



**United Nations  
Environment  
Programme**



**UNEP**

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Regional Workshop: Coastal and Marine  
Water Quality Indicators and Methodologies  
to Determine Pollutant Loads in the Wider  
Caribbean

Havana, Cuba, 4-8 April 2006

***WORKSHOP REPORT***

## **BACKGROUND.**

Decision 1 of the Eleventh Intergovernmental Meeting of the Action Plan for the Caribbean Environmental Program (CEP), and the Eighth Meeting of the Contracting Parties of the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Montego Bay, Jamaica, 28 September – 2 October 2005) approved the CEP Work Plan for 2004 - 2005, where the necessity to update the CEP Technical Report No. 33 from 1994, entitled “Regional Overview of Land-based Sources of Pollution in the Wider Caribbean Region” was identified.

At the Wider Caribbean Region Stakeholders Conference of the White Water to Blue Water (WW2BW) Conference in Miami (March 22-26, 2004), and in response to the General Assembly of the United Nations Resolution 56/12 of 2001, where the General Assembly requested the Intergovernmental Oceanographic Commission, IOC of UNESCO to serve as a focal point in a world-wide effort to develop capacities in Marine Scientific Research (Part XIII of the Convention) and the Transfer of Marine Technology (Part XIV of the Convention), IOC, UNEP-CEP and the Swedish International Development and Cooperation Agency (Sida) launched a partnership called “Regional Network in Marine Science and Technology for the Caribbean: The Know-why Network”

In conformity with the above actions, the Regional Coordination Unit for the Caribbean Action Plan of the United Nations Environment Program (UNEP-CAR/RCU), with the cooperation of the Centre of Engineering and Environmental Management of Bays and Coasts in its capacity as a Regional Activity Centre (RAC-Cimab) for the Protocol Concerning Pollution from Land-Based Sources and Activities (LBS Protocol), and with the financial support of the Swedish International Development and Cooperation Agency (Sida), decided to develop a Regional Workshop on “Coastal and marine water quality indicators and methodologies to determine pollutant loads in the Wider Caribbean”.

The Workshop “Coastal and Marine Water Quality Indicators and Methodologies to Determine Pollutant Loads in the Wider Caribbean” took place in Havana, Cuba, with the following objectives:

- Analyse methodologies used to determine pollutant loads in the marine environment from point and non-point sources and the main coastal and marine water quality indicators.
- Discuss methodologies used for the characterization and quantification of municipal and industrial solid wastes.
- Present preliminary results for the update of the CEP Technical Report No.33.

The LBS Technical Focal Points of each country selected experts to attend the workshop. Representatives from national and international organizations also attended the Regional Workshop invited by RAC-Cimab and CAR/RCU. The countries represented by experts were Barbados, Belize, Colombia, Costa Rica, Cuba, Dominican Republic, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Panama and Venezuela. The full list of participants is attached as Annex I.

## **PART 1: INTRODUCTION.**

1. The opening ceremony took place on Tuesday April 4th, 2005 at 9:00 a.m. Mr. Christopher Corbin, Programme Officer for AMEP, spoke on behalf of the United Nations Environment Programme, and highlighted that emphasis should be given to carry out national and regional projects that have a positive impact on the life and health of Caribbean peoples.
2. Mr. Corbin stated that the workshop had two main objectives which were being carried out by RAC-Cimab. The first was the update of the CEP Technical Report No. 33 (TR 33) from 1994 on land-based sources of pollution in the Wider Caribbean Region, and the second was to discuss the identification of appropriate coastal and marine water quality indicators and methodologies to determine pollutant loads to be used in monitoring programmes within the Wider Caribbean Region. He highlighted that TR 33 is the baseline of the LBS Protocol and recognized that it remains difficult to obtain reliable information and data on the state of the environment of the region and that more recent assessments are needed. This information should then be used to guide decision makers. Mr. Corbin also noted that this data and information are becoming essential to justify requests for financial assistance from donor countries and agencies.
3. He concluded the inaugural speech by welcoming the new Junior Programme Officer (JPO) working at RAC-Cimab and recognized the importance of regional networks for the protection of the marine environment. He finished by thanking distinguished representatives of the participating agencies and institutions, such as RAC-IMA, INVEMAR, UDO, PAHO and IAEA for their presence. A list of all participating countries, representatives and agencies/institutions is attached in Annex I.
4. Mr. Antonio Villasol Núñez, Director of the RAC-Cimab, Cuba, and Mr. Mario Abó, representing the Ministry of Science, Technology and Environment, Cuba, thereafter presented themselves and welcomed the participants.
5. Mr. Antonio Villasol Núñez, highlighted that the Workshop, financed by the Swedish International Development Agency (Sida), is one of the activities that the Regional Coordination Unit of the Action Plan for the Caribbean is carrying out to achieve better environmental quality in the Caribbean Sea and promote the ratification of the LBS Protocol.
6. Mr. Mario Abó, Ministry of Science, Technology and Environment of Cuba, highlighted the opportunity to continue with the development of technical tools to find solutions to environmental problems that affect everyone, and pointed out that the presence of all the representatives at the Workshop made the achievement of the planned objectives possible. He thanked all persons for their presence and wished everyone a great stay in Cuba.

### Organization of the Workshop

7. Mr. Antonio Villasol, explained briefly some aspects referring to the organization of the workshop and the methodologies for the sessions. Speakers could speak either in Spanish or English, with simultaneous translation being provided.

## Approval of the Agenda

8. The participants approved the Agenda of the Workshop, which is attached as Annex II. The presentations of the Workshop are listed in Annex III.

## **PART 2: COASTAL AND MARINE WATER QUALITY INDICATORS**

9. The Programme Officer for UNEP CAR/RCU, Mr. Christopher Corbin, presented the main aspects of the Cartagena Convention and its Protocols, as well as the relationships between the different programmes developed in the Wider Caribbean Region, the Millennium Development Goals and the recommendations from the World Summit of Sustainable Development held in Johannesburg, South Africa in 2002. He pointed out that Memorandum of Understanding had been signed between UNEP CAR/RCU and Multilateral Environmental Convention Secretariats. One such MOU with the BASEL Convention Secretariat has resulted on joint activities on used lead batteries, obsolete pesticides and used oil management in the region..
10. Mr. Corbin presented a review of the history of the Caribbean Environmental Programme (CEP) and highlighted key events such as the adoption of the Cartagena Convention and its Protocols. He also expressed his expectations for the future of CEP which will focus not only on the protection of the environment but also on protecting human health and well-being of the inhabitants and the promotion of socio-economic development.
11. A representative from the International Atomic Energy Agency (IAEA), Mr. José A. Sánchez-Cabeza, presented the mission, main objectives and recent achievements of the only marine laboratory in the UN System. He underlined the interest of IAEA of establishing collaboration with the Wider Caribbean Region, and presented opportunities for such collaboration, for example, using nuclear techniques for the management of coastal zones in the WCR and studying contamination by heavy metals. He announced the development of a coming workshop for the formulation of a project entitled “Use of nuclear techniques for Coastal Zone Management in the Wider Caribbean”
12. Mr. Sánchez-Cabeza expressed that the participation of IAEA in collaborative projects depends on Member Countries, and that the interest for any type of collaboration should come on behalf of the countries and not from the IAEA. He highlighted the possibility to obtain reference material from IAEA to achieve validation of laboratories and provide other technical support issues, on request from regional laboratories and/or Member Countries of the Organization.
13. Mr. Corbin expressed that UNEP welcomed such a collaboration with IAEA, and pointed out that it is a field of work that can be very beneficial in the future for the Region.
14. The presentation of the reports, on the part of the Agencies involved in the Initiative “Know-Why Network”, began with one from RAC-Cimab, in which a proposal for coastal and marine water quality indicators to be used from monitoring in the WCR was presented. In their presentation, they highlighted the necessity for using methods that are replicable and feasible for all laboratories of the Region. They proposed seven (7) compulsory indicators and others which were optional and complementary. The suggested methods should require a minimum of resources to obtain the necessary information, and provide a guide for the participant laboratories to carry out the analyses in similar ways.

