilizing information on previous experience within the Member States. All RCA Member States trade in food and have R&D facilities involved in food irradiation research, although these remain less than optimal in a few countries. Many Member States have full commercial or pilot-scale irradiation facilities for food. National Project Coordinators from earlier RAS projects will be the major human resource. The project involves enabling these specialists to interact with key stakeholders with a view to increasing the commercialization of food irradiation.
Safety and Regulatory Infrastructure	Most of the participating Member States have adequate regulations in food irradiation and regulatory infrastructure and standards in place. Many Member states in the Asian region have trained personnel who have good working experience in radiation processing.
Requirements for Participation	Due to participation in previous RAS food irradiation projects, relevant experience is available in most Member States. A minimum requirement for participants is an active R&D programme in food irradiation and a demonstrated programme to inform the food industry about food irradiation and encourage technology transfer.
Participating Member States	**Resource Countries** Australia Japan Korea New Zealand **Target Countries** All other RCA Member States
Other considerations, e.g. environment, gender	Irradiation can be used as a substitute for food treatments using chemicals either replacing or minimizing the use of chemicals that are potentially harmful to human health and/or the environment. The increased economic activity will be affect men and women similarly, but improvements to the food supply and healthier foods, while positive for all, are issues that have a generally greater impact on women and children.
Project duration	Completion of the main project activities will be completed in 2016-17. However, the final review meeting and editing of a publication will be conducted in 2018 and monitoring of trade volumes and food trade attitudes will continue for up to two years until Dec 2019 as per RCA Guidelines & Operating Rules.

Funding and project budget				
			Euro	Comment
	Government cost-sharing		71,000	Includes costs for output 0, project management
	Counterpart Institution(s)			
	Other partners		12,000	Industry partners
	IAEA TCF:	*FE/SV/TC/WS*	286,000	Includes costs for output 0, project management
		Experts	60,000	
		Equipment		
		TOTAL	429,000	

SECTION-3: IMPLEMENTATION ASPECTS

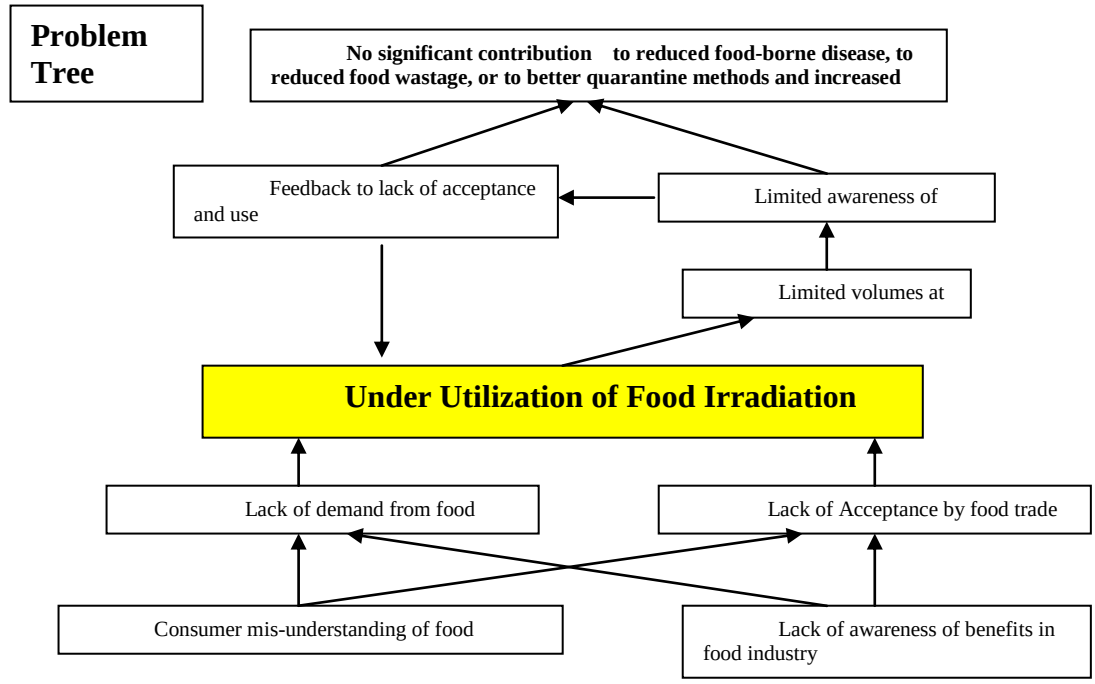
Implementation Strategy	National Project Coordinators (NPC) will take the lead in the implementation of the project and will form a National team consisting of scientists, regulators, traders and policy makers. The NPC will be responsible for finalizing the work and progress of the project and submit mid-term and final reports in consultation with the project team to the RCA Secretariat. Members States have the necessary infrastructure in place to begin project implementation. In Year 1, each National team will provide a report describing existing commercial successes, the reasons for those successes or, if commercial implementation has not yet occurred, the reasons for this situation. National teams will also be responsible for identifying key players among retailers, food producers and food exporters. Key food trade personnel will be invited to a meeting to provide their current views on irradiation of foods and surveyed for their views and the reasons for the limited use of irradiated food. Recommendations for new national strategies will be formulated. In Year 2, national plans will be implemented that include the establishment of partnerships between food irradiation facilities and food traders/retailers (e.g. food irradiation forums targeted at specific stakeholders). It is envisaged that these industry collaborations will initiate marketing trials of irradiated food(s) at food stores in several MSs. These “marketing partnership studies” will probe consumer resistance, generate trade data and information relevant to the economics of trade in irradiated food and in addition assist industry in their appreciation of food irradiation regulations (including labelling). An expected outcome will be that these marketing partnerships will demonstrate the lack of consumer resistance towards irradiated food to the food trade and stimulate more commercial interest in irradiated food as shown by trade surveys at the end of the project. The overall aim of the project activities is to support RCA member states and help them develop their strategic approach. An expert will be recruited to assist Member States to devise the appropriate strategy to bring the commercial successes to the attention of the food trade and to develop greater interest in the technology. Meetings are planned to bring together both the R&D teams and food trade representatives.
Monitoring and Reporting	The initial monitoring activity will be to establish a baseline of irradiated food volumes traded as this will be the fundamental performance indicator. The number of irradiation facilities treating commercial volumes of food in the region will also be established. The National Project Coordinator (NPC) in cooperation with IAEA /RCA secretariat will take the lead in the implementation of the project together with the national project teams. The Lead Country Coordinator (LCC) will take active leadership for project implementation, monitoring and submission of reports through the National Representative that will be submitted to the RCA Secretariat. The reports submitted by the NPC will be sent to RCA Chair who will be responsible for monitoring the progress of the project. It is also the role of the

	Technical Officer (NAFA) responsible for food irradiation to provide technical evaluation of the project. The progress of the project implementation will be submitted by the LCC to the meeting of the National RCA Representative through the National Representative. The NPC and LCC will submit six- monthly progress reports to monitor the progress of the project against the performance indicators from the LFM. The final project report reviewing the achievements of the project will be submitted by the LC to the RCA secretariat with reference to the LFM.
Risk Management	The Participating MS have experience in previous RCA projects with successful implementation. The NPC will either have experience of earlier projects or be able to refer to previous NPCs involved in food irradiation. The majority of the MS have infrastructure, facilities and regulations in place to carry out the project and many are conducting commercial food irradiation activities. Thus the technical risk to the project will be minimal. The major risk is that senior executives and high-level managers in large retail or food producers' organisations will not agree to partnership during or after the project. This risk will be managed through the organization of project activities, the involvement of trade associations and the detailed gathering of pertinent commercial successes and use of an expert(s) in developing strategies to engage the food trade During this process our approach and informational materials will be refined and potential champions who are influential within the food trade will be identified and used to further project aims. In addition, continued monitoring and proper coordination of activities with stakeholders will further minimize these risks.

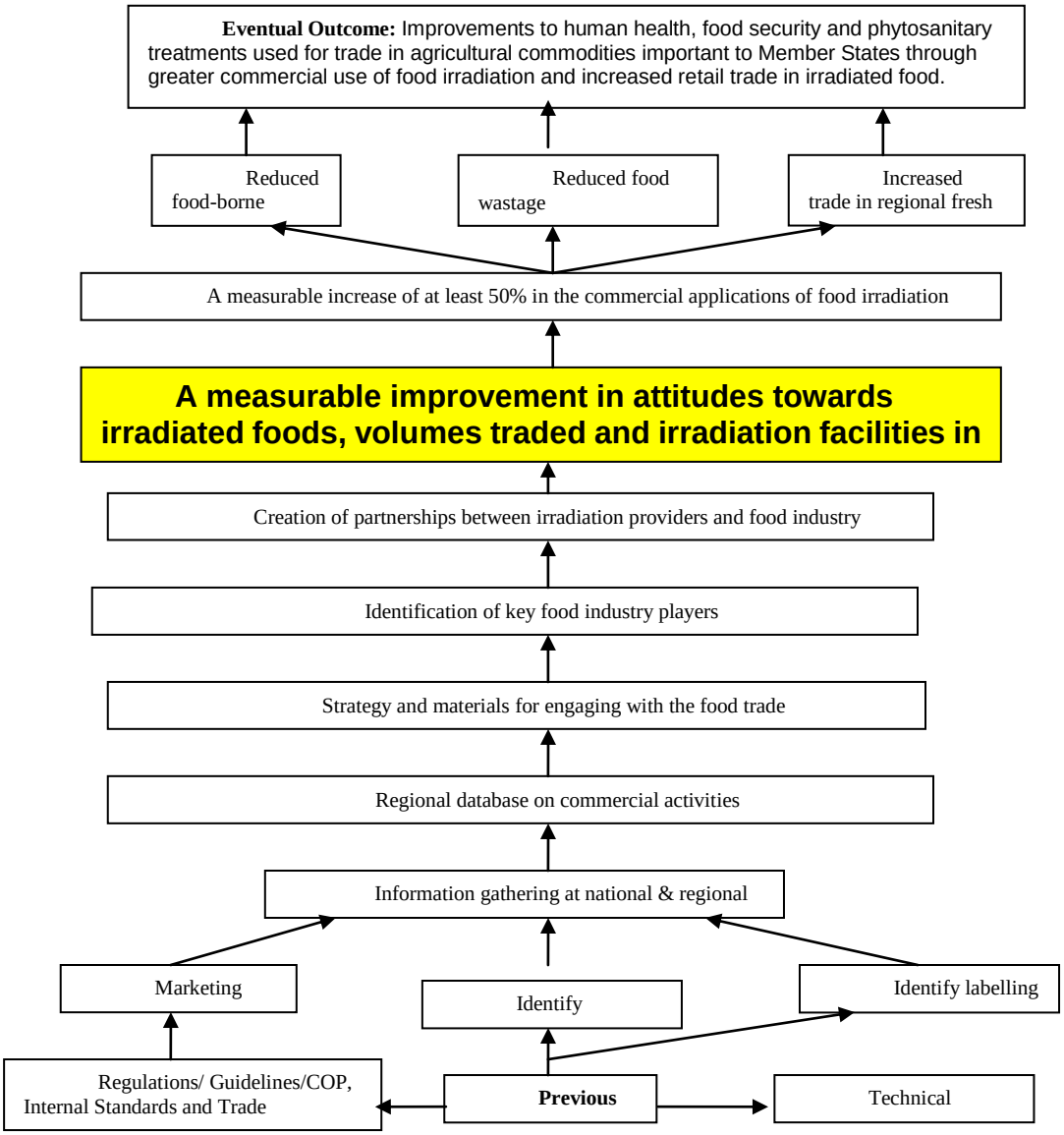
SECTION-4: WORKPLAN

Project Workplan	Attached as Appendix B.

Problem Tree



Objective Tree



Appendix A: Logical Framework Matrix (LFM) template

Design Elements	Narrative Description	Indicators	Means of Verification	Assumptions
Overall Objective	Improvements to human health, food security and phytosanitary treatments used for trade in agricultural commodities important to Member States through greater commercial use of food irradiation and increased retail trade in irradiated food.	Trade volumes increased in irradiated foods for both domestic use and export. A decrease in foodborne illnesses	Government statistics	Existing data on irradiated food trade can be used. Adequate health statistics are available.
Outcome (Specific Project Objective)	A measurable improvement in positive attitudes towards irradiated foods among food retailers, producers and consumers together with a sustainable increase in irradiated food volumes traded and in food irradiation facilities treating commercial volumes in the region.	Comparative surveys of food trade opinion in Year 1 and following completion of the project. An increase of at least 50% in commercial food irradiation activities within 3 years of project commencement	Baseline of commercial activities established at Q2. Questionnaires and feedback surveys from market trials and industry Final project report National progress reports beyond final project report	Retail and food producers act upon the evidence and strategies developed within the project. Sustainable partnerships between institutions, irradiation facility operators and food trade are in place. Extra commercial capacity is available
Outputs	0. Project management team operational (standard for TC projects 1.1 National project team established 1.2 National data on commercial activities 1.3 Identification of successful and unsuccessful	0. Not mandatory 1.1, 1.2 & 1.3 Reports by national project coordinator complete by April 2016	0. Not mandatory 1.1, 1.2, 1.3 Reports provided at regional meeting (activity 2)	0. Not mandatory 1. Government agencies able, and food industry willing, to provide relevant data

Design Elements	Narrative Description	Indicators	Means of Verification	Assumptions
	approaches to the food trade & commercialization in MSs 2.1 Regional database on commercial activities 2.2 Draft strategy for informing food trade about commercial successes in food irradiation. 2.3 Draft presentation (Power Point & Video) for the food trade. 3.1 Attitudes of key regional food trade companies towards food irradiation identified. 3.2 Finalized regional strategy to increase commercial volumes of irradiated food. 4.1 Main areas of potential growth for food irradiation identified. 4.2 Model for collaborative marketing trials 4.3 Identification of irradiation and food trade partners within Member States 4.4 Plans for national forums 5.1 New national plans for increased commercial food	2.1, 2.2 , 2.3. Database, draft strategy and draft presentations completed by June 2016. 3.1& 3.2. Report with strategy agreed & disseminated by Dec 2016. 4.1, 4.2, 4.3 Report complete by April 2017. 4.4 Venues and dates for national forums in at least 6 MSs established by May 2017 5.1 Plans circulated by national project	2.1, 2.2, 2.3 Meeting report. 3.1, 3.2 Meeting report sent to all MSs.including complete industry surveys 4.1, 4.2 ,4.3 Meeting report sent to all MSs. 4.4 Venues and dates forwarded to LCC 5.1, 5.2, 5.3	2. Reports completed from national seminars. Suitable expert identified. 3. Key players in food trade identified and willing to participate. Suitable expert identified. 4. Previous meeting successfully completes outputs on time. Suitable expert identified. MSs able to attract stakeholders to forums

Design Elements	Narrative Description	Indicators	Means of Verification	Assumptions
	irradiation activities. 5.2 Agreements between stakeholders for collaborative market trials of irradiated foods 5.3 Market trials completed 6.1 Review & evaluation of progress in trade attitudes towards irradiated foods and in increased commercial volumes of irradiated food 6.2 Recommendations for any adjustments required to regional/national strategies. 6.3 Publication of market trials in MSs in a major food trade journal	coordinator by August 2017. 5.2 At least 6 MSs with agreements by October 2017 5.3 Report on market trials circulated to local food trade and all NPCs by Dec 2017 6.1, 6.2 Review and recommendations completed by 2018, Q1, surveys of industry attitudes and commercial volumes by 2019 6.3 Publication available by Dec 2018	National plans, agreements and trial reports received by Lead Country Coordinator. 6.1, 6.2 Final project review report. Final trade surveys (2018-19) 6.3 Published article	5. Participation by private sector. 6. All necessary reports available.
Activities	**Output 0** Standard for TC projects **Outputs 1.1 & 1.2** To gather national data **Outputs 2.1, 2.2, 2.3**	**Inputs Summary** **Output 0** Standard for TC projects **National Seminars**		

Design Elements	Narrative Description	Indicators	Means of Verification	Assumptions
	To populate database, agree draft strategy and promotional presentations	**Regional Meeting, Expert Mission**		
	Outputs 3.1, 3.2 To survey industry attitudes; finalize strategy for food trade	**Regional Workshop, Stakeholder Engagement Meeting, Expert Mission, Surveys**		
	Outputs 4.1, 4.2 To agree priority growth areas for development; develop a regional model for collaborative agreements and marketing partnerships between stakeholders; establish venues and dates for national forums and market trials	**Regional Workshop, Expert Mission**		
	Output 5.1, 5.2 To develop new national plans, conduct collaborative market trials and re-survey industry attitudes	**National Seminars and Events**		
	Outputs 6.1, 6.2, 6.3 To review project and publish results of market trials in a food trade journal	**Final Project Review Meeting, Expert Mission, Surveys**		

Appendix B: Workplan template

(OUTPUT /) **Activities**	**Responsibility (MS, IAEA, Others)**	**Inputs (e.g. FE, SV, EX, PR, TRC, meeting, cash)**	**Funding Source (IAEA, Govt. Cost-Sharing, MS, Other)**	**Quantity (Q)**	**Rate (R) (see table in next page for IAEA inputs)**	**Budget (=QxR)**	**Start**	**End**
Output 0: (Standard for all TC projects) **PROJECT MANAGEMENT TEAM OPERATIONAL**								
0.1 …Setting-up project team (CP, team in MS)	MS	1st Coordination Meeting	MS IAEA IAEA	13 1 1	3,000 3,000 5,000	39,000 3,000 5,000	Q1 2016 Q1 2016 Q1 2016	Q2 2016 Q2 2016 Q2 2016
0.2 …Conducting project review/coordination meetings	MS	Mid Project Review Final Project Meeting	IAEA IAEA IAEA	1 13 13	5,000 3,000 3,000	5,000 39,000 39,000	Q3 2017 Q4 2018	Q3 2017 Q4 2019
0.3 …Updating project workplan					0			

0.4 …Preparing and submitting PPARs (every six months)	MS		MS	0	0	0		
0.5 …IAEA field monitoring (mid review and final)	IAEA	IAEA staff/expert travel (3 missions of one week during project life)	IAEA	3	3000	9000		
Output 1: (From the LFM)								
National Seminars for Collection of Data and Views on Food Irradiation	MS	meetings	GCS	13	1,000	13,000	Q1 2016	Q1 2016
Output 2: (From the LFM)								
Regional Meeting on Commercial Activities and Barriers in RCA Member States	IAEA	RWS IEX	IAEA	162	3,000 5,000	48,000 10,000	Q2 2016	Q2 2016
Output 3: (From the LFM)								
Regional Workshop for the Food Industry on Commercialization of Food Irradiation	IAEA	RWS IEX	IAEA	262	3,000 5000	78,000 10,000	Q4 2016	Q4 2016
Output 4: (From the LFM)								
Regional Workshop on Creating New Trade Opportunities Using Food Irradiation	IAEA	RWS IEX	IAEA	202	3,000 5,000	60,000 10,000	Q1 2017	Q1 2017

Output 5 (from LFM)								
	MS	Meetings	GCS	13	1,000	13,000	Q2 2017	Q3 2017
		IEX	IAEA	3	5,000			
						15,000		
National Seminars to Implement New Strategies for Food	MS		GCS	6	1,000			Q4 2017
		Events	Other	6	2,000		Q3 2017	
Irradiation						6,000		
						12,000		
National events for collaborative market trials								
Output 6 (from LFM)								
							Q1 2018	Q1 2018
Final Review meeting Included in Output 0.2								
Collation and editing of data from market trials to publishable standard	IAEA	IEX	IAEA	3	5,000	15,000	Q1 2018	Q3 2018

INDICATIVE PLANNING RATES FOR IAEA TC INPUTS[5]:

Input	Short name	Basis	Time-Unit	Rate (Euros)
International Expert (includes IAEA staff)	**IEX**	1 person	Week	5000
Regional Meeting / Workshop	**RWS**	1 participant	Week	3000
Regional Training Course	**RTC**	1 participant	Week	3500

[5] These rates provide rough level granularity for preliminary budget estimation of TC inputs. Required detail during the PCMF entry stage later in the year may vary.

Fellowship	**FE**	1 person	Month	5400
Scientific Visit	**SV**	1 person	Week	3000

Comment to RCAPAC

RCA Project Concept for 2016-17 *#7/8

Fulfilling the Promise of Food Irradiation to Socio-economic Development through Strengthening Promotion, Acceptability and Trade.

We thank RCAPAC for their helpful and generally positive comments on the project concept. RCAPAC had two major criticisms which have been addressed for consideration in the latest proposal. The modifications are highlighted for convenience here.

Comment 1 was essentially that much of the work to be undertaken in the new project was the same as has been approved for the 2014-15 (RAS5071) that aims to assist adaptation to climate change. The two projects are, however, very different in both purpose and target audience.

RAS5071 brings the known technical benefits of irradiated food to the attention of the scientists and the government and international agencies concerned with adaptation to climate change. The proposed project takes very recent commercial results in the market place and brings them to the attention of food retailers and producers in order to dispel the long-standing perception that consumers will not buy irradiated foods. The specific outcome desired is to improve positive attitudes in the food trade and thereby increase commercialization of irradiated food. This will require different resources, informational materials, strategies and delivery mechanisms from those of RAS5071.

Comment 2 was that the reasons why the project should be a regional rather than a set of national projects were not well enough delineated. There are three aspects to this. First, the several MSs in which commercial use is already underway treat different foods for different markets. Therefore there experience of commercialization differs. Barriers also differ between MSs. We prefer to think of using these different experiences to provide synergy through regional sharing of information. Second, this sharing provides opportunities to open new markets to different MSs. Thirdly, food trade is now a global phenomenon with broad strategies influencing decisions throughout the region.

We look forward to RCAPAC further comments on our proposal.

