

**Use of Nuclear Techniques
to Address the Management Problems
of Coastal Zones in the Caribbean Region**

RLA/7/012

Report of the Assessment Meeting



November 2011
Antigua, Guatemala

BACKGROUND

The results of the IAEA Technical Cooperation Project on *Use of Nuclear Techniques to Address the Management Problems of Coastal Zones in the Caribbean Region*, RLA/7/012 were assessed by the National Coordinators of the participating countries and of the experts during the Meeting held in Antigua, Guatemala on November 7-11, 2011. This project aims to develop and improve capabilities to support integrated coastal zone management to reduce the degradation of the coastal ecosystems of the Wider Caribbean, due to anthropogenic and natural impacts. It was approved with technical cooperation funding by the International Atomic Energy Agency starting in 2007. The project was additionally funded with Extrabudgetary sources from the Governments of Spain and of France.

A Memorandum of Understanding with UNEP/CAR-RCU was signed in April 2007 formalizing the mutual collaboration through this project for the *promotion of integrated coastal zone management in the Wider Caribbean Region*; and for the *development and improvement of national and regional capacity to help reduce degradation of the coastal and marine ecosystems of the Wider Caribbean*.

This project is a contribution to the UN General Assembly Resolution December 20, 2006: "*Towards the Sustainable Development of the Caribbean Sea for present and future generations*".

The meeting aimed to take stock of the results of the project for its conclusion in 2012. It was attended by representatives from the Government environmental, port and water authorities, academe and research institutes from Colombia, Costa Rica, Cuba, Dominican Republic, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama and Venezuela, as well as experts from Spain and the International Atomic Energy Agency (IAEA).

The agenda of the meeting is in Annex 1 and the list of participants in Annex 2.



RESULTS OF RLA/7/012

1. Improved assessment of the coastal ecosystems in the Caribbean Sea through the reconstruction of the pollution history in the last 100 years to present, and baselining heavy metals, organochlorinated pesticides and polycyclic aromatic hydrocarbons in the marine sediments as a basis for monitoring their trends in time. High quality data from this project provides the scientific bases for policy making.

The project initially aimed for 5 core sites and 4 baseline studies at coastal ecosystems by using surface samples. At its completion, 6 participating countries have collected surface sediment samples from the study areas and 12 countries have collected sediment cores from their sites.

Samples have been processed and analyzed by the laboratories of Spain, IAEA-NAEL, Colombia, Costa Rica, Cuba, Mexico and Nicaragua in support of countries that do not have the specific required analytical capabilities.

To date about 6000 analysis (analytical cost estimated at US\$350,000) yielding over 20,000 data, have been generated from the analysis for heavy metal, organics and radionuclides of the 12 sediment cores and some surface samples of the participating countries. These data are stored in the data bank, named by the group as CARISED (for Caribbean Sediment Data Base) hosted by INVEMAR, Colombia. To date, the CARISED data bank has

- 1236 data from surface sediments
- About 2000 data from sediment cores.

The interpretation of the data for all the countries were supported by the Scientific Advisory Group¹. The results are reflected in the Draft Report on *Reconstruction of the contamination history of the coasts of the Wider Caribbean Region* (draft on file).

2. Outreach efforts ensured wide dissemination of results to different audiences resulting in important inputs to science-based decision-making, awareness of the capabilities in the region and recognition of the work and expertise of the IAEA on the environment.

A. Scientific publications have been produced, particularly to guide sampling and provide reference for interpretation. In addition, peer refereed papers have been published by the participating countries.

B. At least 30 presentations have been made in international fora and the intergovernmental meetings, such as at the Goldschmidt Conference on

¹ The Scientific Advisory Group is a project sub-team who are recognized for their scientific expertise and extensive technical experience. They have been organized to examine the analytical results, provide the scientific directions for the counterparts and the technical details for the implementation of the activities of the project. The group acted as the scientific advisor and mentor to the participating countries in the interpretation of the respective national data. It is composed of Carlos Alonso Hernández, Cuba; Ana Carolina Ruiz Fernández, Mexico; Alberto José Quejido Cabezas, Spain ; Joan Albert Sánchez Cabeza, Spain; José Sericano, USA and Jane Gerardo-Abaya, IAEA.

Geochemistry; at the Special session on the Caribbean at the International Symposium on Isotopes, Marine Ecosystems and Climate Change; the IAEA Scientific Forum 2011; as well as in COLACMAR, *a congress once in four years for the stakeholders on the marine environment in Latin America and the Caribbean*.