15. A discussion regarding the proposed water quality indicators took place following the presentation. Issues discussed included the existence of national water quality standards, the accreditation of laboratories, the availability of necessary laboratory equipment in the Region, the presence of pesticides in the indicators, detection limits, standardization of analysis methods, influence of temperature on methodologies used and the possible use of including sediment analysis samples as part of a comprehensive monitoring programme.
16. The representatives from RAC-IMA based their presentation on the main environmental problems in Trinidad and Tobago, previous studies carried out, the main water quality indicators monitored, as well as the challenges and limitations found in their application. They gave additional details on microbiological indicators measured in Trinidad and Tobago and about the existing constraints in their water quality monitoring programmes.
17. The representative from INVEMAR, Mr. Bienvenido Marín, presented the mission of INVEMAR and highlighted studies carried out in Colombia that have allowed the determination of the discharges of pollutants along the Colombian coasts. He informed that a standard was elaborated for the comparison of water quality in coastal waters (ICAM) for the entire country, although it is still a proposal that is yet to be approved. Examples of ICAM were shown for Colombia and the results analyzed.
18. The discussion that followed the presentation from INVEMAR addressed many issues. Among others, Mr. Jesús Beltran from RAC-Cimab outlined that INVEMAR's system (ICAM) should not be used as a starting point for the selection of indicators, but rather as an objective to be reached in the future. He also mentioned that all should be in agreement for the definitions of indicators, parameters and variables. The representative of the IAEA argued that the efforts from INVEMAR needed external validation, which should be supported by publication of the study results in international journals. He stated that such a validation exercise could contribute greatly to improve the work done so far.
19. The representative of UDO, Mr. William Senior, in his presentation highlighted several aspects to keep in mind for the establishment of a monitoring system for water quality in the Region and quality indicators. Among these aspects were:
  - The importance of temperature and salinity on water quality;
  - The international ban for the use of organic solvents for the determination of oils and greases, which creates uncertainty in the analytic determination of this parameter;
  - The importance of sediment characterization, as indicators of historical behavior of contaminants;
  - In the Government Meetings, the Representatives are often not the same, thus limiting the follow up of monitoring programmes and environmental projects.
  - The establishment of a reference manual for indicators and established methodologies. He proposed he could contribute to this manual (Tool Box).
20. The representative from the Pan-American Health Organization (PAHO), Mr. Teofilo Monteiro, gave a detailed presentation of the most frequent illnesses in bathing areas, explaining its causes and effects. He also explained the infection process and the relationship between levels of coliforms in bathing waters and health problems. He emphasized the importance of presenting data to the health authorities to encourage them to take action.

21. To conclude the day, Mr. Antonio Villasol, facilitated discussions to obtain consensus on the selection of the required coastal and marine water indicators for the monitoring of water quality in the WCR. He also announced that the following day's proceedings would include group work to discuss indicators and proposed methods.
22. Group work was carried out during the morning session of April 5th. The facilitator of the Workshop introduced briefly the tasks of the group work, and the objectives to be attained. It was decided that two groups would be formed; one with the English-speaking countries and the other with the Spanish-speaking countries.
23. The group work lasted all morning, and the afternoon session began with a presentation from Mr. Christopher Corbin, who presented the "Know-why Network" Initiative and the plans to update the Technical Report No. 33. Mr. Corbin reminded the participants of the importance of the work presented and discussed at the Workshop in order to implement the Caribbean Action Plan.
24. The first group to present their results and comments was the Spanish-speaking group. They presented what they considered to be the basic and optional indicators. They concluded that more capacity building and training was needed for the laboratories regarding analytical techniques of seawater. They also pointed out the following concerns:
  - Pesticides, heavy metals and hydrocarbons should be determined in sediments;
  - Samples should be representative;
  - The monitoring program should include, as a minimum, a description of the area, the sampling design, the frequency and number of stations. The specific details of a monitoring program should be left open for further discussion, where each country could send its suggestions. Countries should consider as a base the criteria and guidelines provided by the Cartagena Convention and the LBS Protocol.
25. The English-speaking group presented what they considered to be the basic and optional indicators to be monitored. They proposed to include transparency, salinity, temperature and pH as basic indicators, as well as all forms of nitrogen. When summarizing, they expressed the following recommendations:
  - During sampling, the geographical coordinates, meteorological conditions, time of sampling, methods of sampling, presence of visible solid waste, and the tide cycle should be recorded;
  - Comparative studies between laboratories should be carried out at the Regional level for the determination of Nitrogen and Phosphorus;
  - The application of bio-indicators should be evaluated;
  - Access to high-quality information about water quality in the Region should be improved;
  - Quality control of the analytical methods used in the laboratories should be incorporated.
26. During the discussion following the presentations from both groups, the proposed indicators from each group were presented simultaneously in order to identify where the groups were in agreement and not. The main discussion was centered on indicators of organic contamination (BOD<sub>5</sub>/COD), as experts argued primarily on the limitations when estimating COD in marine waters and the complexity and high costs of determining BOD<sub>5</sub>. After long discussions, it was proposed to

eliminate COD as an indicator and have BOD<sub>5</sub> as optional. It was also proposed to determine Total Organic Carbon (TOC), depending on the individual conditions in each country.

27. Another topic that generated much discussion was on the Oil and Grease indicator. Some experts outlined the existing and future difficulty of carrying out this analysis because of the methodology which required the use of banned substances. However, others consider the importance of maintaining this indicator as basic due to the information it provides in regards to land-based sources of pollution. In this context, representatives from small islands outlined that they did not see the need for systematic monitoring of oil and grease because, apart from occasional leaks or accidents, the levels were always very low. The session was concluded by consensus to include oil and grease and dissolved/dispersed petroleum hydrocarbons (DDPH) as basic indicators for the countries for which it is relevant.
28. Another important discussion developed with regards to the determination of the nitrogen in all its forms. Some experts expressed the necessity to have total nitrogen as a basic indicator while having nitrogen as nitrite, nitrate and ammonium as optional. This was eventually resolved by voting and accepted by most with a few reservations. Summaries of each group's proposal and the final proposal are attached in Annex IV.

