THE INTER-AGENCY PROGRAMME ON MARINE POLLUTION

BY FERNANDO P. CARVALHO

The importance of our oceans and seas to economic development and environmental balance is generally acknowledged. For the world's coastal areas — where the majority of the world's population lives — the health, well-being, and, in some cases, the very survival of people depend upon the health and well-being of coastal systems, estuaries and wetlands, as well as their associated watersheds, drainage basins and near-shore coastal waters. Ultimately, sustainable patterns of human activity in coastal areas depend upon a healthy marine environment, and vice-versa.

The Global Programme of Action (GPA) for the Protection of the Marine Environment from Land-based Activities — as well as a number of international conventions (e.g., United Nations Convention on the Law of the Sea, the Oslo and Paris Conventions) and regional agreements — are addressing the needs. The GPA sets the obligations for, and aims at assisting the States to undertake, the monitoring of contaminants in the marine environment and to control and abate pollution sources. Included among the contaminants of major concern are persistent organic pollutants (e.g., pesticides and PCBs), heavy metals, petroleum hydrocarbons, radioactive substances, nutrients, sewage, and litter.

Effective surveillance of contaminants of the marine environment and control of pollution depend upon a number of factors, including appropriate institutional capacity in the countries. In recent years, many countries displayed increased attention to environmental issues and, gradually, infrastructures were developed and environmental protection regulations were put into place.

Effective surveillance also depends on other factors. They include the ability to identify and accurately measure the concentration of contaminants in industrial and urban waste discharges, and in the receiving environment, such as freshwater bodies and the seas. Therefore, regular monitoring programmes require adequately equipped laboratories and trained staff that are able to analyse diverse groups of pollutants. In turn, the data reported by laboratories form the basis for decision-making in pollution control. They further offer a means to check the compliance of waste discharges with environmental regulations and to verify the effectiveness of management measures for protection of the marine environment.

Despite the progress achieved in protecting the oceans through developing conceptual and institutional frameworks, the ability to measure environmental contaminants has probably been overlooked. However, it would not be too emphatic to stress that the success of marine environmental protection measures and sustainable development policies may well depend upon the validity of pollution assessments and, thus, upon the quality of analytical data reported by the laboratories.

This article reviews the global framework for assisting countries to upgrade their capabilities for analysing data related to the marine environment, and particularly focuses on services being provided by the IAEA's Marine Environment Laboratory (MEL) in Monaco.

DATA ABOUT CONTAMINANTS: HOW GOOD?

Analytical intercomparison exercises — based on the analysis of the same material distributed to laboratories — offer analysts a means to test their analytical methods, control their performance, and assess the accuracy of results. Intercomparison exercises are regularly organized by the

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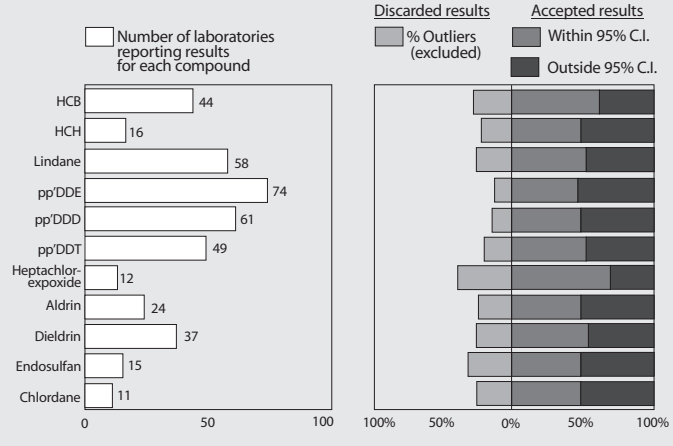
INTERCOMPARISON EXERCISE OF PERSISTENT ORGANIC POLLUTANTS

Most compounds known to be in this sample (mussel tissue homogenate IAEA-142) are persistent organic pollutants. The sample was sent to laboratories in an intercomparison exercise. Eighty-four laboratories sent back results. Off all the results, approximately 25% were outliers and another 50% were outside the range of acceptable precision (i.e., 95% confidence interval).



IAEA laboratories. Important results were obtained in a recent worldwide intercomparison exercise using mussel tissue homogenate. Results showed that the quality of analytical performance of laboratories needs to be improved. *(See graph.)* Only eleven laboratories could identify each persistent organic pollutant in a sample suite.

The ability of laboratories to determine heavy metals and radionuclides is somewhat better. But results still show a variable degree of uncertainty from some laboratories. Undoubtedly, these results call for enhanced training of analysts and measures for ensuring the data quality.