Peter Roberts (NZ National Project Coordinator for food irradiation on behalf of the proposed Lead Country)

8	**Application of mutation techniques to breed green super crop for sustainable agricultural production**	**CPR**

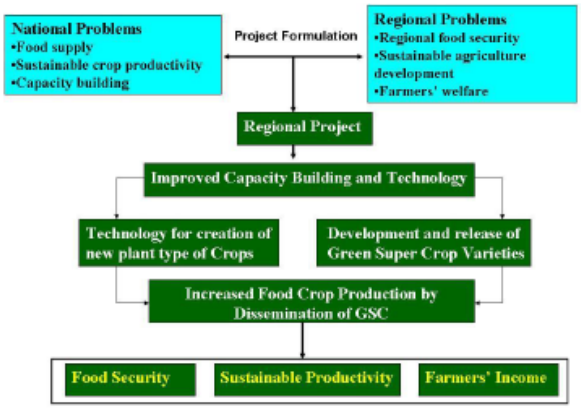
Updated 5 Jan, Based on Feedback

Regional Project Concept Template (Category A)

Region:	Asia and the Pacific		
Regional/Cooperative agreement (if applicable)	RCA	**Priority no. given by regional/cooperative agreement** (for concepts proposed under the auspices of regional cooperative agreements)	
Title	Application of mutation techniques for breeding green super crop to continually increase food productivity		
Field of activity	Crop production		
Regional project category[1]	☐ *Transnational* ☐ *Regional standard setting* ☐ *Capacity building for developing countries (√)* ☐ *Joint TC activities with a regional or international entity*		
Names and contact details of project counterparts and counterpart institutions (starting with the main counterpart)	Expected Counterparts are listed as follows: 1. Mr. Luxiang LIU, Institute of Crop Sciences, Chinese Academy of Agriculture Sciences 2. Mr.Chengdao Li, Crop Improvement Institute, Western Australian Department of Agriculture, Government of Western Australia. 3. Mr. Si-Yong Kang,Advanced Radiation Technology Institute, KAERI, Korea 4. Mr. Rusli Ibrahim, Division of Agrotechnology & Biosciences, Malaysian Nuclear Agency 5. Mr. Protul Kumar Roy, Institute of Food and Radiation Biology, Bangladesh. 6. Bhabha Atomic Research Centre (BARC), Department of Atomic Energy, India 7. Mr. Soeranto Human, Center for the Application of Isotope and Radiation Technology, National Nuclear Energy Agency (BATAN), Indonesia 8. Mr.Noov Bayarsukh, Plant Science and Agricultural research Training Institute, Mongolia 9. Ms. Nyo Nyo Mar, Mandalay Technological University 10. Mr. Karim Dino Jamali, Nuclear Institute of Agriculture (NIA), Tandojam ,Pakistan 11. Mr. Roland Rallos, Philippine Nuclear Research Inst. (PNRI) 12. Mr. Shiromani Edirimanne Horticultural Crops R & D Institute, Sri Lanka 13. Ms. Sumana Ngampongsai, Chainat Field Crops Research Centre, DOA, Thailand 14. Mr. Le Quang Luan Centre for Nuclear Techniques, Vietnam 15. Mr Bindeshwar Prasad Sah, Nepal Agricultural Research Council, Lalithpur, Nepal		
Analysis of regional Gap / Problems/needs	The world food and nutrition security has been a major concern. There are about 870 million hungry people of the 7.1 billion people in the world, among which 563 million in the Asia and the Pacific region, leading the biggest estimated regional distribution of hunger (FAO, 2013). For most countries in this region, great efforts have been done in developing and dissemination of new mutant varieties to continually increase crop productivity. While a number of challenges still need to be met for sustainable crop production: increasingly severe occurrence of insects and diseases; water shortage and increasingly frequent occurrence of drought. This issue is exacerbated by the growing population and disappearing large areas of crop lands with the economic development. It is believed that one of the most economic and effective approaches to address the above challenges should be to develop new type crop variety referred to as Green Super Crop (GSC) with super high yield potential, acceptable quality, good resistance to insects and diseases, tolerance to drought stresses, and high efficiency of nutrient usage. Unfortunately, there are some missing links and technological gaps among regional countries in doing research and developing such type of crop variety in terms of the new plant type construction and new integrated techniques. Induced mutation techniques have been playing very significant roles in combating to some of these problems by developing new mutant germplasm and mutant varieties. By the end of 2012, 1877 mutant varieties, which accounts for more than 60% of the total number of mutant varieties in the world, have been released or approved for		

[1] See the document entitled "Policy and Procedures for TC Regional Projects" at: http://pcmf.iaea.org/DesktopModules/PCMF/docs/2014_15_Docs/notes/Regional_TC_Project_Policy.pdf.

	cultivation in the Asian and Pacific region. Such great success of mutation breeding is partially contributable to the previous RCA projects, which have provided training and techniques in the Member States and organized research and development activities in enhancing crop genetic diversity, development of new techniques and germplasm, and facilitated the exchange of information and genetic materials, for example by establishing the germplasm exchange network and association "Asia and Oceania Association of Plant Mutagenesis (AOAPM)".It is anticipated that further innovative adoption of such strategies and efforts would eventually lead to the development of Green Super Crop. The objective is to strengthen research collaboration on mutational development of GSC among participating countries for increase crop productivity and supporting food security in this region.
Why should it be a regional project?	This new project is expected to bridging technological gaps among the regional cuntries in doing research and developing GSC.The regional approach will support research collaboration, training, sharing of knowledge and harmonization of procedures and methods of GSC development through mutation techniques. This proposed new project is mainly focused on technology related to GSC development and utilization, and hopefully it can be linked and synergized with the previours and on-going RCA projects RAS5040,RAS5045 and RAS5056, in which large efforts have been focused on identifying mutant germplasms and discovering genes for resistance to diseases and insects, drought and salt tolerance, grain quality and yield through effective application of mutation techniques. This proposed project directly links to the first priority area "Plant Mutation Breeding" in Agriculture Thematic Sector, and will address common issues in the region and assist participants to solve problems pertinent to their country in the development of GSC by effective application mutation techniques and biotechnologies. This much-needed boost to sustainable crop productivity will contribute to addressing the region's rising demand for more and better food in a timely and environment-friendly manner.
Stakeholder analysis and partnerships	The proposed project will provide technical support to enhance national and regional capacities, through regional training courses, expert missions and technical meetings. Regional training and information will be provided on the GSC design and use of integrated technologies. This will be distributed at the national level by the National Team, who will devise their own national strategies with regard to the institutes, policy makers, extension agencies, and farmers.
Overall objective (or developmental objective)	The general objective of this project is to enhance the capability of the RCA Member States in effective use of mutation techniques for induction and pyramiding of new mutant genes or germplams to construct new plant type for development of green super crop variety of main food, pulse and oil crops.

Analysis of objectives	
Role of nuclear technology and the IAEA	The effective improvement of crop depends on the availability of sufficient variability. However, most useful variability for important agronomic, quality and economic traits has been used up during the past century, which has naturally required new sources of useful genetic variability that are artificially induced or generated. Nuclear techniques are efficient technologies in mutation induction to improve plant genetics related to green super crop traits such as new plant type, yield component, growth duration and adaptation, etc. It has comparative advantage in some cases where other techniques may also achieve and it is the only technology in many other cases (other technologies are unable to generate the expected results or such technologies are not accessible to some Member States).
Project duration	The proposed starting date for this project is 1 January 2016 and two breeding cycles are needed to sufficiently achieve the project objectives, i.e., 2016-2019.
Requirements for participation	There should be a national program on crop mutation breeding, better supported with available manpower and possible nuclear irradiation facilities to conduct research on crop breeding. Some amounts of national budget to support the project are essentially needed. The requirements can be verified through proposal abstract made by each participating country.
Participating Member States	**Expected Member States to participate in this project:** 1. China, role: Resource (providing facility and expertise of mutation breeding of GSC) 2. Australia, role: Resource (providing facility and expertise of molecular breeding) 3. Korea, role: Resource (providing facility and expertise of mutation breeding of GSC) 4. Malaysia, role: Resource (providing facility and expertise of mutation breeding) 5. Bangladesh, role: Resource (providing facility and expertise of mutation breeding) 6. India, role: Resource (providing facility and expertise of mutation breeding) 7. Vietnam, role: Resource (providing facility and expertise of mutation breeding) 8. Indonesia, role: Resource (providing facility and expertise of mutation breeding) 9. Pakistan, role: Resource (providing facility and expertise of mutation breeding)

	10. Thailand, role: Target (receiving expertise) 11. Philippine, role: Target (receiving expertise) 12. Sri Lanka, role: Target (receiving expertise) 13. Mongolia, role: Target (receiving expertise) 14. Myanmar, role: Target (receiving expertise) 15. Nepal, role: Target (receiving expertise)			
Funding and project budget	*Provide an estimate of the total project costs and the funding expected from each stakeholder:*			
			Euro	Comment
	Government cost-sharing			(to be sent to the IAEA)
	Counterpart institution(s)			
	Other partners			Who?:
	IAEA Technical Cooperation Fund (TCF):	*Fellowships / Scientific visits / Training courses/ Workshops*	600,000	
		Experts	150,000	
		Equipment		
		TOTAL	750,000	

10	**The preclinical application of transdermal oxygen enzymes on the treatment of skin injuries induced by acute radiation accidents.**	**CPR**

IAEA International Atomic Energy Agency

Technical Cooperation (TC) Programme

Regional project concept

Name of the region: Asia and Pacific	**Regional/ Cooperative Agreement** *(if applicable)*: RCA	**Project concept priority number within the Regional/Cooperative Agreement Programme Note** *(if applicable)*:	**Project concept priority number within the Regional Programme Note:**

Title:

The title should be as concise as possible and should summarize the objective of the project.

The preclinical application of transdermal antioxidant enzymens on the treatment of skin injuries induced by acute radiation accidents

Problem statement:

Provide a summary of the issue to be addressed by the project. This should be the result of a situation analysis to identify the problem, and its cause and effect.

With the development of nuclear and radiation technology, the application of nuclear and radiation has become more extensively. Meanwhile, the acute radiation accidents happen frequently. Fukushima and Chernobyl nuclear accidents brought out the great disaster not only regional but worldwide as well. It is very important to know the radiation induced organ injuries and the mechanism of radiation damage. Because skin is usually the first site of external radiation particles entry in radiation treatment, variable degrees of skin reactions can occur. Serious radiation-induced skin injuries can cause severe pain, deformation, secondary infection, ulceration, and even necrosis. Currently, there is no effective and satisfactory therapy for this disease.

The advanced biotechnology is warranted to be applied for treatment of radiation-induced skin injury. Superoxide dismutases (SODs),glutathione peroxidase (GPx), catalase and heme oxygenase-1 (HO-1) are protective enzymes against radiation-induced ROS and damages. However, the existance of stratum corneum blocks the penetration of extraneous functional molecules as a self-protection mechanism. The application of modified protective enzymes with skin penetrating ability should be beneficial in ameliorating radiation-induced skin damage.

Objective:

State succinctly what the project is intended to achieve. Please state only one objective.

Superoxide dismutases (SODs), Catalase, heme oxygenase-1 (HO-1) etc, are all important antioxidases in the organism and can eliminate ROS caused by ion-irradiation effectively. However, they are not clinically applicable because the existance of stratum corneum blocks the penetration of these protective molecules.They can attenuate the injure induced by oxygen radical after been transermally delivered into skin tissue. This project focuses on preclinical application of "skin penetrating peptides" fused protective enzymes on ameliorating radiation-induced skin damage, which provides an effective approach as protein therapy. The foundamental objective of this project is to improve the treatment of radiation-induced skin damage and the living quality of victims.

Specific objectives:

1. Establishment of radiation-induced skin injury of different damage extent in multiple animal models (including rat, pig and monkey models).
2. Preparation of skin penetrating peptide fused protective enzymes, including SODs, Catalase and HO-1. Increasing the transdermal ability of these antioxidant enzymes.
3. Application of the above fusion proteins in ameliorating radiation-induced skin injury and estimating their effects. Their administration can be used individually or in combination.
4. Optimizing an effective therapeutic regimen for radiation-induced skin injury.

End users:

Who will use/benefit from the results of the project? (e.g. decision makers, service users, patients, farmers).

This project will benefit those injuried from acute nuclear and radiation accidents, including workers in the nuclear power plants and rescue personnels during nuclear and radiation accidents.

Past and present regional efforts in addressing the need:

Summarize any past and present regional efforts (including programmes/projects by other regional or international partners) to address the issue to which the project will contribute. Explain any specific gaps that the project will address. Why is a regional approach the most effective mechanism in this case?

This project has been supported by China Atomic Energy Authority (CAEA, Grant number A3820060130-06) and National Natural Science Foundation of China (Grant number 81102078 and 81172597). We have investigated the mechanism underlying radiation-induced acute skin injuries in animal models. Moreover, we have screened and identified an skin penetrating peptide (Chinese Patent No. ZI20910046601.5), which is beneficial for skin tissues when fused with antioxidant enzymes (Gu et al. Radiation Oncology 2013, 8:253). This project will continue our previous work and contribute to the preclinical treatment of radiation-induced acute skin injury, which will benefit those injuried from acute nuclear and radiation accidents. Under this project, We can cooperate with Korea and Japan counterpart in this radiation medicine field.

Role of nuclear technology:

Indicate the specific nuclear technique that would be used, and outline why it is appropriate for addressing the issue. Is the technique the only one available to solve the problem? Does the technique have a comparative advantage to non-nuclear techniques? Does the technique complement non-nuclear techniques?

Nuclear technology is required to create acute and chronic radiation-induced skin injuries in multiple animal models. Linear accelerators, Co60 and heavy ion accelerators are widely used in treating cancers, which may result in this kind of injury. Linear accelerators, Co60 and heavy ion accelerators will be used to produce beta-, gamma- and X-rays. These radiation techniques are currently available and only way to solve this problem.

Role of the IAEA:

What specific role would the IAEA be expected to play in the project?

Although this project has been supported by CAEA and National Natural Science Foundation of China, we expect IAEA to provide essential equipment and financial support to complete this project. Under the support of IAEA, we expect the cooperation with Korea and Japan can be intensified. For example, we can use the heavy ion accelerator at NRIS in Japan.

Participating Member States:

List the Member States expected to participate in the project.

Japan and Korea.

National and regional counterpart institutions / stakeholders involved in the project:

List all national and regional institutions and stakeholders expected to participate in the project. Please enter first the main counterpart institution and the Designated Team Member (DTM). This person will be the regional technical coordinator for the project.

School of Radiation Medicine and Protection of Medical college of Soochow University and Nuclear Emergency Center of Chinese Ministry of Health will be the national institutes to participate this project in China. Contribution: Preparation of transdermal fusion protein; establishment of animal models; administration of proteins; data collection and evaluation of treatments.

Prof. Jianping Cao (jpcao@suda.edu.cn) on Radiation Medicine and Protection, Medical college of Soochow University will be the region technical coordiator for this project.

Link to regional strategies or equivalent:

Is this project directly linked to a priority area identified in the relevant regional strategy? If yes, provide the reference. .

If not, explain why this concept is being presented for consideration.

CAEA and National Natural Science Foundation Committee of China has projects concerning treatment and protection for radiation-induced injuried. Our previous work has been supported (Grant number 81102078,1172597 and A3820060130-06).

Partnership:

List all external institutions and partners (other UN or international organisations, donors, etc.) expected to participate in the project, specifying the contribution of each.

1. National Institute of Radiological Sciences, Chiba, Japan. Contribution: Heavy ion irradiation.

2. Hiroshima University, Japan. Contribution: Animal model of radiation-induced injuries.

3. Korea institute of Radiological & Medical Science (KIRAMS), Korea. Contribution: Animal model of radiation-induced injuries.

Physical infrastructure and human resources:

What physical infrastructure and human resources are available to support the project? For example, existing laboratories, suitable buildings, staff that will be directly involved in this project.

List any regional resource centres that would play a major role in the implementation of the project.

School of Radiation Medicine and Protection, Medical college of Soochow University and Nuclear Emergency Center of Ministry of Health of China have equippted with radiological and molecular mediacal laboratories, SPF-standard animal labs, Co60, inear accelerators and X-ray mechines. Jianping Cao, Shuyu Zhang, Wei Zhu, Ming Li, etc. about 15 investigators and Ph.D students will be directly involved in this project.

Financial resources required and source of funding:

Provide an estimate of the total cost of the project and the expected funding provided by each stakeholder (Government cost-sharing, other partners and IAEA).

The total cost of this project is ~$500,000. The financial sources include central government, state government, research institution and IAEA. We have acquired ~$350,000 support from the Chinese government.

We hope that IAEA can support $150,000.

Duration of the project:

Indicate a realistic starting date for the project and the number of years required to complete the project. Projects should not exceed four years.

It will take three years to conduct this project (2016.11-2019.11)

Safety regulatory infrastructure:

Indicate whether or not the safety regulatory infrastructure and associated standards and procedures in the Member States that are expected to participate in this project are adequate to ensure that the project will be implemented in a safe manner. If not, specify the gaps and indicate how they will be addressed.

School of Radiation and Protection and Nuclear Emergency Center, Medical college of Soochow University has radiological and molecular mediacal laboratories, SPF-standard animal labs, Co60, inear accelerators and X-ray mechines. All these infrastructures have been safely regulated and used according to standards in related projects. The infrastructures in our coperators are all safely implemented.

11	**The investigation of carbon sink in the wet land of Asia using isotopic techniques**	**CPR**

IAEA International Atomic Energy Agency

Technical Cooperation (TC) Programme

Regional project concept

Name of the region: Asia and Pacific	**Regional/ Cooperative Agreement** *(if applicable)*: RCA	**Project concept priority number within the Regional/Cooperative Agreement Programme Note** *(if applicable)*:	**Project concept priority number within the Regional Programme Note:**

Title:

The title should be as concise as possible and should summarize the objective of the project.

The Investigation of Carbon Sink in the vegetated systems of Aisa Using Isotopice Techniques

Problem statement:

Provide a summary of the issue to be addressed by the project. This should be the result of a situation analysis to identify the problem, and its cause and effect.

In general consideration, the oceans, specially the Polar Oceans play a key role in sequestering CO2. But recent research has highlighted the valuabel role that the vegetated coastal ecosystem, specifically mangroves forests, sea grass beds, and salt marshes play in sequestering CO2. Although their global aera is much smaller than that of terrestrial forests or Polar Oceans, the contribution of vegetated coastal habitats per unit area to long-term C sequestration is much greater, in part because of their efficiency in trappping suspended matter and associated organic C during tidal inundation, so the question is how to quantify the amount of C sequestering and what is the mechanisms.

Objective:

State succinctly what the project is intended to achieve. Please state only one objective.

1. To improve scientific understanding of the underlying mechanisms that control C sequestion in vegetated ecosystems.

2. To assess the amount of C sequestration in the vegetated systems.

3. To encourage the application of istopic technology in the study of Global Change.

End users:

Who will use/benefit from the results of the project? (e.g. decision makers, service users, patients, farmers).

The decision makers of governments.

Past and present regional efforts in addressing the need:

Summarize any past and present regional efforts (including programmes/projects by other regional or international partners) to address the issue to which the project will contribute. Explain any specific gaps that the project will address. Why is a regional approach the most effective mechanism in this case?

RAS 7024 Supporting Nuclear and Isotopic Techniques to Assess Climate Change for Sustainable Marine Ecosystem Management.

The specific gaps of this project will address on the carbon sink in the vegetated system, which was ignored in the past. By regional cooperation we can easily and more accurately understand the caron sink in Asian vegetated systems.

Role of nuclear technology:

Indicate the specific nuclear technique that would be used, and outline why it is appropriate for addressing the issue. Is the technique the only one available to solve the problem? Does the technique have a comparative advantage to non-nuclear techniques? Does the technique complement non-nuclear techniques?

The isotopic techniques is more useful in this project because the it will not change with the changing of the environmental conditions.

Role of the IAEA:

What specific role would the IAEA be expected to play in the project?

(1) Provide the experts related with this projects;

(2)Provide fundings.

Participating Member States:

List the Member States expected to participate in the project.

CHINA, THAILAND, MALYSIA, BANGDISH, KOREA, INDONESIA, etc.

National and regional counterpart institutions / stakeholders involved in the project:

List all national and regional institutions and stakeholders expected to participate in the project. Please enter first the main counterpart institution and the Designated Team Member (DTM). This person will be the regional technical coordinator for the project.

Third Institute of Oceanography, SOA, CHINA.

Link to regional strategies or equivalent:

Is this project directly linked to a priority area identified in the relevant regional strategy? If yes, provide the reference. The Blue Carbon in the APEC.

If not, explain why this concept is being presented for consideration.

Partnership:

List all external institutions and partners (other UN or international organisations, donors, etc.) expected to participate in the project, specifying the contribution of each.

IAEA-MESL in Monaco

Physical infrastructure and human resources:

What physical infrastructure and human resources are available to support the project? For example, existing laboratories, suitable buildings, staff that will be directly involved in this project.

List any regional resource centres that would play a major role in the implementation of the project.

Laboratory of Marine Isotopic Technology and Environmental Risk Assessment, TIO,SOA,CHINA

Financial resources required and source of funding:

Provide an estimate of the total cost of the project and the expected funding provided by each stakeholder (Government cost-sharing, other partners and IAEA).

USD 1 millions.

Duration of the project:

Indicate a realistic starting date for the project and the number of years required to complete the project. Projects should not exceed four years.

4 years（2016.1.1-2019.12.31）

Safety regulatory infrastructure:

Indicate whether or not the safety regulatory infrastructure and associated standards and procedures in the Member States that are expected to participate in this project are adequate to ensure that the project will be implemented in a safe manner. If not, specify the gaps and indicate how they will be addressed.

Yes, it is adequate to ensure the projeject will be implemented in a safe manner.

13	**New type of freight vehicle radioactive inspection system.**	**CPR**

IAEA International Atomic Energy Agency

Technical Cooperation (TC) Programme

Regional project concept

Name of the region: Asia and Pacific	**Regional/ Cooperative Agreement** *(if applicable)*: RCA	**Project concept priority number within the Regional/Cooperative Agreement Programme Note** *(if applicable)*:	**Project concept priority number within the Regional Programme Note:**

Title:

The title should be as concise as possible and should summarize the objective of the project.

New type of freight vehicle radioactive inspection system.

Problem statement:

Provide a summary of the issue to be addressed by the project. This should be the result of a situation analysis to identify the problem, and its cause and effect.

In order to ensure the safety of national defense, it is importamt to precaution against nuclear and radiation emergency occurs and effectively curb the crucial nuclear malignant events happened.New type of radioactive material and special nuclear material monitoring system is based on prevent radioactive nuclide and special illegal transfer of nuclear materials and sales.It can detect gamma-rays and neutron at the same time by using large area scintillator in which the B-10 or Li-6 is adopted.

Objective:

State succinctly what the project is intended to achieve. Please state only one objective.

Develope a new type of radioactive material for freight vehicles and special nuclear material inspection system, to establish a nationwide radioactive cargo monitoring network, to ensure the accurate inspection of special nuclear material.The system can be applied between the cooperation country.Ultimately achieve the purpose of the nuclear non-proliferation.

End users:

Who will use/benefit from the results of the project? (e.g. decision makers, service users, patients, farmers).

The homeland security department and the people.

Past and present regional efforts in addressing the need:

Summarize any past and present regional efforts (including programmes/projects by other regional or international partners) to address the issue to which the project will contribute. Explain any specific gaps that the project will address. Why is a regional approach the most effective mechanism in this case?

In 2002,China Institute of Atomic Energy began to develop radioactive material inspection system for pedestrian, this system has been applied in Beijing since 2003.Outstanding characteristics of the system with high sensitivity and accuracy won the praise of security experts, and preventative measures are hailed as a dirty bomb and radioactive material effective barrier to terrorist attacks, it greatly improves the accuracy, reliability and security of the security.Radioactive material inspection system took part in the 2008 Beijing Olympic Games security equipment, and applied in the Shanghai World EXPO and Guangzhou Asian Games.Radioactive check is now receiving the various countries' government attention.Radiological examination need to work together with all of the countries in the asia-pacific region.More regional cooperation will cooperate to combat illegal transfer of nuclear materials, more conducive to regional peace and stability.

Role of nuclear technology:

Indicate the specific nuclear technique that would be used, and outline why it is appropriate for addressing the issue. Is the technique the only one available to solve the problem? Does the technique have a comparative advantage to non-nuclear techniques? Does the technique complement non-nuclear techniques?

Using special scintillation detector, together for gamma ray and neutron detection, each detector can achieve two square meters of area, greatly enhance the detection of radioactive material and special nuclear material sensitivity.By wired or wireless network, the realization of each detection points and the monitoring center of the network, take care of information flow, also facilitate remote diagnosis maintenance of the system.

Role of the IAEA:

What specific role would the IAEA be expected to play in the project?

Coordinate and manage.

Participating Member States:

List the Member States expected to participate in the project.

Japan,Korea,Thailand,Australia,etc.

National and regional counterpart institutions / stakeholders involved in the project:

List all national and regional institutions and stakeholders expected to participate in the project. Please enter first the main counterpart institution and the Designated Team Member (DTM). This person will be the regional technical coordinator for the project.

China Institute of Atomic Energy (CIAE).

Link to regional strategies or equivalent:

Is this project directly linked to a priority area identified in the relevant regional strategy? If yes, provide the reference. .

If not, explain why this concept is being presented for consideration.

No, but the concept can be presented for consideration.Many high-qulity freight vehicle radioactive inspection system has been developted by USA or other Europe countries.The global distribution and the emphasis are unbalanced especially in Asia and Pacific.

Partnership:

List all external institutions and partners (other UN or international organisations, donors, etc.) expected to participate in the project, specifying the contribution of each.

Korea,the national security agency.

Physical infrastructure and human resources:

What physical infrastructure and human resources are available to support the project? For example, existing laboratories, suitable buildings, staff that will be directly involved in this project.

List any regional resource centres that would play a major role in the implementation of the project.

China Institute of Atomic Energy,nuclear counter-terrorism team.

Financial resources required and source of funding:

Provide an estimate of the total cost of the project and the expected funding provided by each stakeholder (Government cost-sharing, other partners and IAEA).

$3,000,000

Duration of the project:

Indicate a realistic starting date for the project and the number of years required to complete the project. Projects should not exceed four years.

2016.1-2019.1

Safety regulatory infrastructure:

Indicate whether or not the safety regulatory infrastructure and associated standards and procedures in the Member States that are expected to participate in this project are adequate to ensure that the project will be implemented in a safe manner. If not, specify the gaps and indicate how they will be addressed.

"The radiation monitoring system and special nuclear material "(GB/T24246-2009)

14	Application of electron accelerator in irradiation processing	CPR

IAEA International Atomic Energy Agency

Technical Cooperation (TC) Programme

Regional project concept

Name of the region: Asia and the Pacific	**Regional/ Cooperative Agreement** *(if applicable)*: RCA	**Project concept priority number within the Regional/Cooperative Agreement Programme Note** *(if applicable)*:	**Project concept priority number within the Regional Programme Note:**

Title:

The title should be as concise as possible and should summarize the objective of the project.

Application of electron accelerator in irradiation processing

Problem statement:

Provide a summary of the issue to be addressed by the project. This should be the result of a situation analysis to identify the problem, and its cause and effect.

Irradiation processing technology has extensively been used in food preservation, sterilization of medic products, plant quarantine and modification of chemical materials.

The promotion of irradiation processing technology would address local food safety, reduce food wastage due to microbial breeding, develop the Asia and the Pacific's fruit marketing, also help local health care, expand chemical material modification industries, promote relevant agencies and enterprise progress and finally promote regional economic development.