### **PART 3: METHODOLOGIES TO DETERMINE POLLUTANT LOADS**

29. The sessions on the 6th of April started with a presentation by Mr. Félix Palacios, Head of the Division of Industrial Ecology at RAC-Cimab. The presentation, entitled Estimation of Municipal Solid Waste in the WCR, reviewed a simple method to estimate the quantity and characterization of municipal solid waste, with the purpose of designing collection, transport and disposal systems in the WCR.
30. Mr. Mauricio Lacayo from Nicaragua asked about the economic sustainability of the collection, transport and disposal systems, to which Mr. Palacios responded that the best option is to achieve about 70% of waste recovery. Alternative methods, such as composting, recycling of valuable materials and biogas production should be investigated depending on local conditions.
31. The representative of Venezuela affirmed that the collection of municipal solid waste is a widespread problem due to the high expenses related to the containers and the collection systems. The representative from Mexico added that in his country the municipalities are those in charge of the management of the solid waste and within the landfills, some people carry out the selection of the valuable materials. He outlined that a concern is that the population of the Wider Caribbean countries generally are unwilling to pay for MSW collection services, and he therefore considers it necessary for there to be a change in attitudes to make it sustainable. Mr. Teofilo Monteiro, representative from PAHO, argued that it was very difficult to charge for solid waste collection services and he recommended the sector evaluation of the production of MSW in the Wider Caribbean Region developed by his organization should be reviewed.
32. Mr. Ernesto Garcia, Department of Industrial Ecology, RAC-Cimab, presented an applied methodology for the estimation of municipal solid waste in Cuba. In the discussion, some technical solutions were shown such as the construction of a solid waste recycling facility and a regional landfill with biogas recovery.

33. In the plenary discussion, several topics were discussed, such as the experience in Dominican Republic on the development of regional landfills instead of local municipal landfills. The representative from Nicaragua explained that waste separation at the source is always an obstacle in the implementation of MSW management systems. She argued that high transportation costs were significant limitations in the application of these processes and that undoubtedly, separation at the source had to be accompanied by an environmental education program. The representative from Mexico talked about their experience in solid waste separation, but highlighted the difficulties in their transport mechanisms.
34. The representative from Colombia asked about polymerization of plastics, and Mr. Teofilo Monteiro, representative from PAHO, replied that a project was carried out in Guyana where plastic bottles were transformed into tiles, which could be an interesting application for the Region.
35. Mr. Félix Palacios, RAC-Cimab, presented a simple method to estimate non-point sources of pollution in the WCR, by calculating appropriate Emission Factors (EF). The proposed method can be used in similar regions and/or countries.
36. The discussion after Mr. Palacios's presentation included aspects such as the importance of carefully defining the study area and the classification of soils, as they are fundamental factors for the application of the methodology. The application of these methods is limited to the availability of such data.
37. Mr. Ernesto García, Department of Industrial Ecology, RAC-Cimab, presented a methodology to estimate pollutant loads from point sources. This methodology described how to estimate pollutant loads, but at the same time highlighted the importance of carrying out direct measurements. He also stated that the proposed indices should be obtained from previous experiences, as well as from literature.
38. Mrs. Idekich García, representative from the Ministry of Science, Technology and Environment of Cuba, presented examples of applied methodologies to estimate pollutant loads in Cuba. She explained that the estimations are derived from national inventories of point polluting sources and the use of indicators. She also argued that the methodology has several premises, such as:
  - Their results should be perceived as an indication of the existent pollution problems;
  - Minor sources with no significant contribution were not considered;
  - To estimate the pollution loads, the average value of pollution indicators of specific activities should be applied;
  - For a specific activity, several indicators should be applied and an average value obtained;
  - Complementary information is needed such as type of treatment, treatment efficiency, etc.
39. In the discussion, many representatives agreed upon the usefulness of the method used in Cuba and emphasized the importance and necessity of starting such analyses from national inventories of pollution sources, which is something that all countries should aim to do in order to determine pollutant loads from point sources and non-point sources in the WCR.
40. The sessions on Friday the 7th of April started with a presentation from Mr. Mauricio Lacaya from Nicaragua, on the application of the methodologies to estimate pollutant loads from point sources and non-point sources on the Atlantic coast of Nicaragua. Some of the key conclusions were:



- There is no regulation to control the consumption of water by industries and in the service sector;
  - Seafood processing and sewage waters are the land-based activities with the greatest impact on pollution in the study area;
  - No wastewater treatment systems found in the study area fully comply with national legislation.
  - The contribution of non-point sources of pollution to the Caribbean Sea from the activities along the Atlantic coast of Nicaragua, were not found to be significant.
41. Mr. Rodolfo Chang, representative from the Autonomous Region of the South Atlantic, expressed his concern about the handling of the LBS Protocol in regards to the characteristics of the Nicaraguan political administration. For example, the development of Environmental Impacts Assessment is responsibility of Autonomous Governments and therefore he considers that LBS should be managed not only through the Environment Ministries but through the Autonomous Governments as well.
42. Mr. Marco Chincilla, representative from Costa Rica, presented examples of applied methodologies to estimate pollutant loads in Costa Rica, and shared his experiences with the application of pollution indices of pollutant loads in his country and he explained his experience in the application of the pollution indices in the analysis of domestic and industrial waters.
43. Mr. Jesús Garay, representative of INVEMAR, presented an inventory and characterization of point land-based sources of pollution for the marine and coastal areas of Colombia. A detailed analysis of the point sources was presented to estimate the pollutant loads. Mr. Garay concluded that even though the data still needs to be validated, it provides a total value of pollutant loads to the Caribbean Sea by domestic waters, industrial waters and rivers.
44. Mr. Teofilo Monteiro, representative from PAHO, mentioned that it is difficult to compare the results of a country with another, as countries are so different in many aspects. He argued that it is necessary to define and work with indices, and not only absolute numbers, to allow comparison between countries. Others commented on the idea of normalizing the values by area, population or another reference.
45. Mr. Gilberto Jácome, representative from Mexico, presented examples of applied methodologies to determine pollutant loads and discharges from wastewaters in his country. He made a detailed analysis of the legal framework associated with the discharges of wastewaters and presented values of loads of BOD5 draining into the Gulf of Mexico.
46. The representative from Venezuela, Mrs. Miriam Carillo, shared her experiences in estimating pollutant loads in her country, and highlighted the following:
- They do not currently have flow measurements for all the rivers in order to carry out a complete evaluation of water quality;
  - The waste water treatment plants do not present characterization and flow of their effluents;
  - The registration of data is not automated, making data retrieval difficult;
  - The methodology for the calculation of the non-point sources is complex, and requires a lot of data as well as qualified staff.

47. The Workshop Facilitator explained to the participants that during the afternoon session, group work would be carried out with case studies to apply a methodology to estimate non-point sources of pollution. The groups were the same as for the evaluation of water quality indicators. The case studies are presented as Annex V.
48. The groups, assisted by specialists from RAC-Cimab, worked until 4:30p.m, and thereafter presented their results. Both groups recognized that the methodologies used in the exercise were very simple for such complex problems, but nonetheless valued the utility of using such tools in the determination of the non-point polluting loads.
49. The sessions on Saturday the 8th of April started with a presentation from Mr. Joaquín Gutiérrez, specialist from the Center of Information and Environmental Management of CITMA, on the application of models to estimate BOD5 loads in rivers and estuaries. Participants found these tools very useful and thanked the presenter for making them available for their use.
50. In the last presentation, the Facilitator urged the participants to examine all proposed conclusions and recommendations for the Workshop in detail before adoption. In Annex VI of this report, the agreed conclusions and recommendations are presented.