Likewise, presentations were made at the high level meetings of the Association of Caribbean States, CARICOM and UNEP.

- C. Media presence has been extensive, at the national and international levels. The Web page on the project hosted by INVEMAR

<http://cinto.invemar.org.co/rla7012/index.php?lang=en>

has been visited by more than 20,000 guests as of 9 November 2011.

The Video in You Tube on “Tracing the Pollution in the Caribbean” has likewise been popularly accessed.

<p>3. Member States use the technical results for the enhancement and creation of their respective programmes on coastal zone management.</p>

Specific examples are as follows:

- a. Modification of the policy in Jamaica: The radiochronological reconstruction of pollutants from samples of the Kingston Harbor, Jamaica detected Endosulfan, a persistent organic pollutant (POPs). The findings were presented in July 2011 to the CEO of the JAM's environmental protection agency (NEPA) as well as the Registrar from the Pesticides Control Authority of Jamaica (PCA). Consequently, in September 2011, a new list of banned pesticides including Endosulfan was published in the official gazette. It was also recommended that remaining pesticide on stock should be used-up but will not be replenished. The PCA and NEPA have now included Endosulfan I as one of the chemicals to be monitored in water, sediment and biota.
- b. Preparation of new sediment quality guidelines at the national level in Cuba and Colombia.
- c. Implementation of a monitoring programme in Dominican Republic.
- d. Establishment of a marine research laboratory in Panama.
- e. Replication of the methods of investigation in other areas in Nicaragua, Colombia, Cuba, Mexico, Dominican Republic, Costa Rica, Venezuela.
- f. Creation of a specific group in INVEMAR, Colombia for nuclear technologies in environmental monitoring.

4. A network of laboratories in participating institutions to support the continuing efforts to ensure a sustainable Caribbean.

All laboratories were provided with capabilities for field work, including sediment corers. Some laboratories were also established and enhanced with capabilities for the analysis of gamma (Colombia and Mexico) and alpha emitters (Cuba and Nicaragua), mercury (Nicaragua) and for XRF analysis (Cuba). A Regional Reference center for the use of nuclear techniques has been established in CEAC, Cuba.

The intercomparison exercise conducted by CIEMAT for radionuclides, trace elements and nutrients in sediments reviewed the reliability of the analytical results in the project and evaluated the performance of the instruments provided to the laboratories. In addition, it also determined the efficiency of the training provided to the counterparts on analytical techniques.

The review concluded that the data from the laboratories are reliable for scientifically-based conclusions. The gamma spectrometer provided to Guatemala is working better than expected considering that counterparts have acquired this capability for the first time. Some tools have been transferred to the region for the organization of future intercomparisons and proficiency testings.

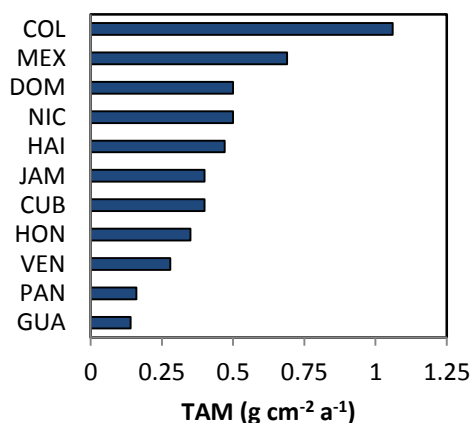
Cuba stores the remaining sediments samples in the *CARISED Regional Sediment Bank*.

5. A critical mass of capable scientific and technical staff in participating institutions to support the continuing efforts to ensure a sustainable Caribbean.

- Counterparts are trained in various analytical techniques mainly in Colombia, Cuba, Mexico, Spain and IAEA. Regional training courses have likewise been carried out in the region to prepare the counterparts in sampling, use of new techniques, quality assurance as well as quantification of organic contaminants in marine sediments.
- Six regional training activities and workshops were conducted on the use of ^{210}Pb , interpretation, laboratory hands on training through fellowships in laboratories. Through these activities, over 75 persons were trained.
- Workshop on data management with field demonstration on the use of radon detector for exploring submarine groundwater discharge and meeting of the Scientific Advisory Committee (Feb. 2010), Mexico
- A total of 23 fellows (83 man-months) were trained on relevant topics for the project, such as alpha and gamma spectrometry, geochronology, heavy metals and organics analyses, data interpretation and data quality, amongst others.