There are two equipments for irradiation processing, the first one is gamma irradiator, and the other one is electron accelerator irradiator. In comparison, the cost of electron accelerator irradiator is relatively less than the gamma irradiation, it also comprises lower nuclear security risk. In the past few decades, gamma irradiator is the main technique in irradiation processing. In the recent years, people pay more and more attention to nuclear safety due to the leaking accident from Fukushima Nuclear Power Plant. The electron accelerator could do the same job without such high risk.

The manufacture of electron accelerator is growing rapidly in China; the electron accelerators is not only fulfilling irradiation processing need but also low in cost, therefore leads to lower radiation and processing cost. It becomes one of the most popular ways to radiate and process in China,furthermore, how to operate the accelerator accurately and ensure the accelerator maintains stable is becoming more and more important.

Objective:

State succinctly what the project is intended to achieve. Please state only one objective.

The objective of this project is to enhance the level of technology, knowledge and the capability of human resources in the region in the application of electron beams in dealing with agricultural and industrial products and environmental pollutants.

Especially to provide the technical service of accelerator to the member states, including technical training and technical consultation.

End users:

Who will use/benefit from the results of the project? (e.g. decision makers, service users, patients, farmers).

Not only the benefiting the countries produce radiation processing products but also for those countries who consume radiation processing products.

The project will contribute to; 1) the immediate application of electron beams for sterilization and improvement of agricultural products; 2) the immediate application of electron beams for processing of industrial products such as hardening of electric cables and enhancing the durability of automobile tyres; 3) the immediate application of electron beams for treatment of environmental pollutants discharged from various industries, power plants and urban living before their release into the environment, impacting on the quality of air and water of the environment and living conditions; 4) cost-savings on environmental conservation services and cost-effective value addition of electron beam processed agricultural and industrial products in the region.

Past and present regional efforts in addressing the need:

Summarize any past and present regional efforts (including programmes/projects by other regional or international partners) to address the issue to which the project will contribute. Explain any specific gaps that the project will address. Why is a regional approach the most effective mechanism in this case?

The previous project RAS5046 (2007-2010) focuses on the application of technologies related to new uses of irradiation for sanitary and phytosanitary purposes, including technology transfer to participating RCA member states. At present, in some countries, the fruit is required to reach the purpose of killing pest by irradiation at the port,while electron accelerator is a relatively safe and convenient method.

The current project RCA/UNDP focuses on electron beam applications for value addition to food and industrial products and degradation of environmental pollutants.It is aiming to provide services for operating electron accelerator training, including operating and maintaining variety of electron accelerator and technology for radiation processing (disinfection, sterilization and modification of materials).

The promotion of irradiation processing technology would address local food safety, also help local health care, expand chemical material modification industries, promote relevant agencies and enterprise progress and finally promote regional economic development.

Role of nuclear technology:

Indicate the specific nuclear technique that would be used, and outline why it is appropriate for addressing the issue. Is the technique the only one available to solve the problem? Does the technique have a comparative advantage to non-nuclear techniques? Does the technique complement non-nuclear techniques?

The current project will utilize radiation processing techniques. Electron accelerator is one of the most promising equipment for radiation processing. So far, it is the only technique that can ensure nuclear safety while processing variety materials. Nuclear techniques are efficient technologies with the characteristics of no residue, cold disinfection, sterilization, clean energy, mainly used for sterilization of medical products, food preservation, modification of materials, environment restoration and pollution control. It has comparative advantage in some cases where other techniques may also achieve, and it is the only technology in many other cases.

Role of the IAEA:

What specific role would the IAEA be expected to play in the project?

In the current project, the IAEA could play important roles. For example, to strength and drive the established network for industrial information exchange, to provide training to member states on new technologies and methodologies, to provide technical service to member states.

Participating Member States:

List the Member States expected to participate in the project.

Australia, Bangladesh, China, India, Indonesia, Korea, Malaysia, Mongolia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Thailand and Vietnam.

National and regional counterpart institutions / stakeholders involved in the project:

List all national and regional institutions and stakeholders expected to participate in the project. Please enter first the main counterpart institution and the Designated Team Member (DTM). This person will be the regional technical coordinator for the project.

CGN Nuclear Technology Application Co., Ltd.

Mr. Jianfeng Zhang

Jiangsu Zhongke HI-WITS Technology Development Co., Ltd

Mr. Qi Liu

Kewell Products Corporation

Mrs. Xiaoting Yang

Chinese academy of science, Shanghai application physics institute

Prof. Deming Li

Nanjing University

Prof. Lin Xiao

CAEA

Mr. Hansi Liu

Vienna International Centre, PO Box 100, 1400 Vienna, Austria

Link to regional strategies or equivalent:

Is this project directly linked to a priority area identified in the relevant regional strategy? If yes, provide the reference. Yes, this project directly linked to electron beam applications, and will provide electron accelerator and technical training.

If not, explain why this concept is being presented for consideration.

Partnership:

List all external institutions and partners (other UN or international organisations, donors, etc.) expected to participate in the project, specifying the contribution of each.

Jiangsu Zhongke HI-WITS Technology Development Co., Ltd- provide service for operation and maintain the electron accelerator.

Physical infrastructure and human resources:

What physical infrastructure and human resources are available to support the project? For example, existing laboratories, suitable buildings, staff that will be directly involved in this project.

List any regional resource centres that would play a major role in the implementation of the project.

Experienced technician and variety of electron accelerator.

Jiangsu Zhongke HI-WITS Technology Development Co., Ltd - have a research and development Center for electron accelerator.

Nanjing university materials engineering institute of technology,Nantong - have a research and development Center for linear electron accelerator.

Chinese academy of science, Shanghai application physics institute - have a research and development Center for dynamitron electron accelerator.

Financial resources required and source of funding:

Provide an estimate of the total cost of the project and the expected funding provided by each stakeholder (Government cost-sharing, other partners and IAEA).

The estimated budget from IAEA will be 700,000 Euro for the first two years (2016-2017). An extra budgetary contribution of a member state could be available.

Duration of the project:

Indicate a realistic starting date for the project and the number of years required to complete the project. Projects should not exceed four years.

The proposed starting date for this project is 1st January 2016. The training is expected to be completed within three years.

Safety regulatory infrastructure:

Indicate whether or not the safety regulatory infrastructure and associated standards and procedures in the Member States that are expected to participate in this project are adequate to ensure that the project will be implemented in a safe manner. If not, specify the gaps and indicate how they will be addressed.

The safety regulatory infrastructure and associated standards and procedures in all the participating Member States of this project are adequate to ensure that the project could be implemented in a safe manner.

15	Strengthening food irradiation applications through education and training in RCA Member States	PAK

Regional Project Concept Template (Category A)

Region:	RCA (Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology for Asia and the Pacific)		
Regional/Cooperative agreement (if applicable)	RCA	**Priority no. given by regional/cooperative agreement** (for concepts proposed under the auspices of regional cooperative agreements)	
Title	Strengthening Food Irradiation Applications through Education and Training in RCA Member States		
Field of activity	**Agriculture – Food Irradiation**		
Regional project category[6]	☐ *Transnational* ☐ *Regional standard setting* ☐ *Capacity building for developing countries* ☐ *Joint TC activities with a regional or international entity*		
Names and contact details of project counterparts and counterpart institutions (starting with the main counterpart)	Coordinators/National Project Teams under RAS5057 of following Member States will participate to coordinate implementation of the project under the leadership of the NPCs: Australia, Bangladesh, China, India, Indonesia, Japan, Republic of Korea, Malaysia, Mongolia, Myanmar, New Zealand, Pakistan, Philippines, Singapore, Sri Lanka, Thailand and Vietnam		
Analysis of regional Gap / Pproblems/needs	*Give an in-depth analysis of the major problems/needs to be addressed by the project, as well as of their causes and effects; and explain how these are linked to regional development plans or frameworks (or equivalent). Refer to past efforts made in addressing these problems/needs, if any, and explain how the current project proposal builds upon them.* *Attach any supporting documents (e.g. texts of regional development plans).* Food irradiation preservation technology was first used in England in 1905 for preservation of cereals and cereal products using radium radiation. After that, many research and development programs of irradiation application in preservation of agricultural products and foodstuffs have been done at many countries. The physical treatment with radiation is considered as a clean, safe, environment friendly and best alternative method for decontamination/ disinfestation and shelf life extension of agricultural commodities. The Joint Food and Agriculture Organization of the United Nations and the International Atomic		

	Energy Agency FAO/IAEA Division of Nuclear Techniques in Food and Agriculture is assisting the Member States in applying nuclear techniques for providing people with more, better and safer food. Following Regional Projects on Food Irradiation have so far been completed or in progress: 1. 1989-1996: Food Irradiation Process Control and Acceptance (RAS/5/020) 2. 1995-1998: Public Acceptance and Trade in Irradiated Food (RAS/0/022) 3. 1999-2001: Irradiation As Sanitary & Phytosanitary Food Treatment (RAS/5/034) 4. 2001-2004: Application of Food Irradiation for Food Security, Safety, and Trade (RAS/5/042) 5. 2007-2010: Novel Applications of Food Irradiation Technology for Improving Socioeconomic Development (RAS/5/046) 6. 2009-2011:Enhancing Sanitary and Phytosanitary Treatment of Regional Products for Export by Irradiation (RAS/5/050) 7. 2012-2014:Implementing Best Practices of Food Irradiation for Sanitary and Phytosanitary Purposes (RAS/5/057) Though there are some anti-food irradiation groups, which are primarily concerned about safety of the irradiated foods, many scientific evidences obtained over 50 years have proved the safety of this technology and the wholesomeness of foods irradiated at approved doses below 10 kGy. Even some special foods, which have been irradiated at doses up to 70 kGy, were also proved to be safe for immunodeficiency patients or astronauts. Despite of above mentioned projects, use of food irradiation is limited due to less awareness in general public about its advantages. Therefore, this new project on "Strengthening Food Irradiation Applications through Education and Training in RCA Member States" is the need of the day to disseminate information regarding food irradiation through awareness campaign for general public, entrepreneurs and policy maker and to educate consumers and technical personnel of food processing industries about the potential, advantages and cost economics of food irradiation technology. An effort will be made to familiarize the use of gamma radiation amongst the traders, processors, exporters, policy makers, potential investors, media personnel and other intellectuals as an effective mean of sanitary and phytosanitary treatment to meet the quarantine requirements of RCA countries. As majority of the Member States are in the process of establishing commercial irradiators in their countries, the aim is to create awareness about the upcoming commercialization of irradiation technology in the region. Experts from IAEA may hold meetings with the concerned authorities in the countries like Nepal, Japan, Mongolia, Myanmar etc where R & D is near to start or in initial stages. In addition to planning meeting of national counterparts, workshops, trainings and seminar on food irradiation will be organized in different member states. Experienced professionals in the subject areas from IAEA, and international experts and other concerned organizations in the member states will deliver lectures in these events. This will provide a forum for stakeholders to discuss

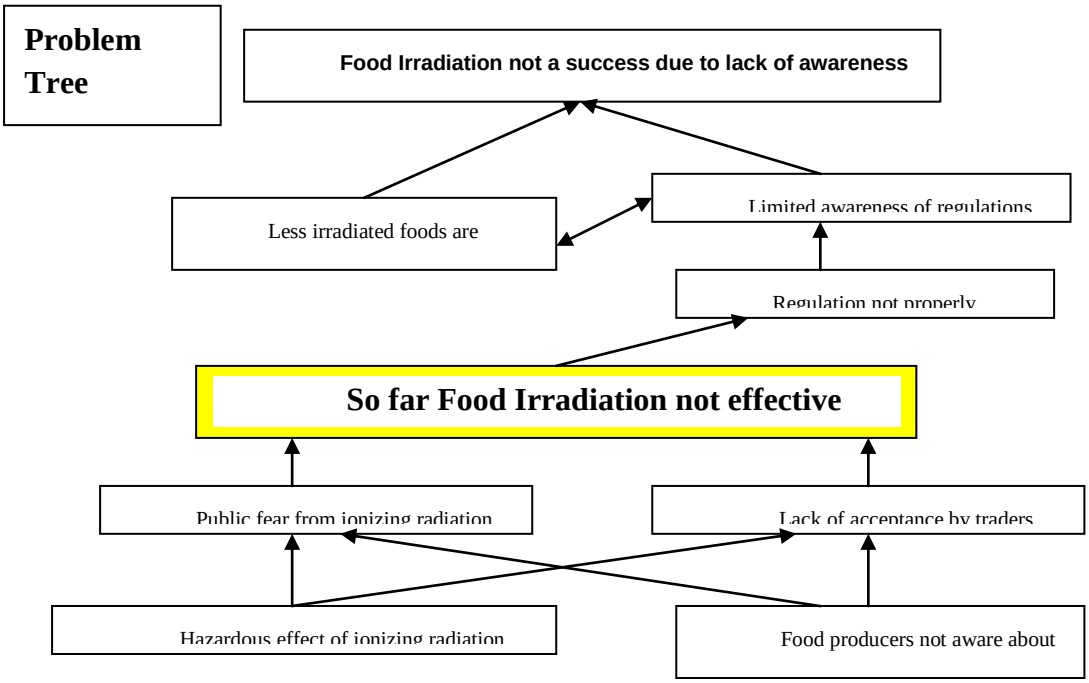
	various aspects regarding adaptation of food irradiation at commercial scale. In addition, expo will also be organized in collaboration with the national and international food and allied industries. The representative of Japan gave the following statement in our last RCA meeting held at Kuala Lumpur, Malaysia in Oct 2013 is: *The gamma-irradiation is used for potato for the purpose of sprouting inhibition. The commercial irradiation of potato has been successfully continuing for almost 40 years at Shihoro Irradiation Center in Hokkaido. In 2012 about 6,000 t of potatoes were irradiated and sold with appropriate labelling at retail outlets. Since the large-scale outbreak of Escherichia coli in 2011, food-borne diseases have posed a major problem in Japan. In August 2012, the Ministry of Health Labour and Welfare (MHLW) initiated research on irradiation treatment of meat products to investigate the efficacy of irradiation in eliminating pathogenic bacteria.* **For this reason Japan and other countries where Food Irradiation is in initial stages would like to be members of this RCA project.**
Why should it be a regional project?	*Indicate why it is better to address these problems/needs through a regional project (as opposed to a national one).* Member states of RCA produce a variety of good quality fruits and vegetables with immense export potential. Majority of RCA countries are among the leading producers and exporters of horticultural commodities to the developed countries. Keeping in view the trade potentials and expertise in food irradiation among RCA countries, this proposal will be a success as a regional project.
Stakeholder analysis and partnerships	*Describe the stakeholder analysis conducted, specifying all the interested or affected parties, end users, beneficiaries, sponsors and partners identified, with clearly defined roles for each entity.* To enhance the effective application of irradiation technology for sanitary and phytosanitary purposed of agricultural products by the farmers, food distributors, exporters, importers, irradiation plant owners/managers and the general public in RCA countries.
Overall objective (or developmental objective)	*State the objective to which the project will contribute, and demonstrate its linkage with any regional or broader development goal or priority. It has to be in line with the problems/needs identified.* The overall objective of the project is to bring food irradiation technology into the lime light, which has the potential to impart positive impact on the overall socio-economic indicators. Other objectives are: • To create awareness among different stakeholders on the commercial use of food irradiation by organizing workshops, trainings, seminars and exhibitions at national levels in different RCA countries • To depute IAEA experts to participates in these activities for the promotion of food irradiation • To compile all training materials, regulations, agreements between various countries in the

	form of DVD, CD, brochures, pamphlets from member states to be used in national events
Analysis of objectives	*Draw up an objective tree to highlight the hierarchy of objectives as well as the cause–effect logic that this project is expected to achieve.* The overall theme of the proposed project would be "To create awareness about the use and benefits of commercial food irradiation technology in the RCA countries". Through this project, a workable liaison between growers, R&D organizations, ministries and food importers/exporters will be developed and new economic activities are expected to be triggered that will help to boost social uplift of these countries. In addition it will help the potential investors to establish food irradiation facilities and related Industries. **The objective tree is attached.**
Role of nuclear technology and the IAEA	*Indicate the nuclear technique that would be used and outline why it is suitable for addressing the problems/needs in question. Is this the only available technique? Does it have a comparative advantage over non-nuclear techniques?* *What specific role is the IAEA expected to play in the project?* In RCA countries, over 35% of the produce is lost on the way from field to market place because of shorter shelf life. Approaches like low temperature steam treatment, pasteurization, drying, fumigation, cold storage, and packing in vacuum or inert gas have been used to increase shelf life of fruits. However, most of these preservation methods are too expensive and would need careful consideration. In comparison to other methods, food irradiation provides a relatively economical solution to the problem. An important feature of irradiation is its ability to achieve different types of beneficial effects (sanitary, phytosanitary and shelf-life extension) on a wide range of products. To be recognized as an effective partner in providing nuclear technologies that address socio-economic needs and contribute to sustainable development in the region
Project duration	*Indicate a realistic starting date and the number of years required to complete the project. (In the case of projects expected to exceed four years, an assessment will be conducted before the end of the fourth year to decide on the validity of an additional year.)* 1-1-2016 to 31-12-2018
Requirements for participation	*Indicate the minimum requirements that counterpart institutions in Member States would need to meet in order to participate in this project, and how the fulfilment of these requirements will be verified.* Since all 17 RCA countries have the capacity to benefit from food irradiation technology but due to lack of awareness about this technology, have not yet been able to to exploit the technology on commercial scale. In addition experts are available in the region; therefore, various workshops,

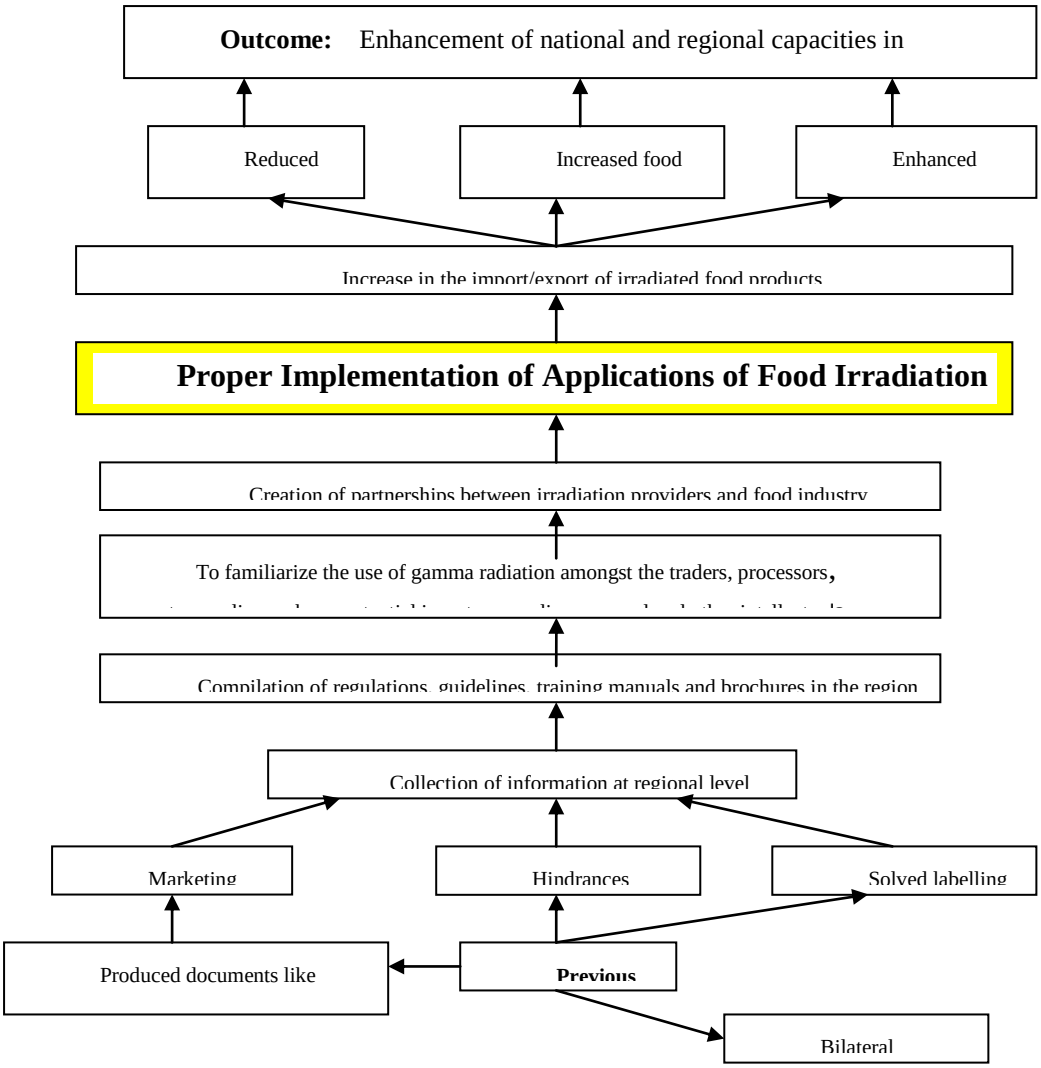
<table>
<tr><td></td><td colspan="4">seminars and conferences could be organized in different big cities under the umbrella of this IAEA project. The MSs will contribute human resources, infrastructure and financial resources to make the project fruitful.</td></tr>
<tr><td>Participating Member States</td><td colspan="4">List the Member States expected to participate in this project that meet the requirements established above. Indicate the role of each Member State in the project.
Country: _____ Role:

All RCA Member States, have strong national commitment, hence, will participate to coordinate for the implementation of the project under the leadership of the NPCs and project teams to be appointed by Governments of the MSs and are responsible for all policy matters related to RCA. The role to be played by the MSs is to provide expertise.</td></tr>
<tr><td></td><td colspan="4"></td></tr>
<tr><td rowspan="9">Funding and project budget</td><td colspan="4">Provide an estimate of the total project costs and the funding expected from each stakeholder:</td></tr>
<tr><td colspan="2"></td><td>Euro</td><td>Comment</td></tr>
<tr><td colspan="2">Government cost-sharing</td><td></td><td>(to be sent to the IAEA)</td></tr>
<tr><td colspan="2">Counterpart institution(s)</td><td>700,000</td><td></td></tr>
<tr><td colspan="2">Other partners</td><td>100,000</td><td>Food companies</td></tr>
<tr><td rowspan="3">IAEA Technical Cooperation Fund (TCF):</td><td>Fellowships / Scientific visits / Training courses/ Workshops</td><td>260,000</td><td></td></tr>
<tr><td>Experts</td><td>85,000</td><td></td></tr>
<tr><td>Equipment</td><td>13000</td><td>Procurement Components</td></tr>
<tr><td colspan="2"></td><td></td><td></td></tr>
<tr><td colspan="2">TOTAL</td><td>1158,000</td><td></td></tr>
</table>

Problem Tree



Objective Tree



16	**Isotopic Techniques in the Assessment of Groundwater Resources for Sustainable Management.**	**PAK**

Regional Project Concept Template (Category A)

Region:	**The Asia and the Pacific**		
Regional/Cooperative agreement (if applicable)	**RCA**	**Priority no. given by regional/cooperative agreement** (for concepts proposed under the auspices of regional cooperative agreements)	**To be decided by NRs**
Title	**Isotopic Techniques in the Assessment of Groundwater Resources for Sustainable Management.**		
Field of activity	Water Resources		
Regional project category[7]	☐ *Transnational* ☐ *Regional standard setting* ☐ *Capacity building for developing countries* ☐ *Joint TC activities with a regional or international entity*		
Names and contact details of project counterparts and counterpart institutions (starting with the main counterpart)	1. Pakistan: Lead Country, Dr. Muhammad Azam Tasneem, DTM/PLCC, Chief Scientist, Isotope Application Division (IAD), PINSTECH, P.O. Nilore, Islamabad, Pakistan Telephone: +92-51-9248835 Fax: +92-51-9248808 E-mail: azam_tasneem@yahoo.com 2. Australia: NPC: Dr. Suzanne Hollins, Australian Nuclear Science & Technology Organization (ANSTO), Locked Bag 2001, Kirrawee DC, NSW, 2232, AUSTRALIA. suzanne.hollins@ansto.gov.au 3. Bangladesh: NCP: Mr. Nasir Ahmad, Institute of Nuclear Science & Technology, AERE, Savar, Bahgladesh. nasirbaec@hotmail.com 4. China: NCP: Prof. Zhonghe Pang, Institute of Geology & Geophysics, Chinese Academy of Sciences, Beijing.		