#### **PART 4 CLOSURE**

51. In the Workshop closing session, Mr. Christopher Corbin, Programme Officer for AMEP, spoke on behalf of the United Nations Environment Programme and expressed satisfaction for the Workshop achievements and thanked the organizing committee for the overall Workshop performance.
52. On behalf of the Cuban Government, Mr. Roberto Castellanos, Delegate of the Minister of Science Technology and Environment in Havana, gave the closing remarks for the Workshop. He highlighted the Workshop results and the collaboration that had been achieved within the region, guided by UNEP-CAR/RCU. He emphasized the disposition of Cuba in collaborating with the countries of the region about common environmental concerns and expressed his gratitude to all the participants, wishing them a happy return to their respective countries. The Regional Workshop on coastal and marine water quality indicators and methodologies to determine pollutant loads in the Wider Caribbean was officially closed on Saturday the 8th of April, 2006 at 12:30pm.

**ANNEX I**  
**List of Participants**

<b>REGIONAL WORKSHOP ON COASTAL AND MARINE WATER QUALITY INDICATORS AND METHODOLOGIES TO DETERMINE POLLUTANT LOADS IN THE WIDER CARIBBEAN REGION.</b>			
Participants/Participants/Participantes	Title/Titre/Título	Address/Adresse/Dirrección	Tel/Fax/Email/Website
<b>BARBADOS</b>			
Ingrid Nadean Lavine Environmental Protection Department	Senior Marine Pollution Officer	Environmental Protection Dept. Jemmoth Lane, St. Michaels	Tel: (1-246) 436-4820 Fax: (246) 228-7103 Email: <a href="mailto:enveng@caribsurf.com">enveng@caribsurf.com</a>
Hazel A. Oxenford CENTRE FOR RESOURCES MANAGEMENT & ENVIRONMENTAL STUDIES (CERMES)		UWI , Cave Hill Campus P.O. Box 64, BB11000	Tel: (246) 417-4571 Fax: (246) 424-4204 Email: <a href="mailto:hoxenford@uwichill.edu.bb">hoxenford@uwichill.edu.bb</a>
<b>BELIZE</b>			
Beverly Patricia Vansén	Environmental Technician	Department of the Environment 10/12 Ambergris Avenue Belmopan.	Tel:(501) 822-2542/822-2816 Fax:(501) 822-2862 Email: <a href="mailto:envirodept@btl.net">envirodept@btl.net</a>
<b>COLOMBIA</b>			
Carlos Arturo Álvarez Monsalve	Coordinador Grupo Gestión Calidad Ambiental	Dirección de Desarrollo Sectorial Sostenible Ministerio de Ambiente, Vivienda y Desarrollo Territorial Calle 37 No. 8-40, Bogotá	Tel: (571) 332-3400 ext. 365 Fax: (571) 288-9725 Email: <a href="mailto:caalvarez@minambiente.gov.co">caalvarez@minambiente.gov.co</a>
<b>COSTA RICA</b>			
Marco Chinchilla Salazar	Técnico Dirección Gestión Calidad Ambiental	Ministerio del Ambiente y Energía, Calle 25, Ave. 8-10, San José,	233-4533 ext. 169 223-5086 Email: <a href="mailto:mchinchilla@minae.go.cr">mchinchilla@minae.go.cr</a>
<b>CUBA</b>			
Mario Jesús Abo Balanza	Director	Centro Información, Gestión y Educación Ambiental (CITMA) Calle 20 No. 4107, esq. 18-A, Playa, Ciudad de La Habana	(537) 202-5534 (537) 204-9031 (FAX) <a href="mailto:mabo@ama.cu">mabo@ama.cu</a>
Carmen Cristina Terry Berro	Espesiclista	Centro Información, Gestión y Educación Ambiental (CITMA) Calle 20 No. 4107, esq. 18-A, Playa, Ciudad de La Habana	(537) 202-5534 (537) 204-9031 (FAX) <a href="mailto:cterry@ama.cu">cterry@ama.cu</a>
Joaquin Gutierrez Díaz	Especialista	Centro Información, Gestión y Educación Ambiental (CITMA) Calle 20 No. 4107, esq. 18-A, Playa, Ciudad de La Habana	(537) 202-9351 (537) 204-9031 (FAX) <a href="mailto:joaquin@ama.cu">joaquin@ama.cu</a>
Carlos Manuel Alonso Hernández	Director	Centro Estudios Ambientales (CITMA). Ap. 5 Ciudad Nuclear, Cienfuegos	53-43-965146 <a href="mailto:carlos@ceac.perla.inf.cu">carlos@ceac.perla.inf.cu</a>
Idekich García Cerda	Especialista	Centro de Información Gestion y Educación Ambiental (CITMA) Calle 20 N. 4107 e/41 y 47 playa, Ciudad Habana	Tel: (53-7) 202-5534 209-6014/202-9351 Fax: (53-7) 204 90 31 Email: <a href="mailto:idekich@ama.cu">idekich@ama.cu</a>

<b>DOMINICAN REPUBLIC</b>			
Juan Felipe de Js. Ditrén Flores	Director	Secretaria de Estado de Medio Ambiente Direccion de Calidad Ambiental Av. 27 de Febrero, esq. Av. Tiradentes, Plaza merengue local 202, Ens. Naco Santo Domingo	Tel: (809) 472-0626 ext. 250 Fax: (809) 472-0631 Email: <a href="mailto:fditren@ceiba.gov.do">fditren@ceiba.gov.do</a> <a href="mailto:calidad@ceiba.gov.do">calidad@ceiba.gov.do</a>
<b>GUATEMALA</b>			
Carlos Abel Noriega Velasquez	Director General	Ministerio del Ambiente y Recursos Naturales 20 Calle 58-58, Zona 10 Ciudad de Guatemala.	Tel: (502-2) 512-2595/2654 Fax: 502-2-3460560 Email: <a href="mailto:canoriega@marn.gob.gt">canoriega@marn.gob.gt</a>
<b>HONDURAS</b>			
José Maria Carbajal Flores	J. Dpto. Hidrologia y Climatología	Departamento de Hidrología y Climatología Dirección General de Recursos Hídricos SERNA/DGRH Edif. Defomin, Blvd Centroamerica, Calle la FAO, Tegucigalpa.	(504) 235-4529 235-4530 239-7455 Email: <a href="mailto:jmcarbajalf@yahoo.com">jmcarbajalf@yahoo.com</a>
<b>JAMAICA</b>			
Paulette Kolbusch	Manager	Regulation Standards & Guidelines Branch National Environment & Planning Agency (NEPA) 10 Caledonia Avenue Kingston 5	Tel: (876) 754-7540/7526 Fax:(876) 754-7399 Email: <a href="mailto:pkolbusch@nepa.gov.jm">pkolbusch@nepa.gov.jm</a>
<b>MEXICO</b>			
Ing. Gilberto Raúl Jácome Cervantes	Subgerente	Reuso del Agua y Dictámenes Técnicos Comisión Nacional del Agua San Bernabé # 549, Col San Jerónimo Lídice, P.B, Ciudad de México.	Tel: (55) 5377-0203 /04 Fax: (55) 5377-0221 Email: <a href="mailto:gilberto.jacome@cna.gob.mx">gilberto.jacome@cna.gob.mx</a>
<b>NICARAGUA</b>			
Llenia Arllery Garcia Peralta	Delegate Regional	Ministerio del Ambiente y Recursos Naturales del Mareno Bluefields, Managua.	Tel: 6423882 / 5720104 Fax: 5722324 Email: <a href="mailto:ilagarcia2003@yahoo.com.mx">ilagarcia2003@yahoo.com.mx</a>
<b>PANAMA</b>			
Isabel del Carmen Villalobos Joén	Evaluadora de Proyectos	Dirección Nacional de Protección a la Calidad Ambiental Oficina de Cooperación Internacional, Ciudad de Panamá.	Tel: (507) 315-0247 Fax (507)-315-1027 Email: <a href="mailto:i.villalobos@anam.gob.pa">i.villalobos@anam.gob.pa</a> <a href="mailto:isabelvi@hotmail.com">isabelvi@hotmail.com</a>

