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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	Characterization and optimization of process dynamics in complex industrial systems using emerging radiotracer and sealed source technology (Continuation of RAS-1012 for the year 2015. This project is already approved for 2012-2014)		
Field of Activity	18 - Cleaner and safer management of industrial processes		
Regional Project Category[1]	☐ *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. 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: Mr. Murray Bartle) **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: Mr. N.N.I.R. Fernando). **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)		

[1] Policy and Procedures for TC Regional Projects

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 holdup, 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 are becoming 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. 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 common in RCA member states and the problems faced by these industries are also common. Therefore it is a common need of the region to work together to address these issues for the benefit of the whole region. Further, the proposed project is in line with common national priorities and development needs of all the participating member states (hence enjoying government commitment) and fulfills 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 problems. Organization of regional training courses on common issues, sharing of experience through technical meetings dissemination of information through executive meetings, expert missions for technical guidance and national executive management seminars 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.* To be provided with LFM
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 enhance the regional capability in using innovative radiotracers and sealed source techniques for investigation of complex industrial systems
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, 2015 (It is Continuation of RAS/1/012. This project is already approved for 2012-2014 and needs to be continued for one more year i.e., for 2015 to achieve its full objectives. **Duration:** One Year (2015)

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 should 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 As the same 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		150,000	In kind contributions from all participating MSs in terms of laboratory infra-structure, provision of necessary manpower, salaries of staff, transport, laboratory /field facilities, equipment, consumables, etc.
Counterpart Institution(s)		Nil	Nil
Other partners		Nil	Nil
IAEA TCF:	*FE/SV/TC/WS*	135,000	02 RTC, 01 Tech. Meeting
	Experts	*20,000*	*04 Expert missions*
	Equipment	*Nil*	*Nil*
	TOTAL	*305,000*	