[7] See the document entitled "Policy and Procedures for TC Regional Projects" at: http://pcmf.iaea.org/DesktopModules/PCMF/docs/2014_15_Docs/notes/Regional_TC_Project_Policy.pdf.

	z.pang@mail.iggcas.ac.cn 5. India: NCP: Dr. U. Saravana Kumar, Bhabha Atomic Research Centre, Mumbai-400085. vsk@barc.gov.in 6. Indonesia: NPC: Dr. Paston Sidauruk Centre for Application of Isotope and Radiation Technology, National Nuclear Energy (BATAN) JI. Cinere Pasar Jumat, Jakarta Selatan 12070. pastons@batan.go.id 7. Korea: NPC: Mr Yong-Kwon KOH, Korea Atomic Energy Research Institute, PM, Daeduk-Daero 1045, Dukjin-Dong, Yuseong-gu, Daejeon,Korea. nykkoh@kaeri.re.kr 8. Malaysia: NPC: Dr. .Wan Zakaria Wan Muhamad Tahir; Malaysian Nuclear Agency (Nuclear Malaysia) Division of Environment, Kajang, Selangor Darul Ehsan, Malaysia. wanzakaria@nuclearmalaysia.gov.my 9. Mangolia: NCP: Dr. Janchivdorj. L, Instutute of Geoecology, Mangolian academy of Sciences, Chinguunjav street Bayangol district, Ulaanbaatar. janchivdorj_mn@yahoo.com 10. Myanmar: (CP: Mr. MAUNG MAUNG, Theingi)Department of Atomic Energy, Building No.21 Nay Pyi Taw, Myanmar. 11. New Zealand: NPC: Dr. Uwe Morgenstern, National Isotope Centre, GNS Science, Lower Hutt 5040, New Zealand. u.morgenstern@gns.cri.nz 12. Philippines: NPC: Ms. Soledad Castaneda, Philippine Nuclear Research Institute, Commonwealth Avenue, Manila, Philippines. sscastaneda@pnri.dost.gov.ph 13. Sri Lanka: NPC: Mr. Viraj Edirisinghe, Division of Industrial Applications, Atomic Energy Authority, 60/460 Baseline Road, orugodawatta, Wellampitiya., Sri Lanka. viraj@aea.ac.lk 14. Thailand: NPC: Mr.KiattipongKamdee, Thailand Institute of Nuclear Technology, Vinhavadi-Raangsit Road, Chatuchak, Bangkok, Thailand. kiat090@yahoo.com 15.Vietnam: NCP: Nguyen Kien Chinh, Center for Nuclear Techniques, Isotope Hydrology Department, Centre for nuclear Techniques (CNT), Add: 217 Nguyen Trai, Dist. I, Hochiminh City, Vietnam. nkienchinh@gmail.com

Analysis of regional Gap / Problems/needs	*Give an in-depth analysis of the major problems/needs to be addressed by the project, as well as of their causes and effects; and explain how these are linked to regional development plans or frameworks (or equivalent). Refer to past efforts made in addressing these problems/needs, if any, and explain how the current project proposal builds upon them.* *Attach any supporting documents (e.g. texts of regional development plans).* Water is one of the core elements of human existence. Groundwater resources are often the only reliable source of clean water in many parts of the world. Good quality aquifers are depleting due to over exploitation. Changing climate may also have significant impacts on the quality and quantity of water that is available and accessible. Groundwater is the largest component of fresh water accessible for human use. While two thirds of the surface area of planet earth is covered with water, most of it is sea water or saline and only 2.5% is fresh water (Shiklomanov and Rodda, 2004). About 30% of fresh water or 0.75% of all water on earth is present as fresh water. Only 0.26% of the total amount of fresh water on earth is in lakes, rivers and reservoirs that are most easily accessible for human (the remaining 1% is estimated to occur as soil moisture, swamp water and permafrost). Groundwater in both renewable and non-renwable aquifers accounts for about 95% of accessible fresh water or 0.70% of all water on earth and provides more than half of all domestic irrigation water used around the world. In semi arid and arid regions and in domestic supplies for rural areas, 80-100% of all fresh water may be derived from groundwater. Therefore, it is imperative to adapt proper strategies for sustainable management of water resources. The Assessment of groundwater resources could not be addressed in any previous project. There is need of groundwater mapping for sustainable development and management of groundwater.Adaptation measures have to be taken, including institutional, educational. For the groundwater development and estimation of safe yield, groundwater assessment may help identify sources of recharge, mixing of aquifers, residence time distribution etc. The investigation of water resources is the need of the day as national programmes with high priority. The scope of isotopic techniques is increasing. The need of proper development and management of water resources for

	sustainable availability has been constantly increasing. Continuous efforts have been made by Member states on national levels to address different aspects related to water resources. The training courses, workshops, meetings were held to disseminate the knowledge of isotopic techniques among the stack holders. Field problems encountered in water resources management are being addressed with active involvement of end users.
Why should it be a regional project?	*Indicate why it is better to address these problems/needs through a regional project (as opposed to a national one).* Most of problems of the member states in RCA region are common in nature. Hence, it needs a regional approach for seeking solution of these common problems. The implementation of RAS/7/022 on regional level during 2012-2015) would provide very strong base which can positively be utilized by the proposed project for its further advancement, successful implementation and achievement of final outcome. Sharing of experience through technical meetings, organization of regional training courses on common issues, dissemination of information through executive meetings, expert missions for technical guidance/on-the job training and national executive management seminars for information dissemination/technology promotion, is planned regional approach to address the common issues effectively. This regional approach will provide economical solution of common regional problems and will also promote TCDC among RCA regional member states.
Stakeholder analysis and partnerships	All the national departments in member states dealing with the development and management of water resources are stakeholders in this project. These departments have been actively involved in all the regional projects completed so far and also on-going project RAS7022. There is no partnership for this project.
Overall objective (or developmental objective)	*State the objective to which the project will contribute, and demonstrate its linkage with any regional or broader development goal or priority. It has to be in line with the problems/needs identified.* To improve the capability for efficient and effective development and sustainable management of groundwater

	resources.
Analysis of objectives	The need of proper development and management of water resources for sustainable availability had been a burning issue at all the times in the past. Continuous efforts have been made on regional basis to address different aspects related to water resources. Some projects concerned with the general areas of Fresh Water Resources were implemented as part of the RCA Programme. The training courses, workshops, meetings will help to disseminate the knowledge of isotopic techniques among the stack holders. Real field problems encountered in water resources management will be addressed with active involvement of end users in five regional projects. Isotope Techniques were applied for groundwater contamination studies in urbanized and industrial areas with special reference to arsenic, fluoride and other metals under a sub-project "Geogenic Contamination of Groundwater". Now through regional project, the member states may share mutual experience for assessment of groundwater resources and improve their capability for efficient and effective development and sustainable management of the groundwater resources. The active involvement of end users may lead to successful adoption of the technology by the water agency managers and policy makers at significant level.
Role of nuclear technology and the IAEA	*Indicate the nuclear technique that would be used and outline why it is suitable for addressing the problems/needs in question. Is this the only available technique? Does it have a comparative advantage over non-nuclear techniques?* *What specific role is the IAEA expected to play in the project?* The environmental isotopes of hydrogen, carbon, nitrogen, oxygen and sulphur are being used to study different problems related to water resources, environment, life sciences and agriculture. The sources of groundwater, its recharge mechanism, mixing of aquifers, surface water/groundwater interrelationship and base flow studies have been carried out. Improvement of the capability for efficient and effective development and management

	of groundwater resources may be addressed by nuclear techniques. In some cases nuclear techniques have advantages over non-nuclear techniques regarding the problems of source identification. Similar is the case with other fields of agriculture, life sciences and environment. In some cases, nuclear and non-nuclear techniques may be combined to achieve required results. Role of IAEA in the proposed project will be Organization of the following events/provision of budget: a) Four meetings (one PFM, two review meetings and the final meeting) b) four regional training courses d) Scientific Supplies/minor equipment/spares (According to the specific needs of each MS) e) Analytical services (Isotopes and some special chemical species through RRUs, IAEA IHL) f) Expert Missions for designing fieldwork, interpretation of data and national seminars, training courses etc.
Project duration	*Indicate a realistic starting date and the number of years required to complete the project. (In the case of projects expected to exceed four years, an assessment will be conducted before the end of the fourth year to decide on the validity of an additional year.)* **Four years (Two Cycles, 2016-2019).** Starting date of the proposed project: Januray 2016
Requirements for participation	*Indicate the minimum requirements that counterpart institutions in Member States would need to meet in order to participate in this project, and how the fulfilment of these requirements will be verified.*

<table>
<tr><td></td><td>Almost all the member states have necessary infrastructure and facilities for implementation of the project. Those who do not have analytical facilities may benefit from other member states (RRU) and experts missions.</td></tr>
<tr><td>Participating Member States</td><td>List the Member States expected to participate in this project that meet the requirements established above. Indicate the role of each Member State in the project.
Country: _____ Role:
□ Resource (providing expertise)
Target (receiving expertise)

AUL, BGD, CPR, IND, INS, ROK, MAL, MYA, MON, NZE, PAK, PHI, SRL, THA,</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Funding and project budget</td><td>Provide an estimate of the total project costs and the funding expected from each stakeholder:
<table>
<tr><td></td><td></td><td>Euro</td><td>Comment</td></tr>
<tr><td colspan="2">Government cost-sharing</td><td>700000.00</td><td>(In kind contribution from all participating MSs)</td></tr>
<tr><td colspan="2">Counterpart institution(s)</td><td></td><td></td></tr>
<tr><td colspan="2">Other partners</td><td></td><td></td></tr>
<tr><td>IAEA Technical Cooperation Fund (TCF):</td><td>Fellowships / Scientific visits / Training courses/ Workshops</td><td>570000.00</td><td></td></tr>
</table></td></tr>
</table>

		Experts	*64000.00*	
		Equipment	*1334000.00*	
		TOTAL	*1334000.00*	

17	**Diagnosing and optimising industrial processes using radiotracers and sealed-source techniques**	**PAK**

Regional Project Document Template (Category A)

Project concepts positively appraised should be further developed into full project documents, following the LFA.

Region	**The Asia and The Pacific Region**		
Regional/Cooperative Agreement (if applicable)	**RCA**	**Priority No. given by Regional/Cooperative Agreement** (for concepts proposed by Regional/Cooperative Agreements)	To be assigned by RCA NRM
Project Title	**Diagnosing and optimizing industrial processes using radiotracers and sealed source techniques**		
Field of Activity	☐ 18 - Cleaner and safer management of industrial processes		
Regional Project Category[8]	☐ *Transnational* ☐ *Regional standard setting* ☐ *Capacity building for developing countries* ☐ *Joint TC activities with a regional entity*		
Names and contact details of Counterparts and Counterpart Institutions (starting with the main counterpart)	☐ The following national institutions of listed RCA member states will be participating in the proposed project: ☐ **1. Pakistan (LC):** Isotope Applications Division, Pakistan Institute of Nuclear Science & Technology (PINSTECH), Islamabad, Pakistan. (DTM/LCC: Mr. Iqbal Hussain Khan) ☐ **2. Australia:** Australian Nuclear Science & Technology Organization (ANSTO), Locked Bag 2001, Kirrawee DC, NSW, 2232, AUSTRALIA. (CP: Mr. Peter McGlinn). ☐ **3. Bangladesh:** Atomic Energy Centre, Dhaka, Bangladesh. (CP: Mr. Md. Ashraful Islam) ☐ **4. China:** China Institute of Atomic Energy, Beijing, China. (CP: Mr. Gao Xiang). ☐ **5. India:** Isotope Applications Division, Bhabha Atomic Research Centre, Trombay, Mumbai 400 085, India. (CP: Mr. H. J. Pant). ☐ **6. Indonesia:** Tracer Group, Centre for Application of Isotopes and Radiation Technology, BATAN, Jakarta, Indonesia. (CP: Mr. Sugiharto) ☐ **7. Korea, Republic of:** Korea Institute of Atomic Energy, Daejon, Republic of Korea. (CP: Mr. Sung Hee Jung)		

[8] Policy and Procedures for TC Regional Projects

	8. Malaysia: Division of Industrial Technology, Malaysian Nuclear Agency, Kajang, Selangor Darul Ehsan, Malaysia. (CP: Mr. Abdullah Jaafar). **9. Mangolia:** Nuclear Energy Agency of the Government of Mongolia. (CP: Mr.Tseren DAMDINSUREN) **10. Myanmar:** Department of Atomic Energy, Myanmar. (CP:Ms. MAUNG MAUNG, Theingi) **10. New Zealand:** National Isotope Centre, GNS Science, Lower Hutt 5040, New Zealand. (CP:) **12. Philippines:** Isotope Techniques Unit, Philippine Nuclear Research Institute, Manila, Philippines. (CP: Mr. Denis D.Aquino). **13. Sri Lanka:** Ceylon Petroleum Corporation, Kelaniya, Sri Lanka. (CP:) **14. Thailand:** Nuclear Technology Service Center, Thailand Institute of Nuclear Technology, Nakornnayok, Bangkok, Thailand. (CP: Mr. Dhanaj Saengchantr). **15. Vietnam:** Center for Applications of Nuclear Technique in Industry (CANTI), Dalat, Vietnam. (CP: Mr. Nguyen Huu Quang)

Analysis of Regional Gap / Problem / Needs	(from concept document - to be further developed and documented through the LFA) *Describe the in-depth analysis of the major problems/needs, their causes and effects; and how these are linked to the Regional Development Plans/ Framework or equivalent. Provide a reference to past efforts made in addressing the problem, if any, and how the current project is built upon them.* *Attach any supporting documents (e.g. Regional Development Plans).* Complex industrial processes (particularly multi-phase systems) are encountered in many industrial and environmental systems. The fluid dynamics of multiphase systems is very complicated and it is often difficult to predict important process parameters such as pressure drop, flow rate, phase hold-up, mass transfer, phase distributions and mixing characteristics. Optimization of industrial processes is essential not only for efficient, safe and sustainable industrial operation, but also to save material, energy, protect the environment and reduce plant shutdown time thus leading to high economic benefits – hence leading to socio-economic development of the society. Characterization of the process dynamics in any such system is pre-requisite for process optimization and trouble-shooting. With advancements in technology, the new industrial systems have become more and more complicated. Due to harsh industrial conditions (high temperature/pressure, toxicity) it is often not possible to open such systems for investigations. It is always preferred to do on-line measurements because off-line investigations are highly un-economical and unsafe. Therefore, safety, economic and

	environmental concerns demand for on-line process investigations. Conventional techniques can not cope with this situation because mostly these are applicable off-line. Further, process engineers prefer to visualize the process for its diagnosis and optimization but industrial processes taking place inside opaque industrial systems make it impossible. The conventional means of process visualization are CFD models which are based on mathematical equations used for simulations and hence need verification. Radiotracer and sealed source technology-based applications provide state of the art techniques that possess the ability to see through opaque industrial systems and can be applied on-line in harsh industrial conditions providing unique opportunity to visualize the process in real time. New emerging and advanced technologies based on radiotracers and sealed source applications (like gamma Computed Tomography (CT)/Single Photon Emission Computer Tomography (SPECT), Computer Aided Radioactive Particle Tracking (CARPT), Radiotracer Residence Time Distribution (RTD) analysis in combination with Computational Fluid Dynamics (CFD) simulations, can play an important role for on-line process visualization, optimization, trouble-shooting & process design/scale-up purposes. Development of new tracers for better and wider applicability in harsh industrial conditions is required not only for sustainability of existing applications but also for investigating complex multiphase processes. Automation and improvements in instrumentation & hardware such as tracer injection systems, detectors & data acquisition systems are required for safer and reliable applications. Utilization of radionuclide generators for on-site production of radiotracers for industrial applications are important to overcome non-availability of radiotracers especially for those member sates that do not have nuclear reactors and radiotracer production facilities. Most of the industries are of common nature in RCA member states and the problems faced by these industries are also common. Therefore it is a common need of the region and it necessitates to work together to address these issues for the benefit of the whole region. It is important to mention that 14 RCA member states have participated in RCA regional project RAS/1/012 and implemented important activities under this project during 2012-2014. It may also be mentioned that RAS/1/012 was proposed for 4 years duration, but due to budgetary reasons, its duration was shortened to 3 years. All the planned regional & national activities are being implemented as planned. However, since the technologies involved are quite sophisticated and the level technical capacity of participating MSs varies from one MS to another, it needs more time and effort to bring the technologies from laboratories to industrial product lines in majority of participating MSs … and hence achieve the final outcome of the project. Further, the proposed project is in line with common national priorities and development needs of all the participating member states. Therefore it enjoys government commitment and fulfils RCA criteria/IAEA central criterion for regional projects and has a great potential for regional cooperation and successful implementation.

Why should it be a regional project?	*Indicate why it is better to address this problem/need through a regional project (as compared to a national one).* Most of the industries in RCA region are common in nature and the problems faced by them are also common. Hence, it needs a regional approach for seeking solution of these common problems. The implementation of RAS/1/012 on regional level during 2012-2014) would provide very strong base which can positively be utilized by the proposed project for its further advancement, successful implementation and achievement of final outcome. Sharing of experience through technical meetings, organization of regional training courses on common issues, dissemination of information through executive meetings, expert missions for technical guidance/on-the job training and national executive management seminars for information dissemination/technology promotion, is planned regional approach to address the common issues effectively. This regional approach will provide economical solution of common regional problems and will also promote TCDC among RCA regional member states.
Stakeholder Analysis and Partnerships	(from concept document - to be further developed and documented through the LFA) Describe the stakeholder analysis conducted, all interested or affected parties, end users, beneficiaries, sponsors and partners identified, with clearly defined roles for each entity. The participating RCA MSs and the industrial end-users are major stakeholders of the proposed project. All the participating RCA MSs have well established groups in their respective nuclear institutions/ministries of science and technology. These groups possess the required capability/capacity to implement the proposed project. In majority of the participating MSs, these groups maintain good liaison with relevant industrial end-users/national institutions. On the other hand industrial end-users are aware of the benefits of nuclear technology and they are themselves approaching national nuclear institutions for help and service provision. As a result, many nuclear techniques like gamma column scanning, leakage detection in heat exchangers/pipelines, flow rate measurements, inter-well communication studies in oilfields, Waster water treatment plant studies, sediment transport studies, RTD verification of CFD simulations, etc. are already being applied on industrial product-lines in routine. In addition to that pilot plant studies of computed tomography, SPECT and CARPT have also been conducted in some participating MSs and the progress in these advanced technologies is quite good. Given the present situation (state of readiness of tracer groups, their technical status & end-user response), it is highly favourable time to initiate & implement the proposed project in the region. It will definitely pay off in terms of socio-economic benefit, better quality of products, safe and economical industrial operation leading to Cleaner and safer management of industrial processes in the region.
Overall Objective (or Developmental Objective)	(from concept document - to be further developed and documented through the LFA) *State the objective to which the project will contribute, and demonstrate its linkage*

	with any regional broader development goal or priority. It has to be in line with the gap / problem / need identified. To advance and consolidate regional capability for on-line industrial process diagnosis, optimization and trouble-shooting using radiotracers and sealed source techniques
Analysis of objectives	(from concept document - to be further developed and documented through the LFA) *Attach the objective tree to highlight the objectives hierarchy and cause-effect logic that this project is expected to achieve.* To be provided with LFM
Role of nuclear technology and IAEA	(from concept document- can be adjusted) *Indicate the nuclear technique that would be used and outline why this is appropriate to address the issue. Is the technique the only one available? Does it have a comparative advantage over non-nuclear techniques?* *What specific role is the IAEA expected to play in the project?* Radiotracers and sealed source techniques have been used extensively for the investigation of industrial systems. Multiphase systems are encountered in many modern industrial processes, which are complicated and difficult to visualize and characterize with conventional methods. It is therefore essential to have suitable means to investigate such systems for process optimization and trouble-shooting – preferably without shutting down the plant/process. Radiotracers and sealed source techniques are best-suited methods to address the problems faced by industry. Nuclear techniques, in most of the cases, provide on-line investigations without shutting down the plant/process. These also complement non-nuclear techniques in certain areas like validation of CFD modeling with radiotracer RTD analysis. In many cases nuclear techniques are the only available techniques that provide valuable insight into otherwise inaccessible plants/processes. Specific nuclear techniques to be utilized for the proposed project are: Gamma CT/SPECT for industrial process visualization Radiotracer RTD Tracing for verification of CFD modeling for industrial process characterization CARPT for process design, optimization and scale-up studies as well as for CFD validation. Radiotracers for process characterization, optimization and trouble shooting in FCCU, gasifiers, trickle bed reactors, extraction columns, combustors, bioreactors & fermentation systems, WWTP and other multi-phase flow systems. Radiotracers for inter-well communications for enhanced oil recovery in oilfield and geothermal resources exploration and exploitation. Use of radionuclide generators for preparation of new tracers for harsh industrial conditions Automation of on-going techniques such as gamma scanning, data acquisition systems, protocol development (of established techniques) for harmonization of radiotracers & sealed source applications and production of training material will be

	carried out as a part of supplementary activities.
Project duration	(from concept document- can be adjusted) *Indicate a realistic starting date and the number of years required to complete the project. (In the case of projects expected to exceed four years, an assessment will be conducted before the end of the fourth year to decide on the validity of an additional year.)* **Starting Date:** 01 January, 2016 □ **Duration:** 02 Year
Requirements for Participation	(from concept document – can be adjusted) *Indicate the minimum requirements that Member States' counterpart institutions would need to meet in order to participate in this project, and how these requirements are going to be verified.* The participating MSs would need to have well established industrial radiotracers and sealed source technology application groups with the capability in terms of: a): Physical infra-structure (e.g., suitable buildings, laboratory facilities, necessary materials and equipment like data acquisition systems, detectors, radiation sources, radiotracers, modeling software) b): Human resources with suitable experience to carry out the proposed project Not: As the same institutions/groups are participating in RAS/1/012, the minimum requirements for participation are already met.
Participating Member States	(from concept document – can be adjusted) *List the Member States expected to participate in the project that meet the requirements established above. Indicate the role of each MS in the project.* *Country: _____ Role:* □ *Resource (providing expertise)* □ *Target (receiving expertise)* Following RCA member states are participating in this project. 1. Australia; 2. Bangladesh; 3. China; 4. India; 5. Indonesia 6. Korea, Republic of ; 7. Malaysia; 8. Mongolia 9. Myanmar

	10. New Zealand 11. **Pakistan (Lead Country)** 12. Philippines 13. Sri Lanka 14. Thailand 15. Vietnam			
Funding and project budget	(from concept document – to be adjusted during project design) *Provide an estimate of the total project costs and the funding expected from each stakeholder:*			
			Euro	Comment
	Government cost-sharing		330,000	In kind contributions from all participating MSs in terms of provision of necessary manpower, laboratory infra-structure, salaries of staff, transport, laboratory /field facilities, equipment, consumables, national training events, technology promotion/ demonstration to end-user industry, etc.
	Counterpart Institution(s)		Nil	N.A
	Other partners		Nil	N.A
	IAEA TCF:	*FE/SV/TC/WS*	250,000	02 Project Meetings, 01 Technical Meeting, 02HBA, 02 RTCs, 01 Workshop
		Experts	20,000	04 Expert missions
		Equipment	Nil	N.A
		TOTAL	600,000	

18	**Improving management of diabetes mellitus and its complications using nuclear techniques**	**PAK**

Regional Project Concept Template (Category A)

The information contained in this template should be uploaded to the PCMF IT platform by the Chair of the relevant regional cooperative agreement or the NLO of the Member State submitting the concept by at the latest. Based on this information the IAEA will assess whether this project concept is in line with the TC quality criteria and requirements. Concepts positively appraised will be further developed into full project documents during the design phase.