<b>VENEZUELA</b>			
Miriam Carrillo	Directora	Laboratorio Ambiental Dirección de Calidad Ambiental Centro Simón Bolívar Torresur, piso 28, Caracas.	Tel: (58-212) 408-1116-1141 Fax:(58-212) 408-1503 Email: <a href="mailto:mcarrillo@marn.gob.ve">mcarrillo@marn.gob.ve</a>

<b><u>ORGANIZATIONS</u></b>			
Participants/Participants/Participantes	Title/Titre/Título	Address/Adresse/Dirrección	Tel/Fax/Email/Website
<b><u>AGENCIA SUECA PARA EL DESARROLLO (SIDA)</u></b>			
Laura Piritz	Oficial de Programa	Dirección Nacional de Pesca. Box 423, 40126 Gofeborg, Suecia.	Tel: 46317430300 Fax: 46317430444 e-mail: <a href="mailto:laura.piritz@fiskeriverket.se">laura.piritz@fiskeriverket.se</a>
<b><u>UNIVERSIDAD DE ORIENTE</u></b>			
William James Senior	Profesor Consultant	Universidad De Oriente Comisión de Investigación Núcleo de Sucre, Apartado Postal 094, Cumaná, Venezuela	Tel: (58) 414-3936315 (cell) Office: (058) 293-4302351 Home: (058) 293-4672387 Home: (058) 293-430227 Email: <a href="mailto:wsenior@sucre.udo.edu.ve">wsenior@sucre.udo.edu.ve</a> <a href="mailto:wsenior@cantv.net">wsenior@cantv.net</a> <a href="mailto:wsenior2@hotmail.com">wsenior2@hotmail.com</a>
Aristide Márquez	Instructor	Universidad De Oriente Comisión de Investigación Núcleo de Sucre, Apartado Postal 094, Cumaná, Venezuela	Tel: (58) 414-3931812 Email: <a href="mailto:aristide@sucre.udo.edu.ve">aristide@sucre.udo.edu.ve</a> <a href="mailto:aristd@cantv.net">aristd@cantv.net</a>
<b><u>PAN AMERICAN HEALTH ORGANIZATION (PAHO)</u></b>			
Teofilo C. N. Monteiro	Environmental Health Advisor	Pan American Health Organization (PAHO) 8 Brickdam, Georgetown Guyana	Tel: (592) 225-3000/227-5150 Fax:(592) 226-6654 Email: <a href="mailto:monteirt@guy.paho.org">monteirt@guy.paho.org</a>
<b><u>UNIVERSITY OF THE WEST INDIES (UWI)</u></b>			
Anthony Michael Greenaway	Senior Lecturer	Department of Chemistry University of the West Indies, Mona Campus, Jamaica	Tel: (1-876) 977-1834 Fax: (1-876) 977-1835 Email: <a href="mailto:anthony.greenaway@uwimona.edu.jm">anthony.greenaway@uwimona.edu.jm</a>
<b><u>INSTITUTO DE INVESTIGACIONES MARINAS (INVEMAR)</u></b>			
Jesús Antonio Garay Tinoco	Subdirector	Coordinación de Investigaciones Dirección General y Subdirección Científica Cerro Punta Betin, Santa Maria, Colombia	Tel: (57) 421-4775 Fax: (57) 431-2975 Email: <a href="mailto:jgaray@invemar.org.co">jgaray@invemar.org.co</a>
Bienvenido Marín Zambrana	Coordinator	Coordinador del Programa Calidad Ambiental Marina-CAM INVEMAR Cerro Punta Betin Santa Marta, Colombia	Tel: (57) 4214775; 4212963 Fax: (57) 4312975 Email: <a href="mailto:biene@invemar.org.co">biene@invemar.org.co</a>

Participants/Participants/Participantes	Title/Titre/Título	Address/Adresse/Dirrección	Tel/Fax/Email/Website
<b>INTERNATIONAL ATOMIC AGENCY</b>			
J.A. Sanchez-Cabeza	Head	Radiometrics Lab IMA Marine Environment Laboratory, 4 Quai Antoine 1er 9800 Monaco	Tel: 377- 97977233 Email: <a href="mailto:J.A.Sanchez@iaea.org">J.A.Sanchez@iaea.org</a>
<b>INSTITUTE OF MARINE AFFAIRS (RAC-IMA)</b>			
Darryl Banjoo	Officer-in-Charge	Marine Chemistry Department Institute of Marine Affairs Hilltop Lane, Chaguaramas P.O. Box 3160, Carenage, Trinidad & Tobago	Tel: (868) 634-4291/2/3/4 Fax: (868) 634-4433 Email: <a href="mailto:dbanjoo@ima.gov.tt">dbanjoo@ima.gov.tt</a>
Christine Bullock	Research Officer	Marine Chemistry Department Institute of Marine Affairs Hilltop Lane, Chaguaramas P.O. Box 3160, Carenage, Trinidad & Tobago	Tel: (868) 634-4291/2/3/4 Fax: (868) 634-4433 Email: <a href="mailto:cbullock@ima.gov.tt">cbullock@ima.gov.tt</a>
<b>RAAN-ASDI-RAAS</b>			
Mauricio Lacayo	Responsable Medio Ambiente	Medio Ambiente Programa RAAN-ASDI-RAAS Avald Card Bolonia lc abajo, Managua Nicaragua	2685965 <a href="mailto:mlacayo@yahoo.com">mlacayo@yahoo.com</a>
<b>SERNA-RAAS</b>			
Rodolfo Chang Bennett	Director	SERNA-RAAS Bluefields, Frente al Parque Reyes Nicaragua	Tel: 5722629 FaxM 5720551 <a href="mailto:caribstyle25@hotmail.com">caribstyle25@hotmail.com</a>
<b>UNEP-CAR/RCU</b>			
Nelson Andrade Colmenares	Coordinador	United Nations Environment Programme, Regional Coordinating Unit 14-20 Port Royal Street Kingston, Jamaica	Tel: (876) 922-9267 Fax: (876) 922-9292 Email: <a href="mailto:nac.uneprcuja@cwjamaica.com">nac.uneprcuja@cwjamaica.com</a>
Christopher Corbin	Programme Officer	United Nations Environment Programme, Regional Coordinating Unit 14-20 Port Royal Street Kingston, Jamaica	Tel: (876) 922-9267 Fax: (876) 922-9292 Email: <a href="mailto:cjc.uneprcuja@cwjamaica.com">cjc.uneprcuja@cwjamaica.com</a>
Jean Nicolas Poussart	J.P.O.	<b>RAC-Cimab</b> Carretera del Cristo No. 3 Esq. Tiscornia, Casablanca, Regla, Cuba.	(537)-862-3051 ext. 219 (537)-8624387 (537)-866-9681 (FAX)
Una McPherson	Officer –in-Charge of Administration	United Nations Environment Programme, Regional Coordinating Unit 14-20 Port Royal Street Kingston, Jamaica	Tel: (876) 922-9267 Fax: (876) 922-9292 Email: <a href="mailto:umm.uneprcuja@cwjamaica.com">umm.uneprcuja@cwjamaica.com</a>