CONCLUSIONS

1. Sedimentation rates (TAM, Figure 1) ranging from 0.14 g cm⁻² a⁻¹ in Guatemala up to 1.1 g cm⁻² a⁻¹ in Colombia year indicate a clear increase in soil erosion, attributed to deforestation, land use changes, urban and industrial activities and climatic factors.



2. The sediments have accumulated various levels of heavy metals and organic contaminants. Of these, Cr, Cu, Hg, Ni, Pb, V and Zn have been found to exceed the Probable Effect Level (Table 1), the level at which biological effects are probable, in at least one location.

Table.1. Range of concentrations of some trace element Rango de concentraciones de ciertos elementos traza ($\mu\text{g g}^{-1}$) observed in some sediments of the region.

Element	Minimum	Maximum	PEL*
Cr	9	485	160
Cu	3	156	108
Hg	0.050	2.94	0.70
Ni	8	322	42.8
Pb	1.5	247	112
V	25	250	NA
Zn	28	450	271

* PEL: Probable Effect Level

3. Some persistent organic pollutants like DDT and Lindane have been detected in the marine sediments several years after these have been banned or restricted by either national regulations in some countries or international agreements. Where this is the case (as in Jamaica) the national authorities have now included organic pesticides in the newly established national chemical management protocol.

4. The project results are used by the countries to comply with the international agreement such as the Cartagena and the Stockholm Conventions.
5. Countries have realized the value of the reconstruction of the pollution history in sediments, particularly where baseline data is unavailable, a common situation. The baselines provide the reference for future monitoring of the pollutant trends.
6. Countries have identified other areas, both in the coastal zone and inland, where similar investigations will be replicated. Examples are: in Cuba, Bahía del Mariel, Golfo de Batabanó, Bahía de Santiago de Cuba, and other marine protected areas; in Dominican Republic, Río Yuna and Río Ozama, Bahía de Samaná; in Honduras, the Pacific region and the only freshwater lake (Lago de Yojoa); in Panama, Panama Bay; in Nicaragua, the two largest lakes in Central America (Cocibolca and Xolotlan lakes); in Haiti, Gonaives Bay.
7. New labs and groups have been created by the respective authorities to continue to carry out the investigations, e.g. in Cuba, Panama, Colombia and Guatemala.
8. In Cuba, the Ministry of Science, Technology and Environment has requested CEAC to elaborate the guide for regulating the characterization and management of marine sediment deposition especially in dredging contaminated areas.
9. In Colombia, INVEMAR has started collaborating with the autonomous national corporation and has created a new section dedicated to the use of nuclear technologies. It is collaborating with the Ministry of Environment and Sustainable Development on the definition of parameters for the quality of marine water and coastal zones. The results of the project have been presented to the environmental authorities of Cartagena.
10. The results in Guatemala are channeled to the Empresa Nacional Portuaria, la Naval, la Marina Mercante in coordination with the Municipal Environmental Unit of Puerto Cortes as a basis for the control of the products entering the country and ensuring compliance to the regulations of the ballast and bilge waters discharged from ships.
11. The remaining sediment samples are stored in Cuba in the CARISED Regional Sediment Bank while the data stored in CARISED Data Base in Colombia.

BEST PRACTICES THAT EMERGED FROM THE PROJECT

- Outreach between decision makers and scientific groups help ensure targeted investigations and optimal use of results.

When the decision-maker appreciates the results, policy actions can immediately be made, e.g., Jamaica experience. On one hand, scientists need also understand what the decision-makers need for an informed decision.

- Regional networking for mentoring and sharing capabilities both for expertise and laboratories are effective.

Issues on the marine environment are transboundary in nature and require a multidisciplinary approach. An understanding of the physicochemical processes within the national boundaries is insufficient to deal with the oceans and regional cooperation is essential. The experiences of this project demonstrate the effectivity of the regional approach.

- Several project management initiatives such as the a) production of project guides, b) regional training using them, c) the establishment of a Scientific Advisory Committee, d) use of comparable analytical techniques and data treatment, e) the creation of a project database named CARSED, and f) the use of regional resources for analytical and capacity building purposes, have contributed to the project success.

RECOMMENDATION

PLAN OF ACTION IN SUPPORT OF THE MANAGEMENT OF THE CARIBBEAN SEA

The UNEP report in <http://www.cep.unep.org/issues/lbsp.html> states that *“there is limited information about the long term effects of siltation in coastal waters. Long term data is needed to establish a time series of patterns and consequences of land use changes in drainage basins”*

Considering the stated need that can be provided by the substantial results of the regional cooperation under RLA/7/012, and the MOU with UNEP, with the cooperation of UNEP CAR-RCU the final results of this project should be presented to the Inter Governmental Meeting of UNEP through its Scientific and Technical Advisory Committee.