Region:	Asia Pacific		
Regional/Cooperative agreement (if applicable)		**Priority no. given by regional/cooperative agreement** (for concepts proposed under the auspices of regional cooperative agreements)	
Title	**Improving Management of Diabetes Mellitus and its Complications Using Nuclear Techniques.**		
Field of activity	6B		
Regional project category[1]	√ *Transnational* √ *Regional standard setting* √ *Capacity building for developing countries* *Joint TC activities with a regional or international entity*		
Names and contact details of project counterparts and counterpart institutions (starting with the main counterpart)	Dr Shabana Saeed Department of Medical Sciences, Pakistan Institute of Engineering and Applied Sciences (PIEAS) P.O. Nilore, Islamabad, Pakistan. Telephone: +92-51-2208361; cell: +923465478927 Facsimile: +92-51-2208070 Email: shabana_saeed@yahoo.com; fac028@pieas.edu.pk		
Analysis of regional Gap / Problems/needs	Worldwide, 200 million individuals currently have diabetes, and projections by the World Health Organization and others suggest that its prevalence will exceed 300 million by 2025 and 360 million by 2030. Diabetes mellitus is associated with various complications including microvascular and macrovascular complications leading to serious diseases affecting the heart and blood vessels, eyes, kidneys, nerves and bones. In addition, people with diabetes also have a higher risk of developing infections. Diabetes is a leading cause of cardiovascular disease, blindness, kidney failure, and lower limb amputation. Management and treatment of diabetic complications imposes a significant economic burden on the state and the individual. In addition, complications of diabetes have a considerable impact on the quality of life of the patient. It, therefore, becomes imperative to institute effective screening and preventive strategies to detect the early signs of complications. Nuclear techniques play an important role in the early diagnosis of the complications of diabetes mellitus. Advanced Glycation End products (AGEs) formation has been postulated to contribute to the progression of many diabetic complications. Early detection of AGEs can lead to early prediction of the diabetic complications. Radioimmunoassay is an important tool for the detection of advanced glycation end products and can be helpful in the long term management of diabetes mellitus. Most of the regional countries are not doing radioimmunoassay for AGEs; this technique needs to be introduced in the regional states. Diabetic patients have two to four folded increased risk of Cardiovascular event and is the most common cause of mortality in diabetic population. Clinical presentation and progression of coronary artery disease (CAD) differs between diabetic and non diabetic patients. It is more advanced, extensive, usually associated with left ventricular dysfunction at the time of diagnosis. Diabetic patients often fail to respond to revascularization. An early diagnosis of CAD is imperative in this regard. Nuclear imaging with SPECT could be used to detect the presence or absence of ischemia and ventricular dyfunction , which is common in		

[1] See the document entitled "Policy and Procedures for TC Regional Projects" at http://pcmf.iaea.org/DesktopModules/PCMF/docs/2014_15_Docs/notes-Regional_TC_Project_Policy.pdf

	diabetic can be assessed by using Gated SPECT or radionuclide ventriculography. Moreover studies have indicated that totally asymptomatic patients with diabetes have at least an intermediate probability of CAD, a prevalence that may justify screening by noninvasive testing such as stress myocardial perfusion imaging. Diabetic nephropathy as a complication of Diabetes Mellitus poses a serious problem in terms of financial load, morbidity and mortality. Diabetes has become the most common single cause of end-stage renal disease. GFR estimation is the only renal parameter which can singly provide a picture of the actual renal status of DM patients at any duration irrespective of the status of albuminuria, azotemia or renal size and morphology as their variability or progression is non-linear. GFR measurement using ^{99m}Tc DTPA thus can play an important role in the in the earlier stages of kidney diseases in diabetes mellitus. Specific complications involving the nervous system are more frequent in cases with longer duration of the disease. Delayed esophageal and gastric emptying is one of the manifestations of diabetic neuropathy. Studies have reported that diabetic gastroenteropathy can occur in the absence of other significant diabetic complications. For early detection of diabetic neuropathy the dynamic esophageal scintigraphy and radionuclide gastric emptying can play an important role However there is a need to propagate and standardize the technique with the definition of reference values. There is also a need to educate to educate the physician in this technique. Infections are common in diabetics and nuclear medicine has a pivotal role to play in their diagnosis. Patients with diabetes have a 10-fold greater risk of soft-tissue infection and bone infection in the lower extremity, compared with healthy individuals. Nuclear Medicine, being a functional imaging modality has always been on forefront in the diagnosis of infections especially in the diabetic foot infections. Radionuclide tests are decisive in the localization and diagnosis of foot osteomyelitis. Other indications for nuclear medicine tests are malignant external otitis, prosthetic infections, osteomyelitis of long bones, Inflammatory bowel disease and renal infections A variety of radiopharmaceuticals including ^{99m}Tc MDP, labelled leukocytes, labelled antibiotics, ^{99m}Tc UBI, ^{99m}TcDMSA etc are employed while emerging techniques include SPECT/CT and ^{18}FDG PET for infection imaging. There is a need of promoting these nuclear medicine techniques in the early diagnosis and follow up of these complications, which will not only help in better management of these patients but also will lessen the economic burden of the disease.
Why should it be a regional project?	The Asia-Pacific region is at the forefront of the current epidemic of diabetes. The region already contains more than 30 million people with diabetes and the number is estimated to double by 2025. Diabetes prevalence rates already exceed 8% in 12 countries and areas within the region. Early diagnosis and management of the complications of diabetes is essential to avoid the high burden caused by the complications of diabetes in terms of mortality and morbidity causing loss of economic productivity of Asia Pacific Region The Asia Pacific region is unique in that it comprises of both developing and developed countries. By joining hands, developing countries of the region can benefit from the technical know-how and expertise of those countries which are more advanced in health care.
Stakeholder analysis and partnerships	Principle beneficiaries of this project comprise of developing countries of Asia and Pacific region. End users will be nuclear physicians of the regional member states involved in the medical application of radionuclides and the beneficiaries are the diabetic population of the member states. Developing countries of the region can benefit from the technical know-how and expertise of those countries which are more advanced in health care.
Overall objective (or developmental objective)	The objective of this project is to utilize the nuclear techniques in the management of diabetes mellitus and its long term complications which will result in the reduction of mortility and morbidity rates and improves the quality of life of the diabetic patients.

Analysis of objectives	The project aims at establishing effective use of nuclear medicine techniques for the management of diabetes mellitus through Agency support the project will contribute: • To identify the most effective nuclear medicine techniques for the early identification of specific complication of the diabetes mellitus. • To promote and spread information on the clinical value of nuclear medicine procedures, specifically in those complications of diabetes mellitus. • To develop a strategy for the use of nuclear medicine procedures in diabetic population and to standardize and harmonize the nuclear medicine techniques for effective management of diabete mellitus in the region. • To provide nuclear physicians in RCA MSs with regionally harmonized training in the effective use of nuclear medicine technique for the management of each complication • To enhance collaboration and transfer of know-how and technology
Role of nuclear technology and the IAEA	All nuclear medicine procedures use unsealed radioactive sources. The Agency is expected to provide technical and administrative support to the project, including organizing training events, and provision of expert services with a cooperation of the counterpart.
Project duration	3 years
Requirements for participation	Participating member states must have an established nuclear medicine set-up with trained nuclear medicine physicians, medical physicists, technologist and radiopharmacist.
Participating Member States	*List the Member States expected to participate in this project that meet the requirements established above. Indicate the role of each Member State in the project.* *Country:* ___ *Australia, China, Japan, Korea, Singapore* ___ *Role:* √*Resource (providing expertise)* *Country: Pakistan, India, Bangladesh, Srilanka, Mongolia, Vietnam, Thailand, Malaysia* ___ *Role:* √*Target (receiving expertise)*

Funding and project budget

Provide an estimate of the total project costs and the funding expected from each stakeholder:

		Euro	Comment
Government cost-sharing			(to be sent to the IAEA)
Counterpart institution(s)			
Other partners			Who?:
IAEA Technical Cooperation Fund (TCF):	*Fellowships / Scientific visits / Training courses/ Workshops*	200,000	
	Experts		
	Equipment		
	TOTAL	*200,000*	

Regional Project Concept Template (Category A)

The information contained in this template should be uploaded to the PCMF IT platform by the Chair of the relevant regional cooperative agreement or the NLO of the Member State submitting the concept by at the latest. Based on this information the IAEA will assess whether this project concept is in line with the TC quality criteria and requirements. Concepts positively appraised will be further developed into full project documents during the design phase.

Region:	Asia Pacific		
Regional/Cooperative agreement (if applicable)		**Priority no. given by regional/cooperative agreement** (for concepts proposed under the auspices of regional cooperative agreements)	
Title	**Capacity building in Therapeutic Applications of Unsealed Radioactive sources in the Management of Benign and Malignant Diseases**		
Field of activity	6B		
Regional project category[1]	! *Transnational* √*Regional standard setting* √*Capacity building for developing countries* √*Joint TC activities with a regional or international entity*		
Names and contact details of project counterparts and counterpart institutions (starting with the main counterpart)	Dr Shabana Saeed Department of Medical Sciences, Pakistan Institute of Engineering and Applied Sciences (PIEAS) P.O. Nilore, Islamabad, Pakistan. Telephone: +92-51-2208361; cell: +923465478927 Facsimile: +92-51-2208070 Email: shabana_saeed@yahoo.com; fac028@pieas.edu.pk		
Analysis of regional Gap / Problems/needs	Radionuclide therapeutics can provide relatively effective treatments for various diseases that are difficult to cure or hard to get satisfactory results in clinical practice.The fundamental theory for radionuclide therapy is to achieve appropriate treatment for the disease through delivery of radiation dose at the desired cytotoxic level with the defined endpoints being cure, disease control or palliation, and at the same time avoids or minimizes toxic effects, both in acute frame and as long term complications. Radionuclide therapeutic procedures are effective treatment options when correctly applied. In most instances they are cost-effective too. Although unsealed radioactive sources have been used in medicine for many years for both diagnostic procedures and therapy, their use in therapy has until recently been limited, being mainly focused on treatment with radioiodine for both benign and malignant thyroid disease and occasional use of phosphorus (^{32}P) for polycythemia and bone metastases. More recently, however, there has been a renaissance in the application of radioisotope unsealed sources in therapeutic indications. Today the field of radionuclide therapy is going through an extremely interesting and exciting phase and is poised for greater growth and development in the coming years This has been stimulated by the development of chemical complexes such as the phosphonate compounds used to target bone metastasis and the neuroendocrine analogues, together with the revolution in monoclonal antibody technology, which has facilitated targeting of a radioactive isotope to sites of interest. Thus modern medicine radioisotope therapy has an important role to play in the management of various diseases. it is an active area of research with the quest for new compounds which will be specific for therapeutic targets. However,there is a need to extend the role of nuclear medicine in therapy, so that maximum benefits of radioisotopes can be reaped for the benefit of ailing humanity. The accessibility of many developing Member States to therapeutic application using unsealed radiopharmaceutical is limited for various reasons. Only few developing states possess appropriate infrastructure, equipment and properly		

[1] See the document entitled "Policy and Procedures for TC Regional Projects" at: http://portal.iaea.org/DesktopModules/PCMF/docs/2014_15_Docs/notes_Regional_TC_Project_Policy.pdf

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	trained personnel to allow conducting these procedures on a routine and safe basis. This project is aimed at addressing this problem through strengthening the ability of RCA Member States in the use of unsealed radioactive sources for therapeutic purposes in the management of benign and malignant diseases.
Why should it be a regional project?	These radionuclide therapies are gaining popularity and increasingly practiced in the west; however in many developing countries of Asia, therapeutic nuclear medicine is still limited to I-131 therapy. Although barriers to radioisotope therapy relate primarily to ease of access and acquisition of radioisotopes, radiation protection regulations, and cost but the lack of experience and training are also important factors hampering the application of radionuclide therapy in the region.There are different perception of value of nuclear medicine therapy and difference in priorities between different countries. Also there is vast discrepancy in resources between different countries with variable standards regarding efficacy and safety. There is a need for collaboration with technologically advanced centres, where radionuclide therapy is being practiced. This project will allow the nuclear physicians of the region be trained in the different aspects of radionuclide therapy and to train them in delivering the effective coordination of a diverse multidisciplinary team that is essential to the safe provision of radionuclide treatment.
Stakeholder analysis and partnerships	The end-users are the nuclear physicians of the regional member states involved in the medical application of radionuclides and the beneficiaries are the patients with cancer (thyroid, neuroendocrine, lymphomas), patients with painful bony metastases and patients with painful joints. Member states with the capability in any aspect of radionuclide therapy will provide expertise and training in advanced radionuclide therapy.
Overall objective (or developmental objective)	The objective of this project is to improve the level of knowledge, skill and the capability of human resources in the Asia-Pacific region in the application of therapeutic nuclear medicine, and to set up practical measures and establish expert networks.
Analysis of objectives	the project will contribute: • To promote the therapeutic applications of radionuclide for the benefit of patients and for improving their quality of life. • To enhance the awareness of the radionuclide therapeutic procedures. • To revive some of the old procedures, which are still useful and relevant • To harmonize the protocol and procedures of new emerging radionuclide therapies. • To provide the knowledge required to administer radionuclide therapy safely and effectively in the individual patient. • Creation of opportunities to widen the boundaries of therapeutic nuclear medicine. • To provide support to human resources capacity building
Role of nuclear technology and the IAEA	All nuclear medicine procedures use unsealed radioactive sources. The Agency is expected to provide technical and administrative support to the project, including organizing training events, and provision of expert services with a cooperation of the counterpart
Project duration	3 years
Requirements for participation	Participating member states must have an established nuclear medicine set-up with trained nuclear medicine physicians, medical physicists, technologist and radiopharmacist.

Participating Member States	*List the Member States expected to participate in this project that meet the requirements established above. Indicate the role of each Member State in the project.* *Country:* ___ *Australia, China, Japan, Korea, Singapore* _____ *Role:* √*Resource (providing expertise)* *Country: Pakistan, India, Myanmmar, Srilanka, Phillipines, Vietnam, Thailand, Malaysia* _____ *Role:* √*Target (receiving expertise)* *Country:* _____ *Role:* *Resource (providing expertise)* *Target (receiving expertise)*

Funding and project budget

Provide an estimate of the total project costs and the funding expected from each stakeholder:

		Euro	Comment
Government cost-sharing		??	(to be sent to the IAEA)
Counterpart institution(s)			
Other partners		??	WARMTH; ICRT
IAEA Technical Cooperation Fund (TCF):	*Fellowships / Scientific visits / Training courses/ Workshops*		
	Experts		
	Equipment		
	TOTAL	*200000*	

19	**Capacity building in therapeutic applications of unsealed radioactive sources in the management of benign and malign diseases**	**PAK**

Regional Project Concept Template (Category A)

The information contained in this template should be uploaded to the PCMF IT platform by the Chair of the relevant regional cooperative agreement or the NLO of the Member State submitting the concept by at the latest. Based on this information the IAEA will assess whether this project concept is in line with the TC quality criteria and requirements. Concepts positively appraised will be further developed into full project documents during the design phase.

Region:	Asia Pacific		
Regional/Cooperative agreement (if applicable)		**Priority no. given by regional/cooperative agreement** (for concepts proposed under the auspices of regional cooperative agreements)	
Title	**Capacity building in Therapeutic Applications of Unsealed Radioactive sources in the Management of Benign and Malignant Diseases**		
Field of activity	6B		
Regional project category[1]	! *Transnational* √*Regional standard setting* √*Capacity building for developing countries* √*Joint TC activities with a regional or international entity*		
Names and contact details of project counterparts and counterpart institutions (starting with the main counterpart)	Dr Shabana Saeed Department of Medical Sciences, Pakistan Institute of Engineering and Applied Sciences (PIEAS) P.O. Nilore, Islamabad, Pakistan. Telephone: +92-51-2208361; cell: +923465478927 Facsimile: +92-51-2208070 Email: shabana_saeed@yahoo.com; fac028@pieas.edu.pk		
Analysis of regional Gap / Problems/needs	Radionuclide therapeutics can provide relatively effective treatments for various diseases that are difficult to cure or hard to get satisfactory results in clinical practice.The fundamental theory for radionuclide therapy is to achieve appropriate treatment for the disease through delivery of radiation dose at the desired cytotoxic level with the defined endpoints being cure, disease control or palliation, and at the same time avoids or minimizes toxic effects, both in acute frame and as long term complications. Radionuclide therapeutic procedures are effective treatment options when correctly applied. In most instances they are cost-effective too. Although unsealed radioactive sources have been used in medicine for many years for both diagnostic procedures and therapy, their use in therapy has until recently been limited, being mainly focused on treatment with radioiodine for both benign and malignant thyroid disease and occasional use of phosphorus (^{32}P) for polycythemia and bone metastases. More recently, however, there has been a renaissance in the application of radioisotope unsealed sources in therapeutic indications. Today the field of radionuclide therapy is going through an extremely interesting and exciting phase and is poised for greater growth and development in the coming years This has been stimulated by the development of chemical complexes such as the phosphonate compounds used to target bone metastasis and the neuroendocrine analogues, together with the revolution in monoclonal antibody technology, which has facilitated targeting of a radioactive isotope to sites of interest. Thus modern medicine radioisotope therapy has an important role to play in the management of various diseases. it is an active area of research with the quest for new compounds which will be specific for therapeutic targets. However,there is a need to extend the role of nuclear medicine in therapy, so that maximum benefits of radioisotopes can be reaped for the benefit of ailing humanity. The accessibility of many developing Member States to therapeutic application using unsealed radiopharmaceutical is limited for various reasons. Only few developing states possess appropriate infrastructure, equipment and properly		

[1] See the document entitled "Policy and Procedures for TC Regional Projects" at: http://pcmf.iaea.org/DesktopModules/PCMF/docs/2014_15_Docs/notes/Regional_TC_Project_Policy.pdf

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	trained personnel to allow conducting these procedures on a routine and safe basis. This project is aimed at addressing this problem through strengthening the ability of RCA Member States in the use of unsealed radioactive sources for therapeutic purposes in the management of benign and malignant diseases.
Why should it be a regional project?	These radionuclide therapies are gaining popularity and increasingly practiced in the west; however in many developing countries of Asia, therapeutic nuclear medicine is still limited to I-131 therapy. Although barriers to radioisotope therapy relate primarily to ease of access and acquisition of radioisotopes, radiation protection regulations, and cost but the lack of experience and training are also important factors hampering the application of radionuclide therapy in the region.There are different perception of value of nuclear medicine therapy and difference in priorities between different countries. Also there is vast discrepancy in resources between different countries with variable standards regarding efficacy and safety. There is a need for collaboration with technologically advanced centres, where radionuclide therapy is being practiced. This project will allow the nuclear physicians of the region be trained in the different aspects of radionuclide therapy and to train them in delivering the effective coordination of a diverse multidisciplinary team that is essential to the safe provision of radionuclide treatment.
Stakeholder analysis and partnerships	The end-users are the nuclear physicians of the regional member states involved in the medical application of radionuclides and the beneficiaries are the patients with cancer (thyroid, neuroendocrine, lymphomas), patients with painful bony metastases and patients with painful joints. Member states with the capability in any aspect of radionuclide therapy will provide expertise and training in advanced radionuclide therapy.
Overall objective (or developmental objective)	The objective of this project is to improve the level of knowledge, skill and the capability of human resources in the Asia-Pacific region in the application of therapeutic nuclear medicine, and to set up practical measures and establish expert networks.
Analysis of objectives	the project will contribute: • To promote the therapeutic applications of radionuclide for the benefit of patients and for improving their quality of life. • To enhance the awareness of the radionuclide therapeutic procedures. • To revive some of the old procedures, which are still useful and relevant • To harmonize the protocol and procedures of new emerging radionuclide therapies. • To provide the knowledge required to administer radionuclide therapy safely and effectively in the individual patient. • Creation of opportunities to widen the boundaries of therapeutic nuclear medicine. • To provide support to human resources capacity building
Role of nuclear technology and the IAEA	All nuclear medicine procedures use unsealed radioactive sources. The Agency is expected to provide technical and administrative support to the project, including organizing training events, and provision of expert services with a cooperation of the counterpart
Project duration	3 years
Requirements for participation	Participating member states must have an established nuclear medicine set-up with trained nuclear medicine physicians, medical physicists, technologist and radiopharmacist.

Participating Member States	*List the Member States expected to participate in this project that meet the requirements established above. Indicate the role of each Member State in the project.* *Country:* ___ *Australia, China, Japan, Korea, Singapore* _____ *Role:* √*Resource (providing expertise)* *Country: Pakistan, India, Myanmmar, Srilanka, Phillipines, Vietnam, Thailand, Malaysia* _____ *Role:* √*Target (receiving expertise)* *Country:* _____ *Role:* *Resource (providing expertise)* *Target (receiving expertise)*

Funding and project budget

Provide an estimate of the total project costs and the funding expected from each stakeholder:

		Euro	Comment
Government cost-sharing		??	(to be sent to the IAEA)
Counterpart institution(s)			
Other partners		??	WARMTH; ICRT
IAEA Technical Cooperation Fund (TCF):	*Fellowships / Scientific visits / Training courses/ Workshops*		
	Experts		
	Equipment		
	TOTAL	*200000*	

20	**Distant learning certification for hybrid imaging (PET/CT and SPECT/CT)**	**PAK**

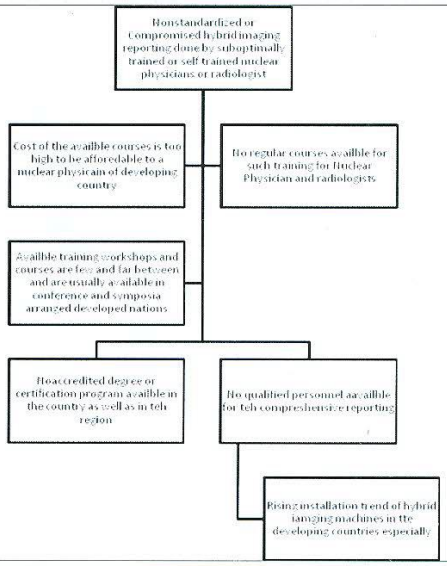
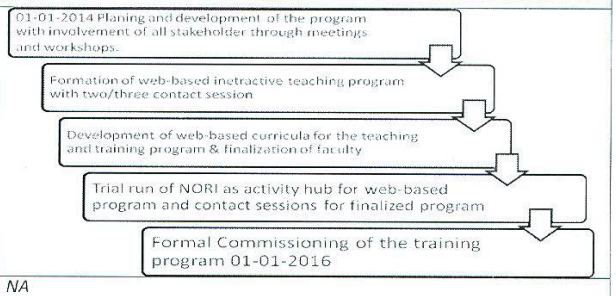
Regional Project Concept Template (Category A)

RCA

Region:			
Regional/Cooperative agreement (if applicable)	RCA	**Priority no. given by regional/cooperative agreement** (for concepts proposed under the auspices of regional cooperative agreements)	
Title	Distant Learning Certification Program for Hybrid Imaging (PET/CT and SPECT/CT)		
Field of activity			
Regional project category[1]	☐ *Transnational* ☐ *√Regional standard setting* ☐ *Capacity building for developing countries* ☐ *Joint TC activities with a regional or international entity*		
Names and contact details of project counterparts and counterpart institutions (starting with the main counterpart)	***Dr. Shazia Fatima*** *PMO* *Nuclear Medicine, Oncology & Radiotherapy Institute Islamabad, Pakistan* *Dr. Shazia Fatima* *Principal Medical Officer* *Nuclear Medicine, Oncology & Radiotherapy Institute Islamabad, Pakistan* MAIN COUNTERPART INSTITUTIONs: 1. NORI Nuclear Medicine Oncology & Radiotherapy Institue 2. INMOL Institute of Nuclear Medicine & Oncology Lahore 3. PIMS Department of Radiology Pakistan Institute of Medical Sciences 4. ASNM Asian School of Nuclear Medicine 5. PIEAS Pakistan Institute of Engineering & Applied Sciences		
Analysis of regional Gap / Problems/needs	During the past several years there has been phenomenal growth in of hybrid imaging equipment like PET-CT, SPECT-Ct and PET-MR. The hybrid imaging procedures have revolutionized the diagnosis and treatment of various ailments. Hybrid imaging modality has edge over the conventional imaging techniques by virtue of providing the comprehensive physiological and morphological information simultaneously, which increases the diagnostic accuracy manifolds. Growing utilization of PET/CT, based on the fact that functional and morphologic correlative images produced by this methodology improve diagnostic accuracy. Similar progress is now being reported for SPECT/CT, a modality which is rapidly evolving from a somewhat under-utilized technical option to gain an acknowledged status for optimizing the diagnostic capabilities of single photon imaging, with potential impact on patient management. SPECT and CT are tomographic imaging procedures, each one with separately proven good diagnostic performance. SPECT produces computer-generated images of local radiotracer uptake, while CT produces 3-D anatomic images of X ray density of the human body. Combined SPECT/CT imaging provides sequentially functional information from SPECT and the anatomic information from CT, obtained during a single examination. CT data are also used for rapid and optimal attenuation correction of the single photon emission data. By precisely localizing areas of abnormal and/or physiological tracer uptake, SPECT/CT improves sensitivity and specificity, but can also aid in achieving accurate dosimetric estimates as well as in guiding interventional procedures or in better defining the target volume for external beam radiation therapy.		

[1] See the document entitled "Policy and Procedures for TC Regional Projects" at: http://pcmf.iaea.org/DesktopModules/PCMF/docs/2014_15_Docs/notes/Regional_TC_Project_Policy.pdf.