<b>CENTRO DE INGENIERIA Y MANEJO AMBIENTAL DE BAHIAS Y COSTAS (RAC-Cimab)</b>			
Antonio Villasol Nuñez	Director General	<b>RAC-Cimab</b> Carretera del Cristo No. 3 Esq. Tiscornia, Casablanca, Regla, Cuba.	(537)-8624387 (537)-866-9681 (FAX) <a href="mailto:villasol@cimab.transnet.cu">villasol@cimab.transnet.cu</a>
Liuba Chabalina	Directora Adjunta	<b>RAC-Cimab</b> Carretera del Cristo No. 3 Esq. Tiscornia, Casablanca, Regla, Cuba.	(537)-862-3051 ext. 261 (537)-8624387 (537)-866-9681 (FAX) <a href="mailto:liuba@cimab.transnet.cu">liuba@cimab.transnet.cu</a>
Orleans García Fuentes	Especialista	<b>RAC-Cimab</b> Carretera del Cristo No. 3 Esq. Tiscornia, Casablanca, Regla, Cuba.	(537)-862-3051 ext. 219 (537)-8624387 (537)-866-9681 (FAX) <a href="mailto:orleans@cimab.transnet.cu">orleans@cimab.transnet.cu</a>
Fernando José Libera Muñoz	Especialista	<b>RAC-Cimab</b> Carretera del Cristo No. 3 Esq. Tiscornia, Casablanca, Regla, Cuba.	(537)-862-3051 ext. 219 (537)-8624387 (537)-866-9681 (FAX) <a href="mailto:libera@cimab.transnet.cu">libera@cimab.transnet.cu</a>
Jesús Manuel Beltran Gonzalez	Director División Contaminación	Cimab Carretera del Cristo No. 3 Esq. Tiscornia, Casablanca, Regla, Cuba.	(537)-862-3051 ext. 255 (537)-8624387 (537)-866-9681 (FAX) <a href="mailto:beltran@cimab.transnet.cu">beltran@cimab.transnet.cu</a>
Ernesto García Martínez	Especialista División Ecología Industrial	Cimab Carretera del Cristo No. 3 Esq. Tiscornia, Casablanca, Regla, Cuba.	(537)-862-3051 ext. 218 (537)-8624387 (537)-866-9681 (FAX) <a href="mailto:ernesto@cimab.transnet.cu">ernesto@cimab.transnet.cu</a>
Felix Manuel Palacios Perez	Director División Ecología Industrial	Cimab Carretera del Cristo No. 3 Esq. Tiscornia, Casablanca, Regla, Cuba.	(537)-862-3051 ext. 261 (537)-8624387 (537)-866-9681 (FAX) <a href="mailto:palacios@cimab.transnet.cu">palacios@cimab.transnet.cu</a>
Hortensia Mancebo Cabañas	J. Laboratorio Microbiología	Cimab Carretera del Cristo No. 3 Esq. Tiscornia, Casablanca, Regla, Cuba.	(537)-862-3051 ext. 261 (537)-8624387 (537)-866-9681 (FAX) <a href="mailto:hortensia@cimab.transnet.cu">hortensia@cimab.transnet.cu</a>
Arlenne Martin Páramo	J. Laboratorio Ensayos	Cimab Carretera del Cristo No. 3 Esq. Tiscornia, Casablanca, Regla, Cuba.	(537)-862-3051 ext. 261 (537)-8624387 (537)-866-9681 (FAX) <a href="mailto:arlene@cimab.transnet.cu">arlene@cimab.transnet.cu</a>

## ANNEX II

### Workshop Agenda

#### “COASTAL AND MARINE WATER QUALITY INDICATORS AND METHODOLOGIES TO DETERMINE POLLUTANT LOADS IN THE WIDER CARIBBEAN”

<i>DAY 1: Tuesday; April 4<sup>th</sup>, 2006</i>		
<b>PART 1: INTRODUCTION</b>		
8.00-9.00	Registration	
9.00-9.45	Opening Ceremony	<ol style="list-style-type: none"> <li>1. Words from the UNEP CAR/RCU representative, Mr. Christopher Corbin.</li> <li>2. Words from RAC-Cimab Director, Mr. Antonio Villasol</li> <li>3. Words from the Cuban Government Representative.</li> </ol>
<b>9.45-10.15</b>	<b>Coffee break</b>	
<b>PART 2: COASTAL AND MARINE WATER QUALITY INDICATORS</b>		
10.15-10.30	Workshop organization	Antonio Villasol, Facilitator
10.30-11.00	<b>Session 1:</b> Action Plan for the Caribbean	Christopher Corbin, AMEP Program Officer CAR /UCR - UNEP
11.00-11.45	<b>Session 2:</b> IOAE Presentation	Dr. J.A. Sánchez-Cabeza IAEA-MEL, Monaco
11.45-12.30	<b>Session 3:</b> Coastal and marine water quality indicators	RAC-Cimab
<b>12.30-14.00</b>	<b>LUNCH</b>	
14.00-14.30	<b>Session 4:</b> Coastal and marine water quality indicators	RAC-IMA
14.30-15.00	<b>Session 5:</b> Coastal and marine water quality indicators, REDCAM	INVEMAR
<b>15.00-15.30</b>	<b>Coffee Break</b>	
15.30-16.00	<b>Session 6:</b> Coastal and marine water quality indicators	UDO
16.00-16.30	<b>Session 7:</b> PAHO/WHO Presentation	Teófilo Monteiro, Program Officer PAHO/WHO
16.30-17.00	Open discussion	Facilitator
<b>18.00-20.00</b>	<b>Welcome Dinner</b>	



<b>DAY 2: Wednesday; April 5<sup>th</sup>, 2006</b>		
<b>PART 2: COASTAL AND MARINE WATER QUALITY INDICATORS</b>		
9.00-12.30	Working Groups	Facilitator

<b>12.30-14.00</b>	<b>LUNCH</b>	
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14.00-14.30	<b>Session 8:</b> “Know Why Network” Initiative	Christopher Corbin, AMEP Program Officer CAR /UCR -UNEP
14.30-15.30	Group 1 Presentation	Relator Group 1
<b>15.30-16.00</b>	<b>Coffee Break</b>	
16.00-17.00	Group 2 Presentation	Relator Group 2

17.00-18.00	Open discussion	Facilitator
18.00-18.30	Conclusions and recommendations	Facilitator

<b>DAY 3: Thursday; April 6<sup>th</sup>, 2006</b>		
<b>PART 3: POLLUTANT LOADS METHODOLOGIES</b>		
8.30-9.00	<b>Session 9:</b> Methodologies for Solid Waste estimation	RAC-Cimab
9.00-9.30	<b>Session 10:</b> Case of Study : Solid wastes in Cienfuegos and Havana Cities	RAC-Cimab
9.30-10.00	Open discussion	Facilitator

<b>10.00-10.30</b>	<b>Coffee Break</b>	
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10.30-11.00	<b>Session 11:</b> Methodologies to estimate non point sources of pollution	RAC-Cimab
11.00-11.30	<b>Session 12:</b> Methodologies to estimate point sources of pollution	RAC-Cimab
11.30-12.00	<b>Session 13:</b> Application of pollutant loads methodologies, Case of study: Cuba	CITMA
12.00-12.30	Open discussion	Facilitator