A proposal for a Plan of Action should likewise be presented to concretize actions for ensuring the sustainability of the results to further develop the regional capabilities for environmental monitoring and management of the Caribbean region.

This should include recommendations for UNEP to use the capabilities and resources for the operationalization of the LBS Protocol, national implementation plan for POPs and the Stockholm Convention. Ministries of Environment should institutionalize the findings into strategic action plans and policies for these conventions.

This Plan of Action should address the following issues:

- How to preserve the informal network that has been established and consider formalizing the network, e.g., by creating a consortium or incorporating in existing relevant networks, among others.
- Ensuring that people who are trained transfer their knowledge and conserve if not expand the know how they have acquired.

- Ensuring adequate use and maintenance of equipment to generate reliable information.
- Preserving the data through CARISED and improving this database.

AGREED ACTIONS

1. The regional project data base is created and named as the “Wider Caribbean Sediment Data Base (RLA/7/012)” **CARISED** hosted by INVEMAR. CUB (Ovel) shall enter data until Dec 12, 2011 for use during the training programme in Dec. 2011. Counterparts and the Scientific Advisory Committee members shall review the database to ensure its quality until March 1, 2012. **CARISED** shall be closed to public for 2 years until Dec 30, 2014 thereafter this can be opened to the public for use and reference.
2. The following publications shall be produced through INVEMAR:

By May-June 2012:

- On the results of the project: *Reconstruction of the contamination history of the coasts of the Wider Caribbean Region*
- *Leaflet on the results of the project:*

By Dec 2012, An ATLAS entitled

Sedimentos del Gran Caribe: 100 anos de historia (The Wider Caribbean Sediments: a history of 100 years)

Annex 1

**Reunión de avances del proyecto RLA/7/012
Antigua, Guatemala., 7-11 de noviembre, 2011**

PROGRAMA DE ACTIVIDADES

HORA		DESCRIPCION	CONFERENCISTAS
		Sábado 5 y domingo 6 de noviembre	
Todo el día	Llegada	Traslado al hotel de Antigua Guatemala	
		Lunes 7 de noviembre	
09:30	Acto Inaugural	Palabras de bienvenida e Inauguración.	NS,JGA, Invitados
		Presentación de Objetivos y Salidas de la reunión.	JASC-CAH-ACRF
		Aprobación de la agenda de trabajo	JASC-CAH-ACRF
		Presentación de resultados y productos informáticos del proyecto	JGA
		Presentación de la guía del proyecto y el libro de radiocronología.	JASC-ACRF
10:30	Pausa-Café		
11:00	Presentaciones	Presentación de los avances del proyecto RLA/7/012-COLOMBIA ¹	Contraparte Nacional
11:20	Presentaciones	Presentación de los avances del proyecto RLA/7/012-COSTA RICA ¹	Contraparte Nacional
11:40	Presentaciones	Presentación de los avances del proyecto RLA/7/012-CUBA ¹	Contraparte Nacional
12:00	Presentaciones	Presentación de los avances del proyecto RLA/7/012-DOMINICANA ¹	Contraparte Nacional
12:20	Presentaciones	Presentación de los avances del proyecto RLA/7/012-GUATEMALA ¹	Contraparte Nacional + CAH
12:40	Presentaciones	Presentación de los avances del proyecto RLA/7/012-HAITI ¹	Contraparte Nacional + CAH
13:00	Almuerzo		
14:30	Presentaciones	Presentación de los avances del proyecto RLA/7/012-HONDURAS ¹	Contraparte Nacional + AQ
14:50	Presentaciones	Presentación de los avances del proyecto RLA/7/012-JAMAICA ¹	Contraparte Nacional + JASC
15:10	Presentaciones	Presentación de los avances del proyecto RLA/7/012-MEXICO ¹	Contraparte Nacional
15:30	Pausa-Café		
16:00	Presentaciones	Presentación de los avances del proyecto RLA/7/012-NICARAGUA ¹	Contraparte Nacional
16:20	Presentaciones	Presentación de los avances del proyecto RLA/7/012-PANAMA ¹	Contraparte Nacional
16:40	Presentaciones	Presentación de los avances del proyecto RLA/7/012-VENEZUELA ¹	Contraparte Nacional
17:00	Presentaciones	Presentación, discusión y aprobación del modelo de Informe Final del Proyecto.	JASC, CAH, JGA.
17:30	Presentaciones	Presentación, discusión y aprobación del modelo de Resumen de Resultados Nacionales a ser integrado al Informe Final del Proyecto.	JASC, CAH, ACRF, AQ
18:00		Fin de la sesión	
		Martes 8 de noviembre	