	Diagnosis and characterization of disease by CT imaging is based on morphologic criteria such as size, texture and tissue attenuation. CT provides information regarding changes in organ size and tissue density, as well as their precise spatial localization and topographic landmarks. However, structural data do not necessarily correlate with the metabolic status of disease. On the other hand, nuclear medicine imaging is based on the bio-distribution of a radioactive agent over time and space, thus visualizing dynamic physiological and pathophysiological processes that define the functional characteristics of disease. Furthermore, whole body assessment is possible with a single radiation exposure, as the ionizing agent is administered to patients rather than being delivered from an external source to each region of the body to be evaluated, as performed with radiologic imaging (e.g. conventional X ray or CT). However, scintigraphic images lack accurate anatomic landmarks for precise localization and characterization of findings, in spite of the fact that specific radiopharmaceuticals are used for assessment and diagnosis of specific disease processes. Despite the advancement in the technical side there is still dire need for the proper teaching and training of human resource in the field of hybrid imaging. The reporting clinicians are usually Nuclear Physicians or Radiologists and the hybrid imaging results are required to be reported on their morphological findings as well as their metabolic activity. Sometime it is logistically impossible to have both specialists available in a single centre. In most of the Pakistan Atomic Energy Nuclear Medicine Centres there is dearth of qualified radiologists because of multiple constraints. Not only this there is no standardized or recognized certification or degree program in Asian region. The only learning option available is short course offered in some meeting or conference etc. To overcome this acute problem of shortage of qualified manpower in hybrid imaging, it is suggested that a new certification or degree program should be started with collaborative efforts of IAEA , PAEC and ASNM .
Why should it be a regional project?	As mentioned above, there is no harmonized teaching and training program available in most of the developing countries and in Asian region. The developing countries are booming with these techniques and as per statistics the installation and usage of the hybrid machine are on rise in the developing countries. newly established To develop a standardized
Stakeholder analysis and partnerships	The major stake holders in this project would be PAEC, IAEA and ASNM. The PAEC has a long track record and commitment towards peaceful use of nuclear techniques and all the Nuclear Medicine centres are the metaphor of this commitment. PAEC is torch bearer in teaching and training in Nuclear Medicine. The M. S Nuclear Medicine program of PAEC was the first of its kind teaching and degree program in the region. Through IAEA fellowship program fellows from various developing nations have acquired this degree. PAEC and IAEA have long history of cooperation and commitment towards each other's goals. This cooperation and commitment is being reflected in the TC projects and CRPs awarded by IAEA and conducted in PAEC establishments.

Overall objective (or developmental objective)	• *Accredited teaching & training program in hybrid imaging (PET-CT/SPECT-CT)*
Analysis of objectives	
Role of nuclear technology and the IAEA	IAEA through its distant learning program is already actively involved in the teaching and training of human resource in the field of Nuclear Medicine. This activity is currently available for technologists only. Building of qualified and trained human resource in field of Nuclear Medicine is one of the key priority area of IAEA.
Project duration	
Requirements for participation	*NA*
Participating Member States	*Country: Pakistan (PAEC)___ Role:* ☐ √ *Resource (providing expertise)* ☐ *Target (receiving expertise)* *Country: ASNM_____ Role:* ☐ √ *Resource (providing expertise)* ☐ *Target (receiving expertise)*

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	Country: Regional countries and local NM centres _____ Role: ☐ *Resource (providing expertise)* ☐ *√Target (receiving expertise)*			
Funding and project budget	*Provide an estimate of the total project costs and the funding expected from each stakeholder:*			
			Euro	Comment
	Government cost-sharing		10, 000 USD	(to be sent to the IAEA)
	Counterpart institution(s)			
	Other partners			
	IAEA Technical Cooperation Fund (TCF):	*Fellowships / Scientific visits / Training courses/ Workshops*	50, 000 USD	
		Experts	*30, 000 USD*	
		Equipment	*20, 000 USD*	
		TOTAL	*1.1Million USD*	

21	**Ecosystem management function in view of anthropogenic influence and climate change trend and impact**	**IND**

IAEA International Atomic Energy Agency

Technical Cooperation (TC) Programme

Regional project concept

Name of the region: Asia Pacific	**Regional/ Cooperative Agreement** *(if applicable)*: RCA	**Project concept priority number within the Regional/Cooperative Agreement Programme Note** *(if applicable)*:	**Project concept priority number within the Regional Programme Note:**

Title:

The title should be as concise as possible and should summarize the objective of the project.

Ecosystem management function in view of anthropogenic influence and climate change trend and impact

Problem statement:

Provide a summary of the issue to be addressed by the project. This should be the result of a situation analysis to identify the problem, and its cause and effect.

The marine ecosystem continues to be one of the most threatened environment by climate change as evidence by severe storm surges, severity and more intense flooding due to sea level rise which are affecting the life and property of the general population.

Changes in the global climate have affected the distribution of organisms as well as their interactions. Human induced increases in atmospheric concentration of green house gases are expected to cause more rapid changes in the earth's climate than have been experienced for millenia. If this happens, the alteration of species distribution and modification of flow of energy and cycling of materials within ecosystem may also happen. Further, temperature also influences organisms biology, affects dissolved oxygen concentrations in water and play a direct role in sea-level rise and in the major patterns of coastal and oceanic circulations.

This project then aims to integrate the data so far collected by the two project RAS 7019 and 7024 and to collect additional data to fill the gaps which are necessary to be able to understand ecosystem and to predict future scenario based changre in behaviour pattern of marine species brought about by climate change effects. This will include survey of contaminants found in sediments, aquatic plants, and their relationship in commonly consumed seafood's such as small fish and benthic organisms (holothurians, crabs, shrimp, snails etc). The investigation and establishment of contamination levels and isotopic ratio of naturally occurring radionuclides and stable isotope of key species using helps in understanding the change in marine ecosystem.

Describe the in-depth analysis of the major problems/needs, their causes and effects; and how these are linked to the Regional Development Plans/ Framework or equivalent. Provide a reference to past efforts made in addressing the problem, if any, and how the current project is built upon them.

Attach any supporting documents (e.g. Regional Development Plans).

Objective:

State succinctly what the project is intended to achieve. Please state only one objective.

1. Use nuclear and isotope techniques and biomarkers to establish baseline levels and understand potential sources of nutrients and heavy metal contaminants found in seafood from marine and estuarine environments in the Asia–Pacific region.
2. Establish an Asia-Pacific marine and estuarine contaminant database of sediments and associated aquatic plants and seafood, including comparisons with WHO recommended values.
3. Change in behaviour of marine species based on isotopic ratio e.g. 226 Ra and 228 Ra and ratio of stable isotopes such as Ba, Sr and Rb
4. Measurement of terriogenous material and chemical biogenic material in the coastal sediment can predict the change due to anthropogenic, weathering and climatic parameters.
5. stable isotope ratios and trace elements that are proxies of temperature, salinity, pH, nutrient inputs, pollution (e.g. Sr, Ba, Ca, Mg, ∂18O, ∂11B, ∂13C) in biological archives such as coral or carbonate sediment cores to allow reconstructing past ocean conditions (at long and recent scale: U series, 14C, 210Pb, 210Po dating techniques) in specific geographical areas.
6. Natural or anthropogenic tracers, such as 14C, of meteorology changes and of seawater movements and currents susceptible to be modified by temperature increase, sea level rise, etc...
7. Use of natural radionuclides (Th/U ratio disequilibrium, 14C) as tracers of vertical carbon fluxes from the sea surface to the bottom and deep ocean.

End users:

Who will use/benefit from the results of the project? (e.g. decision makers, service users, patients, farmers).

The beneficiaries will be coastal/marine research organizations, integrated coastal zone managers (ICZM), regional and international marine programs, and seafood/aquaculture industries. The results are expected to provide science-based data and information to policy makers for legislation, regulations, standards and guidelines development for sustainable environmental management that could lessen the negative impacts of climate change.

Past and present regional efforts in addressing the need:

Summarize any past and present regional efforts (including programmes/projects by other regional or international partners) to address the issue to which the project will contribute. Explain any specific gaps that the project will address. Why is a regional approach the most effective mechanism in this case?

The IAEA through this regional cooperation has developed and established nuclear and isotope-based techniques in understanding and characterizing the coastal and marine environment and in monitoring resources to protect public health and safety. This IAEA Regional Project will provide education to RCA Member States to increase capability via training and awareness of coastal environment issues to manage and reduce these contaminates. Resources will be pooled to ensure Member States are able to assess sites of concern even if required analytical techniques are not readily available within their own country.

Indicate why it is better to address this problem/need through a regional project (as compared to a national one).

This project builds and consolidates on the achievements and networks developed through previous marine projects RAS/8/080 on Management of Marine Coastal Environment and its Pollution, RAS/7/011 on Enhancing the Sustainability of the Marine Environment and RAS/07/024 on Supporting Nuclear and Isotopic Techniques to Assess Climate Change for Sustainable Marine Ecosystem Management

Role of nuclear technology:

Indicate the specific nuclear technique that would be used, and outline why it is appropriate for addressing the issue. Is the technique the only one available to solve the problem? Does the technique have a comparative advantage to non-nuclear techniques? Does the technique complement non-nuclear techniques?

Nuclear analytical techniques (NATs) such as Alpha, beta and gamma spectrometry for radionuclides (uranium series, Cs-137, etc) could provide essential chronological information on past changes in climatic regimes and trace rates of key climate-impacted environmental processes, often trans-boundary in nature. Neutron activation analysis (NAA), PIXE and XRF could be utilized in contaminant/sediment fingerprinting and quantification studies. Isotope ratio mass spectrometry (IRMS) for C, S, and N isotopes could identify sources of nutrients and pollution, the mixing proportions of land-derived material (eg. water, sediments and pollutants such as sewage and industrial discharges) with non-polluted seawater and it could determine keystone organisms in the food chain for more detailed investigations. In vivo laboratory radioecology and radiotracer studies could be used for predicting the behaviour, uptake and transfer of elements essential for health/nutrition of biota and contaminants for toxicological and food chain risk assessments of contaminant releases in coastal environments.

These NATs are specific, selective and cost-effective. They are often non-destructive and have multielement capability. Sample size could be very limited sometimes and NATs provide the only effective answer. In other cases, naturally occuring and fission radionuclides provide specific tracers for environmental processes.

NATs contribute a unique understanding of the Earth system, not available via non-nuclear techniques, and quantify changes related to global climate and their impact in the coastal zone. NATs complement ancillary non-nuclear techniques undertaken by project members, participating collaborators and end-users.

Role of the IAEA:

What specific role would the IAEA be expected to play in the project?

IAEA extends its technical assistance through providing experts, arranging Regional Training Courses, Workshops and Meetings.

Participating Member States:

List the Member States expected to participate in the project.

India , Newzeland, Philippines, Malaysia, Srilanka, Myanmar, Vietnam, Thailalnd. Other RCA Member states who identifies the problem as one of their national priority also can join the project.

National and regional counterpart institutions / stakeholders involved in the project:

List all national and regional institutions and stakeholders expected to participate in the project. Please enter first the main counterpart institution and the Designated Team Member (DTM). This person will be the regional technical coordinator for the project.

Bhabha Atomic Research Centre, National Environmental Agencies; National Environmental Regulatory Authorities; corresponding Regional Organizations; Coastal populations

Link to regional strategies or equivalent:

Is this project directly linked to a priority area identified in the relevant regional strategy? If yes, provide the reference.

The integration of significant Technical Cooperation between Developing Countries contributions into the project can be better achieved through a regional project. This will provide national and regional synergies in data sharing and shared cost of regional expenses. Project activities will assist in the development of regional skill-bases, promotion of local experts

If not, explain why this concept is being presented for consideration.

Partnership:

List all external institutions and partners (other UN or international organisations, donors, etc.) expected to participate in the project, specifying the contribution of each.

Physical infrastructure and human resources:

What physical infrastructure and human resources are available to support the project? For example, existing laboratories, suitable buildings, staff that will be directly involved in this project.

List any regional resource centres that would play a major role in the implementation of the project.

This project then aims to integrate the data so far collected by the two project RAS 7019 and 7024 and to collect additional data to fill the gaps which are necessary to be able to conduct modelling of the baseline ecosystem and to predict future scenario on the marine ecosystem brought about by climate change effects. Nuclear and isotopic techniques will be used to determine contaminant origin and concentration factors and investigate trophic processes. As part of national and regional monitoring programs, conventional analysis of samples will be complemented by chemical biomarkers (where appropriate).

Financial resources required and source of funding:

Provide an estimate of the total cost of the project and the expected funding provided by each stakeholder (Government cost-sharing, other partners and IAEA).

IAEA contribution will be USD 200,000

Duration of the project:

Indicate a realistic starting date for the project and the number of years required to complete the project. Projects should not exceed four years.

2016-2018. 3 years

Safety regulatory infrastructure:

Indicate whether or not the safety regulatory infrastructure and associated standards and procedures in the Member States that are expected to participate in this project are adequate to ensure that the project will be implemented in a safe manner. If not, specify the gaps and indicate how they will be addressed.

Safety and regulatory infrastructure is expected to be in place for nuclear facilities and radioisotope users in the member states. This is ensured by the corresponding nuclear authority in each MSs which are the main participants in this Project. Member states are also expected to follow the IAEA guidelines in safe handling of nuclear related techniques/methodologies.

22	**Defining the Precise Role of Hybrid Positron Emission Tomography-Computed Tomography in the management of Infectious and Aseptic Inflammatory disorders**	**IND**

Technical Cooperation (TC) Programme

Regional project concept

Name of the region:	**Regional/ Cooperative Agreement** *(if applicable)***:**	**Project concept priority number within the Regional/Cooperative Agreement Programme Note** *(if applicable)***:**	**Project concept priority number within the Regional Programme Note:**

Title:

The title should be as concise as possible and should summarize the objective of the project.

Defining the Precise Role of Hybrid Positron Emission Tomography-Computed Tomography in the management of Infectious and Aseptic Inflammatory disorders

Problem statement:

Provide a summary of the issue to be addressed by the project. This should be the result of a situation analysis to identify the problem, and its cause and effect.

The proposed project is aimed at precisely defining *the role of FDG-PET/CT imaging in detecting and evaluating* infectious and non-infectious inflammatory lesions including early monitoring of therapeutic response. Both infectious diseases and non infectious inflammatory disorders are heavily emphasized in the developing world and are frequently encountered in the developed nations (especially the latter group), are major sources of morbidity and mortality, and are associated with significant costs and burden to the respective societies. Therefore, by conducting this proposed project, we believe the participating countries will benefit from the clinical applications of approaches that will be validated for routine use in the day to day practice of these potentially treatable disorders.

Objective:

State succinctly what the project is intended to achieve. Please state only one objective.

*The primary objective of this proposed project is to examine a group of patients with a*ctive infective and aseptic inflammatory disorders of varying etiologies using PET/CT imaging to clearly define,

validate and develop guidelines with regard to its utility for characterizing and quantifying the degree of inflammation in the affected organs and other systems at baseline and following treatment. We believe the endeavour through this powerful imaging technique may facilitate earlier diagnoses in this group of patients and potentially be utilized as an outcome measure to determine response to treatment in clinical trials and thus facilitate novel drug development.

The plan will be to carry out jointly innovative studies comprising PET-CT imaging techniques for the following inflammatory disorders: A. I**NFECTIOUS DISEASES** [1. Osteomyelitis in Diabetic foot and Complicated bone fracture; 2.Bacterial spondylodisctis, TB spondylodisctis and Noninfectious bone diseases including Osteoarthritis; 3.Infection in painful joint prosthesis; 4.Tuberculosis including other opportunistic infections (involving multi-organ systems) in the immunocompromised patient (cancer and HIV);] and **B. ASEPTIC INFLAMMATORY DISORDERS** [5.Inflammatory Bowel Disease (IBD); 6.Rheumatoid Arthritis; 7.Sarcoidosis; 8. Atherosclerosis; 9. Vasculitis, vascular graft infection and vascular thromboembolism;10. IgG4 related disoreders, spanning over 4 years.

End users:

Who will use/benefit from the results of the project? (e.g. decision makers, service users, patients, farmers).

It is expected that at the completion of the proposed project, the role of various novel and powerful imaging modalities (PET-CT in particular) will be clearly defined in the management of patients with these challenging and serious complications. The procedure will be implemented by the nuclear medicine physicians in the RCA Member states participating in this project. It is expected that the mechanism evolved from this project and the expertise gained by the participating member states will further enhance the promotion of nuclear medicine centered programmes, especially PET/CT procedures to other areas of medical concerns besides cancer diagnosis and therapy. The prime beneficiaries are the patients suffering from the above disorders.

Past and present regional efforts in addressing the need:

Summarize any past and present regional efforts (including programmes/projects by other regional or international partners) to address the issue to which the project will contribute. Explain any specific gaps that the project will address. Why is a regional approach the most effective mechanism in this case?

Recently, FDG-PET imaging has been proposed for detecting infections and inflammatory disorders. Many investigators have noted the affinity of FDG for active inflammatory and infectious disorders, such as sarcoidosis, the abdominal abscess, brain abscess, lung abscess, renal abscess, inflammatory pancreatic disease, lobar pneumonia, asthma, tuberculosis, colitis, sinusitis, myositis, mastitis, vasculitis, deep venous thrombosis and osteomyelitis in diabetic foot. Activated inflammatory cells have significantly elevated glycolysis and therefore can be visualized by PET.

While recognized by the practitioners and clinicians worldwide, FDG-PET/CT is employed

inconsistently in both infectious and aseptic inflammatory conditions by the medical community in both developing and developed nations.

Molecular imaging with PET has had an enormous impact on the practice of oncology and neuropsychiatric disorders. Unfortunately, infectious and inflammatory disorders have not been the subject of investigation by various scientific groups either in Europe or in United States. The infectious disorders are particularly a major issue of the developing world.

It is envisioned that through this effort, this advance application can be employed in a large set of population which is very specific to the subcontinent and thereby new data might be generated.

Role of nuclear technology:

Indicate the specific nuclear technique that would be used, and outline why it is appropriate for addressing the issue. Is the technique the only one available to solve the problem? Does the technique have a comparative advantage to non-nuclear techniques? Does the technique complement non-nuclear techniques?

PET/CT is a powerful imaging modality that holds tremendous promise for detecting and localizing infection. *Although FDG-PET alone is highly sensitive and specific with regard to metabolic activity of various* disorders, it cannot precisely determine the exact location of the abnormalities detected. Therefore, a combination of CT and PET may help to clarify the locations of lesions and their relations to adjacent structures. By imaging with the two modalities in a single scanning session, disease sites may be identified and clearly localized, potentially leading to more effective plans of treatment.

Role of the IAEA:

What specific role would the IAEA be expected to play in the project?

By harmonizing and characterising the role of PET-CT in these disorders as defined in the application, IAEA could serve as the nodal authority to develop guidelines that will provide to the medical community a scientific approach for their daily practice.

This will have great impact in choosing the best treatment in each patient on an individual basis.

Participating Member States:

List the Member States expected to participate in the project.

All the Asian/South Asian countries are expected to participate.
India can offer its expertise to function as the lead country for this project.

National and regional counterpart institutions / stakeholders involved in the project:

List all national and regional institutions and stakeholders expected to participate in the project. Please enter first the main counterpart institution and the Designated Team Member (DTM). This person will be the regional technical coordinator for the project.

Radiation Medicine Centre, BARC, DAE, India. The other national medical institutions practicing nuclear medicine PET/CT also will be actively participating.

Link to regional strategies or equivalent:

Is this project directly linked to a priority area identified in the relevant regional strategy? If yes, provide the reference.

If not, explain why this concept is being presented for consideration.

Infectious diseases are heavily emphasized in the Asian countries especially the Indian subcontinent, and are major sources of morbidity and mortality, and are associated with significant costs and burden to the respective societies of several countries of this region. Therefore, through the proposed project, we believe all countries will benefit and will substantially enhance science and practical applications of modern molecular imaging techniques in these countries.

Partnership:

List all external institutions and partners (other UN or international organisations, donors, etc.) expected to participate in the project, specifying the contribution of each.

Physical infrastructure and human resources:

What physical infrastructure and human resources are available to support the project? For example, existing laboratories, suitable buildings, staff that will be directly involved in this project.

List any regional resource centres that would play a major role in the implementation of the project.

Radiation Medicine Centre, BARC, DAE, India is the focal institute having all the necessary infra structure facilities required for the implementation of this project

Financial resources required and source of funding:

Provide an estimate of the total cost of the project and the expected funding provided by each stakeholder (Government cost-sharing, other partners and IAEA).

Approximately US$150000

Duration of the project:

Indicate a realistic starting date for the project and the number of years required to complete the project. Projects should not exceed four years.

2016: Planning and Development of the Programmes through meetings and workshops

2017-2019: Conducting the proposed Project and drafting guidelines on “Precise Role of PET-CT in Infectious and Aseptic Inflammatory Disorders”.
Safety regulatory infrastructure: *Indicate whether or not the safety regulatory infrastructure and associated standards and procedures in the Member States that are expected to participate in this project are adequate to ensure that the project will be implemented in a safe manner. If not, specify the gaps and indicate how they will be addressed.* Member states having the PET/CT facility can participate in this project and is anticipated that the Member States practicing PET/CT will be following the safety guidelines prescribed by the IAEA for PET/CT.

23	**Organ contouring using ultrasound image-guidance for treatment plannig in the intracavitary radiotherapy of carcinoma cervix**	**IND**

IAEA
International Atomic Energy Agency

Technical Cooperation (TC) Programme

Regional project concept

Name of the region: Asia Pacaific	**Regional/ Cooperative Agreement** *(if applicable)*: RCA	**Project concept priority number within the Regional/Cooperative Agreement Programme Note** *(if applicable)*:	**Project concept priority number within the Regional Programme Note:**

Title:

The title should be as concise as possible and should summarize the objective of the project.

Organ contouring using ultrasound image-guidance for treatment planning in intracavitary radiotherapy for Carcinoma Cervix.

Problem statement:

Provide a summary of the issue to be addressed by the project. This should be the result of a situation analysis to identify the problem, and its cause and effect.

Radiotherapy for carcinoma cervix is main stay of the treatment. The modern radiotherapy is given with high-precision radiotherapy techniques such as three-dimensional conformal radiotherapy (3D-CRT) and intensity modulated radiation therapy (IMRT). Currently, during radiotherapy planning CT scan are used for delineating tumor and organ at risk. For intracavitary irradiation orthogonal x-rays are obtained for 2D planning and at some centres CT/MRI scans are used for 3D planning.

Helical CT, MRI and Ultrsound are the most commonly used modalities. However studies have shown CT to be less sensitive than the former two modalities. MR imaging, when available, remains the most important of all these. However abdominal and endoluminal (transrectal and transvaginal) ultrasound are cost effective and readily available examinations. Before radiation therapy is started for each patient, a treatment planning CT scan may be done with a full bladder followed by acquisition of an ultrasound scan. The reference ultrasound image is aligned to the CT image. , the outline of bladder and other organs such as the uterus, cervix and vaginal canal can be drawn on the US image directly, and their volumes can be measured too. After acquisition of the daily US image, 3D reconstructions of the images is possible with modern ultrsound machines and software. These contours from ultrsound can be superimposed with CT/MRI contours and later after verification can be used for treatment planning. Once the satisfactory results are confirmed by all users group this can be put to the routine practice.

The ultrasound will be cositing substantially less and is easily available in in all institutions. Similarly ultrsound can be used for other cancers like prostate, bladder, endometrial cancer etc.

Objective:

State succinctly what the project is intended to achieve. Please state only one objective.

The primary objective would be to compare CT/MRI contouring and contours using Ultrasound imaging.

To develop consensus on contouring protocols using ultrsound for clinical implementation for intracavotary irradiation.

To develop consensus on contouring of different pelvic anatomic sites.

End users:

Who will use/benefit from the results of the project? (e.g. decision makers, service users, patients, farmers).

Intracavitary irradiation is integral part of radiotherapy treatment for carcinoma cervix. Identifying tumor and organ at risk for 3D brachytherapy planning and controlling dose to organ at risk will reduce the complication and hence improve quality of life of patients.

The This will address the issue for treating physicians & decision-makers to reduce the cost of treatment for patients.

Past and present regional efforts in addressing the need:

Summarize any past and present regional efforts (including programmes/projects by other regional or international partners) to address the issue to which the project will contribute. Explain any specific gaps that the project will address. Why is a regional approach the most effective mechanism in this case?

There are practically no efforts made in this respect, no regional efforts addressing this issue in the past. There is lack of consensus on the most appropriate and optimal methods of IGRT during intracavitary radiotherapy as CT and MRI is not available at most centres for this purpose. Several of the Member States are presently involved in RCAs designed to improve infrastructure for high-precision radiotherapy planning and delivery through image-based techniques. Thus a regional approach would be the most effective mechanism.

Role of nuclear technology:

Indicate the specific nuclear technique that would be used, and outline why it is appropriate for addressing the issue. Is the technique the only one available to solve the problem? Does the technique have a comparative advantage to non-nuclear techniques? Does the technique complement non-nuclear techniques?

For intracavitary irradiation accurate treatment planning and delivery is essential for obtaining optimal tumor conytrol and reduced complications from adjoining normal organs. Conventional x-ray based planning has limitaion in identifying tumors and normal structures . Ultrasound will help in delineating these structures and help in radiotherapy dose delivery.

Role of the IAEA:

What specific role would the IAEA be expected to play in the project?

1. Funding and supporting meetings and training courses (2-3 per year) on various aspects of Image Guided brachytherapy.

2. Formation of an expert committe for providing guidance on IGRT to Member States.

3. Providing support for USG machine and its software for needy member states participating in the study through TC mechanism

Participating Member States:

List the Member States expected to participate in the project.