<b>12.30-14.00</b>	<b>LUNCH</b>	
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<b>14.00-17.00</b>	<b>Field Trip</b>	
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**DAY 4: Friday; April 7<sup>th</sup>, 2006**

**PART 3: POLLUTANT LOADS METHODOLOGIES**

8.30-9.00	<b>Session 14:</b> Application of pollutant loads methodologies, Case of study: Nicaragua	Nicaragua
9.00-9.30	<b>Session 15:</b> Application of pollutant loads methodologies	Costa Rica
9.30-10.00	<b>Session 16:</b> Application of pollutant loads methodologies	Colombia

<b>10.00-10.30</b>	<b>Coffee Break</b>
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10.30-11.00	<b>Session 17:</b> Application of pollutant loads methodologies	Mexico
11.00-11.30	<b>Session 18:</b> Application of pollutant loads methodologies	Venezuela
11.30-12.30	Working Groups	Facilitator

<b>12.30-14.00</b>	<b>LUNCH</b>
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14.00-15.30	Working Groups	Facilitator
<b>15.30-16.00</b>	<b>Coffee Break</b>	
16.30-17.00	Group 1 Presentation	Relator Group 1
17.00-17.30	Group 2 Presentation	Relator Group 1

**DAY 5: Saturday; April 8<sup>th</sup>, 2006**

**PART 4: CLOSURE**

9.30-10.00	<b>Session 19:</b> Spreadsheets for Pollution loads estimation	Joaquin Gutierrez CIGEA-CITMA
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<b>10.00-11.00</b>	<b>Coffee Break</b>
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11.00-12.00	Conclusions and recommendations	
12.00-12.30	Closing Ceremony	

<b>12.30-14.00</b>	<b>LUNCH</b>
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### ANNEX III

#### **CONFERENCES AND PRESENTERS**

<b>CONFERENCES</b>	<b>PRESENTERS</b>
Action Plan for the Caribbean	Christopher Corbin, AMEP Program Officer PNUMA UCR/CAR
AIEA Marine Laboratory	J.A. Sánchez-Cabeza, AIEA-MEL, Mónaco
Coastal and marine water quality indicators	Arlenne Martin y Jesús Beltrán, RAC- Cimab
Bacteriological quality in coastal and marine water of Trinidad & Tobago	Christine Bullock-Ramsumair y Darryl Banjoo, RAC-IMA
Coastal and marine water quality indicators, REDCAM	Bienvenido Marín Zambrana, INVEMAR
Recreational waters and diseases	Teófilo Monteiro, Program Officer WHO/PAHO
“Know-why Network” Initiative	Christopher Corbin, Program Officer UNEP CAR/RCU
Methodologies for Solid Waste estimation	Felix Palacios, RAC-Cimab
Case of Study: Solid wastes in Cienfuegos and Havana Cities	Ernesto García, RAC-Cimab
Methodologies to estimate non point sources of pollution	Felix Palacios, RAC-Cimab
Methodologies to estimate point sources of pollution	Ernesto García, RAC-Cimab
Application of pollutant loads methodologies, Case of study: Cuba	Idekich García, CIGEA- CITMA
Application of pollutant loads methodologies, Case of study: Nicaragua	Mauricio Lacayo, RAAN-ASDI-RAAS Program
Application of pollutant loads methodologies in Costa Rica	Marco Vinicio Chinchilla Salazar, MINAE
Application of pollutant loads methodologies in Colombia	Jesús Antonio Garay Tinoco, INVEMAR
Application of pollutant loads methodologies in México	Gilberto Jácome Cervantes, Water National
Application of pollutant loads methodologies in Venezuela	Miriam Carrillo, Environmental Laboratory, MARN

ANNEX IV

GROUPS AND INTEGRATED PROPOSAL FOR MARINE AND COASTAL WATER QUALITY INDICATORS

	English Group		Spanish Group		WORKSHOP CONCLUSIONS	
	Basic	Optional	Basic	Optional	Basic	Optional
Dissolved Oxygen	Basic		Basic		Basic	
Total Suspended Solids	Basic		Basic		Basic	
Total Phosphorous	Basic		Basic		Basic	
Phosphate	Basic			Optional	Basic	
Total Kjeldahl Nitrogen	Basic			Optional	Basic	
Chlorophyll - a	Basic			Optional	Basic	
Oil & Grease		Optional	Basic		Basic	
Transparency	Basic		Basic		Basic	
Salinity	Basic		Basic		Basic	
Temperature	Basic		Basic		Basic	
pH	Basic		Basic		Basic	
Dissolved petroleum hydrocarbons		Optional		Optional		Optional
Fecal coliforms	Basic	E. coli	Basic	Enterococci	Basic	Enterococci E. coli
Nitrogen as Ammonium	Basic		Basic			
Nitrogen as Nitrate	Basic			Optional		
Nitrogen as Nitrite		Optional		Optional		
Silicon as Silicate		Optional		Optional		
Biochemical Oxygen Demand		Optional	Basic	COT		BOD <sub>5</sub> /COT
Pesticide Residuals		Optional		Optional		
Heavy metals		Optional		Optional		
Poly Aromatic Hydrocarbons		Optional		Optional		
Plankton				Optional		
Turbidity				Optional		

**ANNEX V**

**CASES OF STUDY**

**PRACTICAL EXERCISE #1**

Determine the annual nitrogen-polluting load and the medium surface run off volume of a basin localized at the West part of Isla de la Juventud of 90 hectares with a surface area of citric cultivation of 50 hectares, where the lands are hilly, of medium sandy texture and an annual rainfall average is 1400 mm. The surface area is fertilized with an integral fertilizer 5-8-7 (5% nitrogen, 8% phosphorus, as phosphorus pentoxide, 7% potassium) in annual averages quantities of 120 tons per hectare. Beside that, obtain the Factor of Emission and justify if the nitrogen contributions due to the fertilizer application fulfill the demands of the Protocol Concerning Pollution From Land Based Sources and Activities in the Wider Caribbean Region.

Estimate using the extrapolation method, the nitrogen polluting contributions to the marine environment from a surface area of citric cultivation at the South of the province of Matanzas with a basin extension of 90 hectare that uses the same fertilizer per hectare, with a slope of 8%, a medium soil texture and an annual rainfall of 1500 mm.

**PRACTICAL EXERCISE #2**

Determine the annual polluting load of pesticide issued to the marine ecosystems at the South of the province of Pinar del Río by the use of toxaphen pesticide (C<sub>10</sub>H<sub>10</sub>CL<sub>8</sub>), in a surface area of cattle and forage cultivation, to eliminate the soil plagues and insects that attack the forage plants and certain vegetables, as well as to control the ectoparasites of the livestock. The toxaphen is used as a prepared in a proportion of 20% toxaphen, 40% sulphur and 40% inert material, in approximately quantities of 50 tons annuals. The linked surface area is a basin of 70 hectares, of thick soil and slope below 1%. The annual average rainfall is 1200 mm. Calculate the average surface run off volume and obtain the factor of emission to extrapolate the obtained results to a cattle area to the South of Camagüey province where the lands are scarp, the basin has an extension of 72 hectares and 50 tons of toxafeno are applied annually.