HORA		DESCRIPCION	CONFERENCISTAS
9:00	Trabajo grupal	Elaboración de los resúmenes de resultados nacionales según el formato aprobado.	Todas las contrapartes
10:30	Pausa-Café		
11:00	Trabajo grupal	Adecuación de los resúmenes de resultados nacionales al formato aprobado. Cont.	Todas las contrapartes
13:00	Almuerzo		
14:30-15:30	Trabajo grupal	Adecuación de los resúmenes de resultados nacionales al formato aprobado. Cont.	Todas las contrapartes
15:30	Pausa-Café		
16:00-18:00	Trabajo grupal	Adecuación de los resúmenes de resultados nacionales al formato aprobado. Cont.	Todas las contrapartes
		Miércoles 9 de noviembre	
9:00	Trabajo grupal	Adecuación de los resúmenes de resultados nacionales al formato aprobado. Cont.	Todas las contrapartes
10:30	Pausa-Café		
11:00	Trabajo grupal	Adecuación de los resúmenes de resultados nacionales al formato aprobado. Cont.	Todas las contrapartes
13:00	Almuerzo		
14:30	Trabajo grupal	Adecuación de los resúmenes de resultados nacionales al formato aprobado. Cont.	Todas las contrapartes
15:30	Pausa-Café		
16:00-18:00	Plenaria	Integración de resúmenes de resultados nacionales.	Todas las contrapartes
		Jueves 10 de noviembre	
09:00	Trabajo en Grupo	Presentación de comisiones de trabajo para el monitoreo y evaluación de la matriz de marco lógico aprobada del proyecto. Trabajo en grupo	Participantes
10:30	Pausa-Café		
11:00	Trabajo en Grupo	Trabajo en grupo	Comisiones
13:00	Almuerzo		
14:30	Plenaria	Presentación de los resultados de Comisión I "Objetivos, Resultados y Salidas".	Participantes
	Plenaria	Presentación de los resultados de Comisión II "Actividades de Capacitación".	Participantes
	Plenaria	Presentación de los resultados de Comisión III "Capacidades analíticas desarrolladas y aportaciones al proyecto".	Participantes
	Plenaria	Presentación de los resultados de Comisión IV "Divulgación de resultados"	Participantes
15:30	Pausa-Café		
16:00-18:00	Plenaria	Adecuación de plan de trabajo hasta cierre de proyecto.	Participantes
		Viernes 11 de noviembre	

HORA		DESCRIPCION	CONFERENCISTAS
09:00	Plenaria	Revisión y aprobación de política de diseminación de resultados. Programa de publicaciones científicas.	Participantes
10:00	Pausa-Café		
10:30	Plenaria	Lecciones aprendidas y acciones de mejoras para nuevos proyectos.	Participantes
11:00	Plenaria	Elaboración del Reporte Final de la Reunión	Participantes
13:00	Almuerzo		
14:30	Plenaria	Presentación, discusión y aprobación de Reporte Final de la Reunión	Participantes
		Conclusiones de la reunión	Participantes
		Sábado 11 de noviembre	
Todo el día	Regreso	Traslado de Antigua a Ciudad Guatemala	Participantes

¹En las presentaciones nacionales deben hacer énfasis en la discusión de resultados, conclusiones y perspectivas de futuro. También debe presentarse los impactos de los resultados del proyecto al manejo integrado de las zonas

costeras bajo estudio, así como las acciones realizadas con los tomadores de decisiones.

²Los participantes debe traer ordenadores portátiles, así como la base de datos con los resultados generados en el proyecto.

³Se necesita conectividad a internet para consultas en TC-Pride y PCMF.

Annex 2
List of Participants

Assessment Meeting of RLA 7 012
Antigua, Guatemala City
November 7 to 11, 2011

1	Colombia	Dr Jesús Garay Tinoco Instituto de Investigaciones Marinas y Costeras (INVEMAR) Cerro Punta Betin Apartado Aereo 1016 SANTA MARTA COLOMBIA Tel.: 0057 5 4211380 Fax: 0057 5 4312986 EMail: jgaray@invemar.org.co
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