India , Korea , China , Japan , Australia, Bangladesh, Pakistan, India, Sri Lanka, Thailand , Myanmar , China, Philippines , Indonesia, Mongolia.

National and regional counterpart institutions / stakeholders involved in the project:

List all national and regional institutions and stakeholders expected to participate in the project. Please enter first the main counterpart institution and the Designated Team Member (DTM). This person will be the regional technical coordinator for the project.

Dr.S.K. Shrivastava, Department of Radiation Oncology, Tata Memorial Centre, Mumbai could serve as Regional Technical Co-ordinator for this RCA.

Link to regional strategies or equivalent:

Is this project directly linked to a priority area identified in the relevant regional strategy? If yes, provide the reference. Yes, one of the ongoing RCAs 'transition from 2D to 3D Image Guided Brachytherapy is using a three-tiered image-based radiotherapy approach to improve radiotherapy planning and delivery in the region. This is using CT scan or MRI. While USG based planning needs to be developed and promoted so most of member states can use this technology freely and improve quality of life of patients.

If not, explain why this concept is being presented for consideration.

Not applicable.

Partnership:

List all external institutions and partners (other UN or international organisations, donors, etc.) expected to participate in the project, specifying the contribution of each.

Physical infrastructure and human resources:

What physical infrastructure and human resources are available to support the project? For example, existing laboratories, suitable buildings, staff that will be directly involved in this project.

List any regional resource centres that would play a major role in the implementation of the project.

Ultrasonography machine in operating roomand its software to transfer data from USG to TPS is needed for Image based brachytherapy planning. Well-trained Radiation Oncologistsand Medical Physicists are the require human resource.

Financial resources required and source of funding:

Provide an estimate of the total cost of the project and the expected funding provided by each stakeholder (Government cost-sharing, other partners and IAEA).

As per IAEA norms- Contribution from IAEA: Meeting/ Travel, Equipments & Other ($200,000),

Duration of the project: *Indicate a realistic starting date for the project and the number of years required to complete the project. Projects should not exceed four years.* Four years.
Safety regulatory infrastructure: *Indicate whether or not the safety regulatory infrastructure and associated standards and procedures in the Member States that are expected to participate in this project are adequate to ensure that the project will be implemented in a safe manner. If not, specify the gaps and indicate how they will be addressed.* Adequate safety regulatory infrastructure and associated standards and procedures in Member States.

24	**Multicentric trial on chemotherapy (CT) added to palliative radiotherapy (RT) in palliation of advanced carcinoma esophagus**	**IND**

IAEA International Atomic Energy Agency

Technical Cooperation (TC) Programme

Regional project concept

Name of the region: Asia Pacific	**Regional/ Cooperative Agreement** *(if applicable)*: RCA	**Project concept priority number within the Regional/Cooperative Agreement Programme Note** *(if applicable)*:	**Project concept priority number within the Regional Programme Note:**

Title:

The title should be as concise as possible and should summarize the objective of the project.

Multicentric Trial on Chemotherapy(CT) added to Palliative Radiotherapy (RT) in palliation of Advanced Carcinoma Esophagus

Problem statement:

Provide a summary of the issue to be addressed by the project. This should be the result of a situation analysis to identify the problem, and its cause and effect.

Esophageal cancer is the ninth most common cancer in the world and fifth most common in the developing world. It is known to be an aggressive neoplasm and is associated with very poor prognosis. At least 30% of patients present with metastatic cancer and most patients of local disease develop metastasis despite potentially curative local therapy. Purpose of receiving some form of treatment is to improve symptoms through local and systemic control of cancer and prolong patient's symptom free survival. Potential benefits of receiving treatment must be carefully balanced with the potential risks. Since dysphagia is most common, alleviating this single symptom would provide best palliation. Hence role of local treatment. Radiation results in more durable palliation since it relieves the luminal obstruction by reducing the gross tumour mass. Radiotherapy achieves better quality of life, physical function and better global health scores.Radiotherapy alone provides dysphagia relief in 70-90% of patients and improvement in swallowing status in 91% of patients with approximately 50% remaining dysphagia free till death. Median survival with radiotherapy alone in this setting is around 5-8 months. A combination of brachytherapy with external radiotherapy would provide most effective mode of palliation- both immediate as well as durable relief of dysphagia (from a previous IAEA trial). Although it relieves the major symptoms median survival in patients receiving radiotherapy alone is dismal. The major cause of death in patients with advanced cancer is systemic metastasis as well as progressive local disease. By halting the progress of local disease by local measures the survival can be extended provided the metastasis are taken care of. The systemic therapy also would halt local progression adding up to the local measures.

Objective:

State succinctly what the project is intended to achieve. Please state only one objective.

To compare radiotherapy alone versus radiotherapy with chemotherapy in the palliation of advanced Carcinoma esophagus:

Duration of Local symptom relief (Dysphagia, odynophagia, regurgitation, pain)

Systemic progression

Overall survival

End users:

Who will use/benefit from the results of the project? (e.g. decision makers, service users, patients, farmers).

This is a common scenario in the developing countries. The results from this trial will help oncologists in identifying patients who will benefit maximally from either local therapy alone or who need systemic therapy in addition to local therapy and are likely to benefit from the same. This will also address the need for supportive care in this debilitating disease since, both modalities are widely used and there is no level one evidence to support use of chemotherapy in addition to radiotherapy in this group of patients.

Past and present regional efforts in addressing the need:

Summarize any past and present regional efforts (including programmes/projects by other regional or international partners) to address the issue to which the project will contribute. Explain any specific gaps that the project will address. Why is a regional approach the most effective mechanism in this case?

As stated earlier this is a comon problem of the region. There have been at least 3 multicentric randomised trials addressing the most effective form of palliation in advanced Carcinoma Esophagus, looking at efficacy, which modality and shortened duration of treatment for best results. However, chemotherapy is a widely used modality in advanced Carcinoma Esophagus without any level I evidence to support its use. The present trial addresses this issue in the same group of patients and aims to identify the subgroup of patients who would maximally benefit from its use.

Role of nuclear technology:

Indicate the specific nuclear technique that would be used, and outline why it is appropriate for addressing the issue. Is the technique the only one available to solve the problem? Does the technique have a comparative advantage to non-nuclear techniques? Does the technique complement non-nuclear techniques?

Radiation therapy, either external beam or HDR- brachytherapy

The aim of the study is to identify if Radiation therapy alone is sufficient for palliation of symptomatic patients with locally advanced carcinoma esophagus. Is there a need for chemotherapy in addition to this for symptom control of improvement in survival. This answer, whether if in favor of RT alone will help avoid the systemic effects of chemotherapy in this group of patients who are already debilitated.

Role of the IAEA:

What specific role would the IAEA be expected to play in the project?

Help to conduct this trial as a multicentric study within countries in the Asia Pacific region and provide necessary infra structure support where needed.

Participating Member States:

List the Member States expected to participate in the project.

Korea , China , Japan , Australia, Bangladesh, Pakistan, India, Sri Lanka, Thailand , Myanmar , China, Philippines , Indonesia, Mongolia.

National and regional counterpart institutions / stakeholders involved in the project:

List all national and regional institutions and stakeholders expected to participate in the project. Please enter first the main counterpart institution and the Designated Team Member (DTM). This person will be the regional technical coordinator for the project.

Faculty members from Tata Memorial Hospital could serve as members and Dr.S.K.Shrivastava, as Regional Technical Co-ordinator. Besides, other national/regional cancer research institutions will take part in the implementation of the project

Link to regional strategies or equivalent:

Is this project directly linked to a priority area identified in the relevant regional strategy? If yes, provide the reference. Improving Outcomes in Radiotherapy using new strategies of treatment delivery in common cancers in the region. Radiotherapy is the main modality of treatment for cancer and is an integral part of the national programmes for combating cancer in all the RCA Member States.

If not, explain why this concept is being presented for consideration.

Partnership:

List all external institutions and partners (other UN or international organisations, donors, etc.) expected to participate in the project, specifying the contribution of each.

Physical infrastructure and human resources:

What physical infrastructure and human resources are available to support the project? For example, existing laboratories, suitable buildings, staff that will be directly involved in this project.

List any regional resource centres that would play a major role in the implementation of the project.

Tata Memorial Centre, Mumbai, India.

Once the project has been approved as a RCA Project, other centres in the region will also be invited to participate

Financial resources required and source of funding:

Provide an estimate of the total cost of the project and the expected funding provided by each stakeholder (Government cost-sharing, other partners and IAEA).

As per IAEA norms- Contribution from IAEA: Meeting/ Travel, Equipments & Other ($,200,000).

Duration of the project: *Indicate a realistic starting date for the project and the number of years required to complete the project. Projects should not exceed four years.* 4 years
Safety regulatory infrastructure: *Indicate whether or not the safety regulatory infrastructure and associated standards and procedures in the Member States that are expected to participate in this project are adequate to ensure that the project will be implemented in a safe manner. If not, specify the gaps and indicate how they will be addressed.* Yes

25	**Clinical implementation of image-guided radiation therapy (IGRT) and adaptive radiation therapy (ART).**	**IND**

IAEA International Atomic Energy Agency

Technical Cooperation (TC) Programme

Regional project concept

Name of the region: Asia Pacific	**Regional/ Cooperative Agreement** *(if applicable)*: RCA	**Project concept priority number within the Regional/Cooperative Agreement Programme Note** *(if applicable)*:	**Project concept priority number within the Regional Programme Note:**

Title:
The title should be as concise as possible and should summarize the objective of the project.
Clinical implementation of image-guided radiation therapy (IGRT) and adaptive radiation therapy (ART).

Problem statement:
Provide a summary of the issue to be addressed by the project. This should be the result of a situation analysis to identify the problem, and its cause and effect.
High-precision radiotherapy techniques such as three-dimensional conformal radiotherapy (3D-CRT) and intensity modulated radiation therapy (IMRT) are relatively intolerant to set-up errors. Image-guided radiation therapy (IGRT) - the process of in-room volumetric verification prior to treatment delivery has thus emerged a natural corollary to 3D-CRT/IMRT. The initial planning CT is perhaps the most biased representation of the patient's anatomy and a single plan designed before the first fraction of radiotherapy is insufficient to describe actual dose delivered and can often lead to suboptimal treatment. Adaptive radiotherapy (ART) is defined as changing of the original radiation treatment plan (by modifying beam apertures and/or intensity patterns) during a course of fractionated radiotherapy to account for temporal changes in anatomy (weight loss, tumor shrinkage, organ motion) or changes in tumor biology or function (hypoxia, proliferation, metabolism). ART can be considered as the next logical step of IGRT. The implementation of IGRT and ART in the clinic is associated with a steep learning curve and can be quite challenging. Different methods can be used for IGRT and ART for different sites (brain, head-neck, thorax, abdomen, pelvis) and there is lack of consensus on the most optimal method for a particular site.

Objective:
State succinctly what the project is intended to achieve. Please state only one objective.
The primary objective would be to develop consensus protocols for clinical implementation of IGRT and ART for different anatomic sites.

End users:
Who will use/benefit from the results of the project? (e.g. decision makers, service users, patients, farmers).
Patients, treating physicians, & decision-makers will use the results.

Past and present regional efforts in addressing the need:
Summarize any past and present regional efforts (including programmes/projects by other regional or international partners) to address the issue to which the project will contribute. Explain any specific gaps that the project will address. Why is a regional approach the most effective mechanism in this case?
To the best of our knowledge, no regional efforts addressing this issue have been made in the past. There is lack of consensus on the most appropriate and optimal methods of IGRT/ART that will be addressed by this project. Several of the Member States are presently involved in RCAs designed to improve infrastructure for high-precision radiotherapy planning and delivery through image-based techniques. Thus a regional approach would be the most effective mechanism.

Role of nuclear technology:

Indicate the specific nuclear technique that would be used, and outline why it is appropriate for addressing the issue. Is the technique the only one available to solve the problem? Does the technique have a comparative advantage to non-nuclear techniques? Does the technique complement non-nuclear techniques?

Medical linear accelerator with in-room image guidance technology (kVCT or MVCT) would be the specific nuclear technique to be used for IGRT and ART. In addition molecular imaging with positron emission tomography (PET) using different flourine-labelled radiotracers such as flouro-deoxy-glucose (FDG) and flouro-misonidazole (F-MISO) could be used for selected patients for biology-guided adaptive radiotherapy.

Role of the IAEA:

What specific role would the IAEA be expected to play in the project?

1. Funding and supporting meetings and symposia (2-3 per year) on various aspects of IGRT and ART.
2. Formation of an expert committe for providing guidance on IGRT and ART to Member States.
3. Conducting a CRP on IGRT and ART in 1-2 specific sites (eg. head-neck, cervix) thorugh Member States.

Participating Member States:

List the Member States expected to participate in the project.

All Member States with IGRT capable technology can participate.

National and regional counterpart institutions / stakeholders involved in the project:

List all national and regional institutions and stakeholders expected to participate in the project. Please enter first the main counterpart institution and the Designated Team Member (DTM). This person will be the regional technical coordinator for the project.

Dr.S..K..Shrivastava, Department of Radiation Oncology, Tata Memorial Centre, Mumbai could serve as Regional Technical Co-ordinator for this RCA on IGRT and ART.

Link to regional strategies or equivalent:

Is this project directly linked to a priority area identified in the relevant regional strategy? If yes, provide the reference. Yes, one of the ongoing RCAs is using a three-tiered image-based radiotherapy approach to improve radiotherapy planning and delivery in the region. The tertiary care centres involved in that RCA (with in-room image guidance capability) can come together in this proposed RCA on IGRT and ART.

If not, explain why this concept is being presented for consideration.

Not applicable.

Partnership:

List all external institutions and partners (other UN or international organisations, donors, etc.) expected to participate in the project, specifying the contribution of each.

Korea , China , Japan , Australia, Bangladesh, Pakistan, India, Sri Lanka, Thailand , Myanmar , China, Philippines , Indonesia, Mongolia.

Physical infrastructure and human resources:

What physical infrastructure and human resources are available to support the project? For example, existing laboratories, suitable buildings, staff that will be directly involved in this project.

List any regional resource centres that would play a major role in the implementation of the project.

IGRT capable medical linear accelerators are needed for IGRT and ART. Well-trained Radiation Oncologistsand Medical Physicists are the require human resource.

Financial resources required and source of funding:

Provide an estimate of the total cost of the project and the expected funding provided by each stakeholder (Government cost-sharing, other partners and IAEA).

As per IAEA norms- Contribution from IAEA: Meeting/ Travel, Equipments & Other ($200,000),

Duration of the project:

Indicate a realistic starting date for the project and the number of years required to complete the project. Projects should not exceed four years.

Four years.

Safety regulatory infrastructure:

Indicate whether or not the safety regulatory infrastructure and associated standards and procedures in the Member States that are expected to participate in this project are adequate to ensure that the project will be implemented in a safe manner. If not, specify the gaps and indicate how they will be addressed.

Adequate safety regulatory infrastructure and associated standards and procedures in Member States.

26	**Enhancing stereotactic body radiation therapy for frequent cancers in the RCA region**	**ROK**

Regional Project Concept Template (Category A)

Region:	Asia-Pacific		
Regional/Cooperative agreement (if applicable)	RCA	**Priority no. given by regional/cooperative agreement** (for concepts proposed under the auspices of regional cooperative agreements)	
Title	Enhancing Stereotactic Body Radiation Therapy for Frequent Cancers in the RCA Region		
Field of activity	Human Health		
Regional project category[9]	☐ *Transnational* ☐ *Regional standard setting* ☐ *Capacity building for developing countries* ☐ ***Joint TC activities with a regional or international entity***		
Names and contact details of project counterparts and counterpart institutions (starting with the main counterpart)	Australia: Royal North Shore Hospital, Dr. Fiona Hegi-Johnson Bangladesh: National Institute of Cancer Research & Hospital, Mr. Obayedullah Mollah Baki China: Beijing Cancer Hospital, Dr. Guangying ZHU Cambodia: Calmtte Hospital, Dr. Eva Sokha India: Tata Memorial Hospital, Dr. J. P. Agarwal Indonesia: Dr.Cipto Mangunkusumo National General Hospital(RSCM), Dr. Soehartati Gondhowisrdjo Japan: Tokyo Metropolitan Cancer and Infectious Diseases Center Komagome Hospital, Dr. Katsuyuki Karasawa Korea, Rep.of(LCC): Korea Institute of Radiological & Medical Sciences(KIRAMS), Dr.Chul-Koo CHO Malaysia: Universiti Kebangsaan Malaysia Medical Centre, Dr. Nik Muhd Aslan Abdullah Mongolia: National Cancer Center, Dr. Minjmaa Minjgee Myanmar: Naypyitaw General Hospital, Dr. Kaung Myat Shwe		

[9] See the document entitled "Policy and Procedures for TC Regional Projects" at: http://pcmf.iaea.org/DesktopModules/PCMF/docs/2014_15_Docs/notes/Regional_TC_Project_Policy.pdf.

	Nepal: National Academy of Medical Science(NAMS) BIR Hospital, Dr. Sandhya Chapagain Acharya New Zealand: Auckland City Hospital, Dr. Hedley Kawitz Palau: The Belau National Hospital Pakistan: PMO, INOR Abbottabad, Dr. Nadeem Zia Abbasi Philippine: Philippine General Hospital, Dr. Nonette Cupino Singapore: National Cancer Centre, Dr. Daniel Tan Yat Harn Sri Lanka: National Cancer Institute, Dr. Davatage Kanthi Angela Perera Thailand: Chulalongkorn University, Dr. Mantana Dhanachai Vietnam: Nuclear Medicine and Oncology Center, Dr. Mai Trong Khoa
Analysis of regional Gap / problems/needs	*Give an in-depth analysis of the major problems/needs to be addressed by the project, as well as of their causes and effects; and explain how these are linked to regional development plans or frameworks (or equivalent). Refer to past efforts made in addressing these problems/needs, if any, and explain how the current project proposal builds upon them.* *Attach any supporting documents (e.g. texts of regional development plans).* Cancer is one of the most rapidly growing diseases in the RCA region. However, the existing infrastructure of developing countries is far behind to successfully cope with this increasing threat. Technological advancement in radiation therapy has increased the survival rate, reduced damage to normal tissue, and enhanced the quality of life of cancer patients. However, the developing countries do not benefit from this advanced radiotherapy such as Stereotactic Body Radiation Therapy (SBRT) due to lack of radiotherapy machines and insufficient number of specialized medical staff. Upon pursuing the improvement of the situation, timely training is significant because the investment on human resource does not bring out an immediate result, unlike the investment on equipment and facility. Therefore, it is required to share expertise of Stereotactic Body Radiation Therapy (SBRT) through training and consultation in order to properly respond to the growing demand for radiotherapy. RCA projects on radiotherapy in the early stage, such as RAS/6/027(Quality Assurance in Radiation Therapy, 1997-2000) and RAS/6/040(Improvement in Quality of Radiotherapy for Frequent Cancers in the Region, 2005-2008), mainly focused on quality control/assurance of radiation treatment. Recent RCA projects including RAS/6/048 (Application of High-Precision 3D Radiotherapy for Predominant Cancers in the RCA region, 2007-2009) and RAS/6/053(Improving Image Based Radiation Therapy for

	Common Cancers in the RCA region, 2010-2014) dealt with IGRT(Image-Guided Radiation Therapy), one of advanced radiation therapy techniques using volumetric imaging data in the treatment. Besides, RAS/6/062 (Supporting 3D Image-Guided Brachytherapy Services, 2012-2015) targets cervical cancer, one of predominant cancers in the RCA region. RAS/2012013 (Strengthening Intensity Modulated Radiation Therapy Capability in the RCA Region, 2015-2018) will disseminate expertise on another advanced radiotherapy, IMRT. A survey on the past & ongoing regional projects shows there is no regional project dealing with Stereotactic Body Radiation Therapy (SBRT) except RAS/6/6065 (Strengthening Application of Stereotactic Body Radiation Therapy to Improve Cancer Treatment, 2012-2015). The proposed project is linked with RAS/6/065. Since its starting year, there has been a progress such as the increase of SBRT application in India and Thailand, the initiation of SBRT in Indonesia, Pakistan, Malaysia, Philippine, and a government plan of investment on RT units in Vietnam, Sri Lanka, Mongolia. However, due to limited opportunities to access to expertise and lack of guidelines in spite of growing interest, strong needs for further training are identified among Member States. Participating NPCs agreed with designing continuous regional project with more regional training courses focusing on SBRT for frequent tumor types.
Why should it be a regional project?	*Indicate why it is better to address these problems/needs through a regional project (as opposed to a national one).* It is proper to address these needs through a regional project because there is a high potential of technical cooperation and expertise exchange, and expected benefits of expert networking between technically advanced countries and developing countries in the RCA region within the frame of TCDC.
Stakeholder analysis and partnerships	*Describe the stakeholder analysis conducted, specifying all the interested or affected parties, end users, beneficiaries, sponsors and partners identified, with clearly defined roles for each entity.* Cancer patients who need radiotherapy will benefit from better treatment results and relatively short radiation treatment period. Radiation oncologists and medical physicists are end users interested in this project.

	The Korean Society for Radiation Oncology(KOSRO) is an external partner, expected to participate in the project as an expert group. Participating institutes of Australia, China, India, Japan, Thailand, Singapore are identified to contribute to sharing their expertise and experiences under TCDC. (Royal North Shore Hospital, Beijing Cancer Hospital, Tata Memorial Hospital, Tokyo Metropolitan Cancer and Infectious Diseases Center Komagome, National Cancer Centre, Chulalongkorn University)
Overall objective (or developmental objective)	*State the objective to which the project will contribute, and demonstrate its linkage with any regional or broader development goal or priority. It has to be in line with the problems/needs identified.* The enhancement of Stereotactic Body Radiation Therapy in the region through the training of trainers and consultation will be the objective to which the project will contribute. It is linked with the regional goal of cancer control in the RCA region and global efforts to cope with the increasing threat of cancer.
Analysis of objectives	*Draw up an objective tree to highlight the hierarchy of objectives as well as the cause–effect logic that this project is expected to achieve.* Please refer to annex 1.
Role of nuclear technology and the IAEA	*Indicate the nuclear technique that would be used and outline why it is suitable for addressing the problems/needs in question. Is this the only available technique? Does it have a comparative advantage over non-nuclear techniques?* *What specific role is the IAEA expected to play in the project?* Radiosurgery was originally introduced in 1951 by Dr. Lars Leksell to describe the closed-skull destruction of a stereotactically defined target with a single high dose of ionizing radiation. It is a non-invasive treatment to remove intracranial and extracranial tumors which could be otherwise inaccessible or inadequate for conventional surgical treatment. It has been advanced into Stereotactic Body Radiation Therapy (SBRT) along with technological progress. Then, recent technological advancement in addition to better understanding of the clinical radiobiology of high-dose and small-volume irradiation responses has expanded the scope of application of SBRT. SBRT is currently regarded as a powerful therapeutic tool to be continuously refined through further technical improvements and advancement of the clinical radiobiology. Furthermore, since SBRT delivers