## *ANNEX VI*

### *CONCLUSIONS AND RECOMMENDATIONS*

#### **CONCLUSIONS**

1. Experts acknowledged the significant support of Sida through the implementation of the Know-Why Network and the update of TR 33 Projects and recognized the additional contributions provided by partner Agencies and Member Governments.
2. Experts reiterated the need for scientific research, monitoring and exchange of data and other scientific information relating to the purposes of the Cartagena Convention and the LBS Protocol as outlined in Article 13 of the Convention and Article VI of the LBS Protocol.
3. Experts confirmed that monitoring of coastal waters and conducting inventories of pollutant loadings were national responsibilities but institutional, financial and technical constraints often limited the scope and detail of such national studies.
4. Experts outlined that the lack of adequate national and regional monitoring programmes (RMPs) prevented a comprehensive review for evaluating the effectiveness of the Protocol concerning Land-based Sources of Pollution and in guiding future priority setting and environmental policy development.
5. Experts highlighted the importance of environmental monitoring as a baseline to assess the state of the overall marine environment of the Wider Caribbean Region and in the identification process of major polluting discharges and considered the definition of specific coastal waters as guidance for Integrated Coastal Zone Management and decision-making.
6. Experts expressed that while there were limited national monitoring programmes for marine water quality and inventory studies, there were no clear reporting procedures for countries to submit pollutant data to the Secretariat to enable an assessment of the state of the marine environment of the Wider Caribbean Region.
7. Experts suggested that in a given RMP, the indicators selected in the Workshop should be applied, based on country characteristics to address the most important regional problems in the marine environment.
8. Experts also noted that a RMP should be flexible and modular, starting with a limited number of indicators, which can be added to over time depending on changing regional priorities and emerging pollution issues, and based on improvements in available technologies and capacity building at laboratories.

9. Experts recognized that a harmonized dataset requires agreement on methodologies and an internationally recognized data quality assurance programme. They also recognized that this will require capacity building at some national laboratories and it was further agreed that a consistent reporting format should be implemented for ease in creating a regional database.
10. Experts suggested that emerging priorities and pollution issues should be guided by national and regional pollutant assessment studies such as those being undertaken to update CEP Technical Report 33.
11. Experts recognized the importance of doing comprehensive inventories of pollutant loadings and expressed that there are often difficulties in obtaining required information. In such cases, the use of estimation methodologies should be promoted.
12. Experts confirmed the importance of data analysis and evaluation so that information is provided to decision makers in a simple useable form.
13. Experts suggested the development of Environmental Quality Indicators for the Wider Caribbean coastal waters and the application of GIS and other tools for the analysis and presentation of relevant information.
14. Experts recognized the importance of having national and regional monitoring programmes for water quality supported by the development of a regional database. It was further suggested that all relevant water quality data should be made available to this future database.
15. Experts highlighted the importance of conducting national and regional epidemiological studies to assess the suitability of microbial indicators currently used to evaluate the microbiological quality of recreational waters, and request the assistance of WHO/PAHO in this regard.
16. Experts recognized that for some environmental indicators, differing national circumstances and the current state of analytical methodologies requires further research and flexibility in the use and analysis for these indicators.

## **RECOMMENDATIONS**

1. The Secretariat should continue to work with countries to assist in the development of long-term national monitoring programmes that are required to fulfill their obligations as stipulated in the Cartagena Convention and its Protocols.
2. The Secretariat should also assist countries, to the extent possible, in the completion of the national assessments of pollution loadings to the marine environment which will facilitate the update of CEP Technical Report 33 using the agreed methodologies.

3. Countries should evaluate the benefits of ratifying the LBS Protocol and should be encouraged to comply with the monitoring and reporting requirements.
4. Countries should be encouraged to coordinate national monitoring programmes, in association with competent international organizations such as UNEP, IAEA and PAHO as appropriate, and to ensure quality of the data being generated through appropriate quality assurance procedures.
5. A regional assessment should be made of the existing national and regional water quality monitoring programmes, analytical methodologies and monitoring capacity of institutions in the region, and national procedures for sharing water quality data in the region. This should be done as part of the Know-Why Network Partnership.
6. The following five steps should be considered in establishing a regional coastal zone monitoring programme of benefit to the countries of the Wider Caribbean:
  - i. Defining regional marine problems and indicators
  - ii. Network building for monitoring and data exchange
  - iii. Quality – assured pollutant measurements through the implementation of the RMP
  - iv. Review and evaluation of the RMP and assessment of marine pollution
  - v. Reporting to the meeting of Contracting Parties
7. To support the monitoring and assessment of marine pollution, adequate funding must be allocated at three levels, namely nationally, regionally and globally.
8. In the further development of the Know-why Network Partnership, the Secretariat should ensure close collaboration and cooperation with existing and proposed environmental characterization and monitoring studies in the region, such as that coordinated by IAEA.
9. The Secretariat, working in collaboration with the LBS RACs, associated laboratories and other regional and international agencies, should mobilize resources to facilitate more detailed research on the various methods being used for the assessment of microbial contamination and nutrient loading of the marine environment. This would assist in identifying the most appropriate indicators and methodologies for use in the Wider Caribbean Region.
10. Countries should be urged to complete national inventories of pollutant discharges to enable the completion of the update of TR 33, and the submission of a first draft of that report by UNEP CAR/RCU for consideration at the 12<sup>th</sup> IGM of the Cartagena Convention to be held in Jamaica in November 2006.
11. The Secretariat should obtain the reaffirmation from Governments at the 12th IGM of the Cartagena Convention for the continued development and implementation of marine water quality monitoring programmes in the Wider Caribbean Region, and continued assessment of the state of the marine environment of the Region in support of the LBS Protocol.



12. A regional training needs assessment for water quality monitoring is required that takes into account the basic water quality monitoring indicators identified during this workshop. Based on this assessment, efforts should be made to provide training on inter alia, analytical methodologies, sample collection, and data analysis and interpretation using tools such as GIS. This should be done in collaboration with regional and international agencies with the required expertise.
13. In order to ensure effective collaboration with the IAEA, the secretariat should address a letter requesting for technical assistance in overall quality aspects such as training in the analysis of pollutants, organizing regional inter-comparison exercises, the provision of adequate reference materials and, if needed, conduct the analysis of pollutants in samples from the region.
14. The Secretariat should coordinate actions through the LBS RACs and associated agencies, together with countries in the region, to unify evaluation criteria for marine and coastal water quality in the Wider Caribbean Region, aiming to compare results and updating of Technical Report 33.
15. The Secretariat, in collaboration with the LBS RACs and associated agencies, should elaborate an action plan, which contains the activities, responsibilities and time table for the countries of the Wider Caribbean Region, and the Secretariat itself, to allow the satisfactory development of the aspects agreed upon during the workshop.
16. Priority should be given to the urgent establishment of a Regional Monitoring Network, based on the recommendations provided by the RAC's and other partner laboratories with the required experience and capacity. The provision of additional training and capacity building for other laboratories will improve the effectiveness of this Regional Monitoring Network through inclusion of other relevant agencies.
17. The development of an inter-calibration system between the RAC's and associated laboratories through the use of reference materials should be given high priority.
18. Efforts should be made to gain access to satellite images that will assist in future data analysis and interpretation.
19. The RAC's and other laboratories belonging to the Regional Monitoring Network, if they are not certified should begin a certification process, as part of their quality assurance procedures.
20. Countries should improve national coordination mechanisms and establish synergies between actions taken for the conservation and protection of the marine environment, within the framework of the LBS Protocol and other related national programmes, projects and activities carried out to comply with Multilateral Environmental Agreements and others regional and global initiatives promoting Cleaner Production and Sustainable Consumption practices.