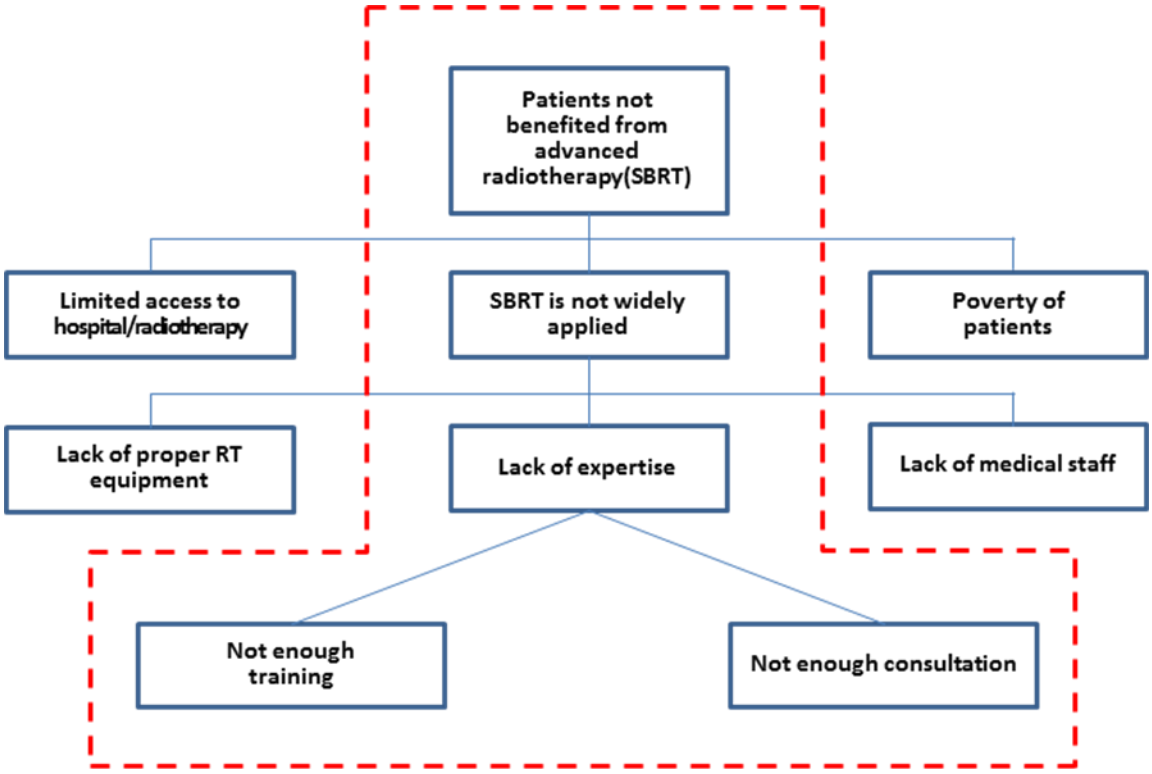
	one or just a few fractions of high dose radiation to tumor targets, it enhances quality of life for cancer patients by reducing the need to administer radiation at low doses over many fractions during several weeks. IAEA is expected to provide coordination with governments and public organizations/associations, technical support, and financial resources
Project duration	*Indicate a realistic starting date and the number of years required to complete the project. (In the case of projects expected to exceed four years, an assessment will be conducted before the end of the fourth year to decide on the validity of an additional year.)* 3 years (2016~2018)
Requirements for participation	*Indicate the minimum requirements that counterpart institutions in Member States would need to meet in order to participate in this project, and how the fulfilment of these requirements will be verified.* Linear Accelerator with MLC (over 6 MV), radiation oncologists, and medical physicists are minimum requirements for the participation in this project. Member States with a plan to procure the above equipment in near future are also eligible. They can be verified by data and statistics of hospital and radiation protection agency, and by the government plan.
Participating Member States	*List the Member States expected to participate in this project that meet the requirements established above. Indicate the role of each Member State in the project.* *Resource Country(institute): Australia, China, India, Japan, Korea, Rep.of(ROK), Thailand, Singapore* *Target Country: Australia, Bangladesh, China, Cambodia, India, Indonesia, Malaysia, Mongolia, Myanmar, Nepal, New Zealand, Palau, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, Vietnam* □ *Resource (providing expertise)* □ *Target (receiving expertise)*
Funding and project budget	*Provide an estimate of the total project costs and the funding expected from each stakeholder:*

	Euro	Comment
Government cost-sharing		
Counterpart institution(s)		
Other partners		

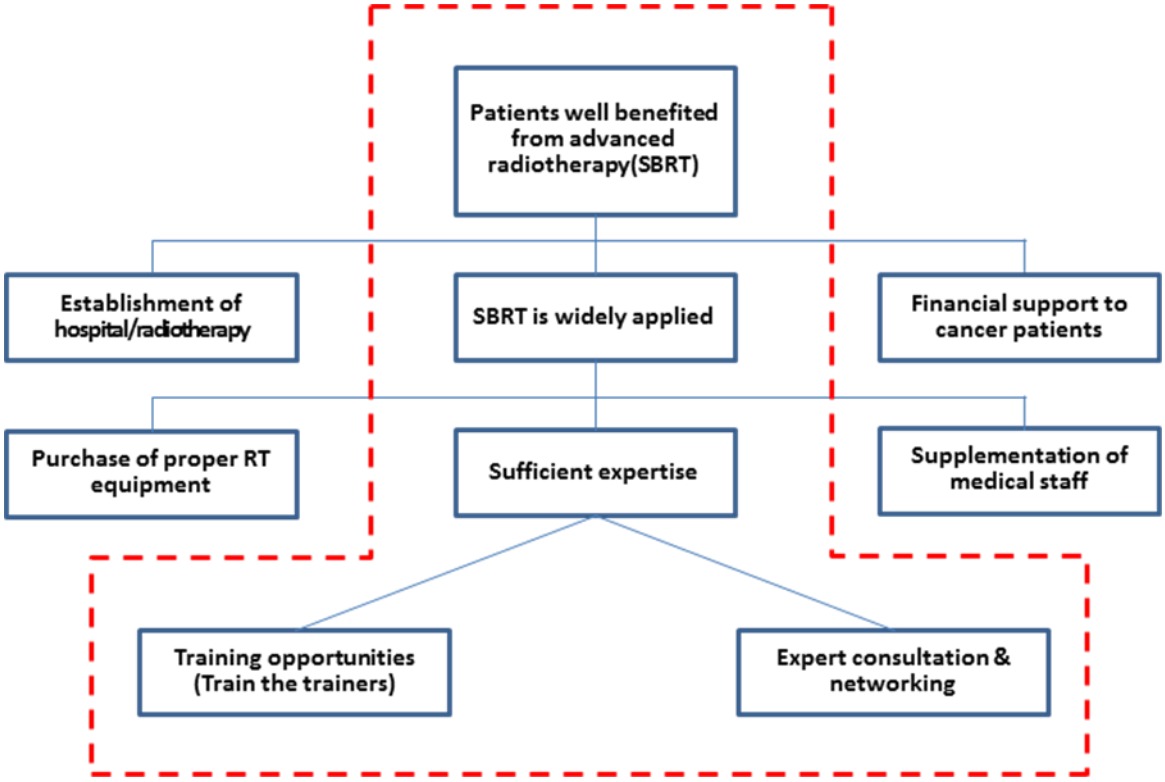
	IAEA Technical Cooperation Fund (TCF):	*Fellowships / Scientific visits / Training courses/ Workshops*	157,010	3 Meetings (Planning/Mid & Final Review)
			247,310	5 Regional Training Courses (Lung, liver, Head & Neck, Prostate & spine, Metastasis)
		Experts	9,950	3 Expert Missions
		Equipment	*N/A*	
		TOTAL	414,270	*TC Standard HR Rates for 2015 applied*

[Annex 1-Analysis of objectives]

☞ **Problem tree**



☞ **Objective tree**



27	***Improving Soil Fertility, Land Productivity and Land Degradation Mitigation [not reviewed as it was submitted too late]***	***NZE***

IAEA
International Atomic Energy Agency

Technical Cooperation (TC) Programme

Regional project concept

Name of the region: REGIONAL ASIA AND PACIFIC	Regional/ Cooperative Agreement *(if applicable)*: RCA	Project concept priority number within the Regional/Cooperative Agreement Programme Note *(if applicable)*: 12	Project concept priority number within the Regional Programme Note:

Title:

The title should be as concise as possible and should summarize the objective of the project.

Improving Soil Fertility, Land Productivity and Land Degradation Mitigation

Problem statement:

Provide a summary of the issue to be addressed by the project. This should be the result of a situation analysis to identify the problem, and its cause and effect.

The expanding population and economic development in the region is putting severe pressure on the utilization of the limited soil and water resources. Response to poverty alleviation and food supply concerns have resulted in rapid deforestation and clearing of lands to give way to agricultural cultivation. Furthermore, the steady increase of the contribution of animal-derived protein to the diet in many Member States has significant implication on land-use. In some Member States, maize, which is used as animal feed, is increasingly grown in areas of steep slopes. This causes erosion and has a degrading impact on soil and water quality. In addition, inappropriate intensification of agricultural activities through the increased utilization of pesticides, fertilizers and livestock waste to enhance agricutural productivity can potentially lead to degradation of both soil and water. Sustainable agriculture will depend on maintaining an appropriate balance between environmental protection and the use of soil nutrients and water resources for crop and livestock production systems.

There are available data on soil erosion rates in agricultural landscapes in the regions. However, insufficient data exist with regard to the identification of hot-spot areas of land degradation in agricultural catchments for effective soil conservation measures and the area-wide environmental impacts of erosion, sedimentation and the associated nutrients and pesticides on land productivity and farmers' environment. Scientific data on the distribution, source and pathway of the soil redistribution within landscapes are needed to address and then mitigate land degradation processes and to discriminate anthropogenic from natural causes such as El Niño phenomenon, La Niña events and the prevailing climate change. Therefore an integrated approach is required to solving problems related to this declining soil and water quality caused by inappropriate land use intensification (combining aspects of livestock management with cropping systems) and ultimately its environmental impacts on nutrient cycling and water quantity and quality. Furthermore, in many Member States, the predicted climate variability and change could lead to more extreme weather events, such as droughts and flooding, both in terms of magnitude and frequency.

To combat impacts of farming activities and land uses on climate change, improved agricultural greenhouse gas emission inventories and models are needed in all states, so that developed and developing nations can constructively engage in negotiations to limit emissions without undermining sustainable development (including local agricultural development). In soil and land use studies, isotopic techniques play a crucial role as tracers to study the influence of both natural and anthropogenic processes on GHG emissions and land-water quantity and quality. This will result in outcomes at a variety of different scales, from providing individual farmers with insights on more effective and efficient cropping and livestock production systems with improved soil-water-crop-livestock management practices, as well as giving political decision makers the background to enable informed decisions to be made on adaptation and mitigation options at national and regional levels.

Objective:

State succinctly what the project is intended to achieve. Please state only one objective.

The proposed project will be a two-year extension of RAS5055 (Improving Soil Fertility, Land Productivity and Land Degradation Mitigation), which has the objective of assisting Member States (MSs) in the development and effective implementation of area-wide precision conservation measures to control the impacts of land-use practices on land and water quality degradation through enhancing MSs' capacities in the use of nuclear and isotopic techniques to assess and evaluate on-farm management practices on soil and surface water quality.

End users:

Who will use/benefit from the results of the project? (e.g. decision makers, service users, patients, farmers).

The immediate beneficiaries in all Member States will be those national institutions responsible for land and water management. The outputs of the programmes will support them in providing scientifically rigorous feedback and advice to land-use policy makers. The outcomes will be sound legislation in the Member States with repect to standards and guidelines on sustainable land management to enhance air-land-water quality for . Ultimately, at the national and regional scale, the accumulated knowledge will also support Member States in international negotiations on climate

change and carbon emissions trading issues. This will in turn provide a feedback loop to individual farmers and consumers, providing them with the ability to make informed behavioural decisions.

Past and present regional efforts in addressing the need:

Summarize any past and present regional efforts (including programmes/projects by other regional or international partners) to address the issue to which the project will contribute. Explain any specific gaps that the project will address. Why is a regional approach the most effective mechanism in this case?

This project is well on track, and all originally envisaged activities are expected to be implemented during the first four years under RAS5055 (2012-2015). We propose to expand collaboration and training under this project to consolidate on the integrated use of fallout radionuclides (FRN), compound specific stable isotope (CSSI) and the use of nitrogen-15 at a natural abundant level as tracers for soil carbon dynamics and sources of nitrate in receiving waters. These additional activities will build on and complement the achievements from quantifying soil erosion through the FRN technique and identifying sediment sources through CSSA with information on the dynamics of soil changes to unravel management and environmental factors that influence soil carbon storage and sequestration and potential source of carbon and nitrate pollutants in receiving waters. This will be achieved through training courses, expert missions, and measurement of samples and reference material at Regional Resource Units, which will establish regional capability in measuring timescales of erosion and residence times of soil organic matter.

The project will build on the significant network and enhanced human capability which has already been established under RAS5055, as well as the regional database on isotopic signatures of crop and soil compounds. It will provide decision makers with accurate background information for the development of effective policies to mitigate the impact of land-use practices on soil quality.

The project contributes to outcomes which are at the focus of one of the most pressing global issues, i.e. sustainable land-use. A two-year extension therefore also presents unique opportunities to establish synergies with other potential RCA projects within the agricultural thematic sector and beyond, notably groundwater-related issues in the environment thematic area. This will link sustainable land management with water resources and environmental management so as to optimize the impact of RCA activities in an environment of limited financial resources.

Role of nuclear technology:

Indicate the specific nuclear technique that would be used, and outline why it is appropriate for addressing the issue. Is the technique the only one available to solve the problem? Does the technique have a comparative advantage to non-nuclear techniques? Does the technique complement non-nuclear techniques?

Traditionally, soil erosion studies have significantly benefited from the study of natural and anthropogenic radionuclides, such as 137Cs, 210Pb, 7Be. Depending on the half-lives of these radionuclides, assessments covering time frames of up to 100 years can be performed. These techniques will continue to play a vital role, in particular in the adaptation of integrated land and agricultural water management practices to the regional conditions and challenges. In addition, stable isotope techniques (e.g. carbon and nitrogen) have been used as tracers to study soil processes, providing information about origin of soil and linked nutrients in the agricultural landscape, as well as stability of the soil material and to unravel contribution of fertilizers and animal excreta to crop nutrients and soil fertility. In recent years the technique of compound specific stable isotope (CSSI) has provided a quantum leap in this area, by enabling to identify the critical land degradation areas induced by different land use and management practices in the landscapes. As the use of CSIA in indentifying hot spots of land degradation is still in its infancy state for the participants of this RAS 5055, there is a need to consolidate this technique over the next TC cycle. Stable isotopes can also contribute to studies of (i) the sources of nitrate from animal manure, nitrogen fertilisers, soil organic matter or crop residues in receiving waters (streams or rivers) and (ii) soil C accumulation and sequestration. Where conversions have been made between C3 vegetation (e.g. forest) and C4 vegetation (e.g. maize or sugar cane), or fertilizer trials have been implemented, stable isotope techniques can efficiently partition sources. Data obtained from these nuclear techniques will be collated and be used to validate field data obtained from conventional non-isotopic methods and extrapolated to other areas using modeling approach. Of significant importance in this context is the compilation of data about the regional and global distribution of stable isotopes in soils (Isoscapes).

Role of the IAEA:

What specific role would the IAEA be expected to play in the project?

Even where nuclear technologies applied in the agricultural sector have reached a high level of technical maturity, there is a significant need for consolidation in terms of documentation, capacity building, and training to ensure their effectiveness and sustainability at the regional and national scale. In the RCA Strategic Priorities 2012-2017 document, TCDC has been identified as able to play a significant role in this context. The IAEA is expected to act as a regional coordinator and facilitator for scientific communication, meetings and workshops, as well as a provider of technological support and capability development (equipment, training, fellowships, scientific visits, expert missions). Furthermore, the development of a regional database on stable isotopes and FRN in soils is expected to significantly benefit from a coordinated approach under the IAEA umbrella.

Participating Member States:

List the Member States expected to participate in the project.

Australia (AUL), Bangladesh (BGD), China (CPR), India (IND), Indonesia (INS), Korea (ROK), Malaysia (MAL), Mongolia (MON), Myanmar (MYA), Nepal (NEP), New Zealand (NZE), Pakistan (PAK), Philippines (PHI), Sri Lanka (SRL), Thailand (THA), Vietnam (VIE).

National and regional counterpart institutions / stakeholders involved in the project:

List all national and regional institutions and stakeholders expected to participate in the project. Please enter first the main counterpart institution and the Designated Team Member (DTM). This person will be the regional technical coordinator for the project.

AUL • A/Professor Greg Hancock, University of Newcastle, Australia. Dr. Frank Bruhn Australian Institute of Nuclear Science and Engineering (AINSE Ltd.) • Dr Paula Jones, Australian Cotton Research Institute, Commonwealth Scientific and Industrial Research Organization (CSIRO) BGD • Dr M.A. Sattar, Bangladesh Institute of Nuclear Agriculture (BINA) • Soil Resources Development Institute (SRDI) CPR • Prof Dr LI Yong, Institute of Environment and Sustainable Development in Agriculture (IEDA), Chinese Academy of Agricultural Sciences (CAAS) IND • Dr Vancheeswaran Ramachandran Bhabha Atomic Research Centre (BARC); Department of Atomic Energy (DAE) • Dr V. Ramachandran, Nuclear Agriculture & Bio-technology Division, BARC, Trombay • Dr S.F. D'Souza, Nuclear Agriculture & Bio-technology Division, BARC, Trombay • Dr Debashis Mandal, Central Soil & Water Conservation Research & Training Institute (CSWCRTI), Dehradun INS • Mr Barokah Aliyanta, Center for the Application of Isotope and Radiation Technology, National Nuclear Energy Agency (BATAN) • Forestry department, social forestry and land rehabilitation ROK • Prof. Kye-Hoon Kim, University of Seoul, Dr. Kyung-Hwa HAN, Rural Development Administration (RDA), National Academy of Agricultural Science, Soil & Fertilizer Management Division MAL • Prof Dr Zainudin bin Othman, Head Department of Geography, Faculty of Social Sciences and Humanities MON • Ms Badral BURMAA, Director, Monitoring and Evaluation Department, Ministry of Food and Agriculture MYA • MAUNG MAUNG, Theingi, Department of Atomic Energy. NEP • Dr. Padam Raj Devkota, Ministry of Science, Technology and Environment. NZE • Prof. David Hamilton, Environmental Research Institute, University of Waikato • Dr Max Gibbs, National Institute of Water and Atmospheric Research • Dr Craig Ross, Landcare Research. PAK • Dr. Muhammad Rafiq Sheikh, Radiation and Isotope Application Division (RIAD), Pakistan Institute of Nuclear Science & Technology (PINSTECH) • PHI • Ms Adelina DM. Bulos, Philippine Nuclear Research Institute • Philippine Nuclear Research Institute • Bureau of Soils and Water Management • Bureau of Agricultural Research SRL • Ms Champa Kumari Kularatne Dissanayake Dewage, Atomic Energy Authority • Dr W.M.A.D.B. Wickremasinghe, Natural Resource Management Centre (NRMC), Department of Agriculture • Dr K.M.A.Kendaragama , Natural Resource Management Centre (NRMC), Department of Agriculture • Mr D.G.L.Wickremanayake, Atomic Energy Authority (AEA) of Sri Lanka THA • Ms Dr. Wanpen Wiriyakitnateekul, Office of Science for Land Development, Ministry of Agriculture and Cooperatives • K. Srisuksawad, Nuclear Research and Development Group, Thailand Institute of Nuclear Technology • W. Thangnipon, Pesticide Research Group, Ministry of Agriculture and Cooperatives VIE • Mr Phan Son Hai, Center for Environment Research and Monitoring, Nuclear Research Institute.

Link to regional strategies or equivalent:

Is this project directly linked to a priority area identified in the relevant regional strategy? If yes, provide the reference. 12

If not, explain why this concept is being presented for consideration.

Partnership:

List all external institutions and partners (other UN or international organisations, donors, etc.) expected to participate in the project, specifying the contribution of each.

UNDP and FAO will potentially contribute to this important area of research and development. Facilitating such contacts is one of the mandates of the RCA Regional Office, and the Lead Country Coordinator will closely liaise with the RCARO to explore such opportunities. There are also significant opportunities to create effective partnerships under the umbrella of the Global Research Alliance on Agricultural Greenhouse Gases. This alliance was initiated by the New Zealand Government and launched during the Copenhagen Climate Conference 2009. Some RCA Member States (e.g. AUL, IND, JPN, MAL, NZL, VIE) are founding members of this initiative.

Physical infrastructure and human resources:

What physical infrastructure and human resources are available to support the project? For example, existing laboratories, suitable buildings, staff that will be directly involved in this project.

List any regional resource centres that would play a major role in the implementation of the project.

The following physical infrastructure is currently available in the individual Member States to suport the project: AUL • Analytical Laboratory for Measuring Environmental Radioactivity (137Cs) • Soil Quality Analysis Laboratory BGD • BINA in collaboration with Soil Resources Development Institute (SRDI) will play a major role in the implementation of the project. CPR • Analytical laboratory for measuring environmental radioactivity • Soil quality analysis laboratory • GC-IRMS Laboratory are available as Regional Resource Center for providing analysis services of both FRN and CSSI and training for the participanting member states. IND • Radiotracer laboratory for environmental radioactivity

monitoring equipped with modern analytical instruments like LSC, gamma-ray spectrometer, AAS, XRD etc. • Soil testing laboratory • BARC in collaboration with CSWCRTI will play a major role in the implementation of the project INS • Environmental radioactivity laboratory • Stable isotope laboratory • Tritium and radiocarbon dating facility MAL • Radiochemistry and Environmental Laboratory • IRMS (SerCon CF20-20) • Soil Laboratory (at University of Malaya) NZE (will make its facilities available as a Regional Resource Centre for human capability development and measurement) • Stable Isotope Laboratory • Gas Chromatograph for compound-specific stable isotope analysis • Accelerator Mass Spectrometry-Radiocarbon Laboratory • Tritium and Water Dating Laboratory (already RCA-Regional Resource Unit) • Cosmogenic Isotope Laboratory (7Be, 137Cs, 210Pb) PAK • Stable Isotope Laboratory (Including three mass spectrometers) • Cosmogony 137Cs testing laboratory • Chemical testing laboratory PHI • Gamma spectrometry system • Alpha spectrometry laboratory and detection system • Isotope Ratio Mass Spectrometry • Soil chemical analysis laboratory (carbon, nitrogen, phosphorous) • Soil survey/Mapping Office SRL • Laboratories for gamma detection, as well as other laboratory facilities for soil sampling and preparation are available. Field staff for sampling and extension work is available at NRMC. THA • Soil survey and Classification Office, Landuse Planning Office, Office of technology mapping, Office of Science for LDD Soil Physical lab, Soil Chemical lab, Soil Morphology and mineralogy lab, Soil environmental lab etc. • Thailand Institute of Nuclear Technology have devices for measuring the radioisotopes. • Pesticide Analysis Laboratory • Isotope Ratio Mass Spectrometry is presently undergoing performance test and test runs) VIE • Naturally-occurring Radioisotope Laboratory • Soil Quality Analysis Laboratory • Stable isotope-ratio mass spectrometry

Financial resources required and source of funding:

Provide an estimate of the total cost of the project and the expected funding provided by each stakeholder (Government cost-sharing, other partners and IAEA).

The budget requested from IAEA will be approximately US$250,000 per year for 2 years. This is to enable: • fellowships, training and workshops • expert missions • project formulation and review meetings • some infrastructural support. Below is a summary of expected funding provided the governments of the respective Member States: AUL Funding currently supplied by existing grants and associated University infrastructure and support personell. BGD Government source/BINA (Manpower, infrastructure, laboratory & field facility): US$100,000. CPR Fund from CAAS and NSFC will be supplied to carry out the field sampling and laboratory measurment of isotopes: US$200,000. IND Government source/BARC for Manpower, infrastructure, lab & field facility INS Government Source (Manpower, infrastucture and supporting field equipments): US$45,000 MAL Currently carrying out studies of lake sedimentation using 210Pb. In the process of proposing research funds (ca. US$ 30,000) for studies of cosmogenic radionuclide of 7Be in rainwater/soil and relation of 137Cs with physico-chemical properties. NZL Funding currently supplied by existing grants and associated infrastructure and support personell. PAK Government/ institute providing funding for manpower, infrastructure for chemical, isotope analysis, cosmogony radionuclide analysis and supporting field experiments. However, some small spares and standards may require from IAEA. PHI Philippine Local fund for Operating Expenses: US$20,000 THA We will propose this project via our department to the Office of National Research Council of Thailand to ask for the budget from our government. VIE Government source through a national project in the project period for studies of soil erosion and its impact: US$40.000

Duration of the project:

Indicate a realistic starting date for the project and the number of years required to complete the project. Projects should not exceed four years.

The project is proposed for a duration of 2 years, starting in 2016. This timeframe is based on the developed technical and scientific capabilities in the utilization of nuclear techniques to address soil and landuse issues.

Safety regulatory infrastructure:

Indicate whether or not the safety regulatory infrastructure and associated standards and procedures in the Member States that are expected to participate in this project are adequate to ensure that the project will be implemented in a safe manner. If not, specify the gaps and indicate how they will be addressed.

AUL All nuclear measurement and laboratory facilities at The University of Newcastle are operated under a comprehensive radiation safety management plan which addresses current rules and regulations. All other laboratory work is governed by full risk assessment and standard operating procedure guidelines. BGD BINA have/will have safe infrastructure and associated standards to implement the project. CPR All nuclear facilities at IEDA-CAAS are operated under a comprehensive radiation safety management plan which addresses current rules and regulations. IND All nuclear facilities at IEDA-CAAS are operated under a comprehensive radiation safety management plan which addresses current rules and regulations. INS All facilities are equiped and operated under standard of safety management regulation. MAL The Radiochemistry and Enviromental Laboratory complies with standard safety regulations and the laboratory procedures are ISO certified. NZE All nuclear facilities at GNS Science are operated under a comprehensive radiation safety management plan which addresses current rules and regulations. PHI Nuclear facililities and radiation usage is being regulated by the PNRI. In-house license for use of radioactive materials are being secured from the radiation safety board. SRL Safety regulatory infrastructure necessary for the safe implementation of nuclear research is available at AEA. THA We ensure that the project will be implemented in a safe manner. VIE All activities related to the project in VAEC will be performed in a safe manner.