A few Regional Programmes have understood this need and adopted measures to incorporate quality assurance protocols in the work carried out by participating laboratories. For example, the Mediterranean Laboratories implementing marine monitoring programmes achieved important progress in the measurement of chemical contaminants. Results in the analyses of intercomparison samples show an improvement over time in precision and accuracy. This is a benefit of adopting a comprehensive data quality assurance programme, which includes training of analysts, intercomparison exercises, and regular use of reference materials.

IS MORE DATA BETTER?

In principle, all the analytical data reported by laboratories and national and regional programmes could be useful and thus would be worth compilation and storage in centralized databases ("the more the better"). International approaches for assisting countries with database information on pollution assessment are actually foreseen in the GPA as a clearinghouse mechanism. Also, global information systems, such as the Global Ocean Observing System (GOOS) set up by international organizations, seek to compile and stimulate the generation of more information on the atmosphere, ocean, and land. This information can help in solving problems related to food supply, climate, the environment, biodiversity, and freshwater supplies. Therefore, it is likely that in the near future States will seek the necessary scientific support for decision making in these information systems.

If the accuracy and comparability of data reported is not ensured, the assessment of marine environmental contamination hardly can be better than the quality of the data. As a consequence, the assistance and advice sought by countries in centralised databases may be hampered by the uncontrolled quality of the data. It seems, therefore, that a more sensible way to meet the needs of States would be to implement a "clearing-house mechanism" to laboratories and to urgently adopt harmonised procedures to enhance and ensure data quality.

WHAT PROBLEMS ARE FACING LABORATORIES?

In 1997, MEL's Marine Environmental Studies Laboratory (MESL) carried out an assessment of the main difficulties of worldwide laboratories in obtaining accurate results and in implementing marine

QUALITY CONTROLS

The Marine Environmental Studies Laboratory (MESL) — one section of the IAEA's Marine Environment Laboratory in Monaco — is in charge of studies on non-nuclear pollutants. MESL operates under a tripartite agreement between the IAEA, IOC and UNEP. Among its multiple tasks, MESL is the analytical support centre for MEDPOL, implements marine monitoring programmes in collaboration with regional laboratories, provides training in analytical techniques, and is the pillar of the quality assurance programme for determination of non-nuclear contaminants in the oceans. The analytical capabilities of MESL cover a wide range, such as heavy metals, pesticides, petroleum hydrocarbons, PAHs, PCBs and sterols. This is supplemented by MEL's analytical capabilities for measuring natural and anthropogenic radionuclides.

Following the recommendations of Agenda 21, MESL implements the Inter-Agency Programme on Monitoring and Assessment of Marine Environmental Contamination. Through this programme, MESL aims to expand collaboration with UNEP's Regional Seas Programmes. In this way, it is contributing further to capacity building, design, and implementation of monitoring programmes, and data quality assurance in the regions.

Photos: Laboratories at MEL operate quality control services for improving analytical capabilities in participating States. Also offered are training programmes for marine scientists selected from around the world. *(Credit: MEL)*

monitoring programmes. For this assessment a questionnaire with 32 questions was sent out to 350 laboratories in all regions, of which 117 were returned duly filled in and signed. Answers were received from laboratories in Western Europe (32%), Eastern Europe (18%), North America (4%), Latin America (11%), Africa (10%) and Asia-Pacific (25%).

All responding laboratories said they are aware of quality assurance/quality control methods and most of them have adopted in variable degree, or intend to adopt, those methods. Nevertheless, the answers indicate that 85% of the laboratories are not, as yet, regular participants in quality assurance processes (e.g., in intercomparison exercises) because it is not mandatory or for other reasons.

The major difficulties in implementing regular and successful marine monitoring programmes were identified as: problems with equipment maintenance, inadequate training of the analysts, lack of reference materials, unsuitable analytical methods, and insufficient intercomparison exercises and proficiency tests.

Laboratories perceive the participation in intercomparison exercises as useful to their work. Furthermore, those who are already participants in quality assurance processes stated that the benefit of participation in intercomparison exercises to their work has been "very high/high", and those who received analytical training considered it as "essential" to the progress made in their laboratories.

When laboratories were questioned about their

awareness of the series entitled *Reference Methods for Marine Pollution Studies* (which includes approximately 70 titles) about half of the them were not aware of it; the other half were following/using the recommended methods. Those who were aware of the set of *Reference Methods* overwhelmingly recommended the set's further development.

From the full set of responses to the questionnaire, it was clear that most laboratories call for strengthened support to their analytical work and for reinforced programmes for building their capacities.

INTER-AGENCY PROGRAMME ON MARINE POLLUTION

Being aware of the need for improved data quality assurance, international agencies and programmes joined forces to provide quality assurance services to regional programmes and laboratories. The Inter-Agency Programme (IAP) on Marine Pollution was agreed between the IAEA, the United Nations Environment Programme (UNEP), and the Intergovernmental Oceanographic Commission (IOC) of UNESCO in response to the 1992 UN Conference on Environment and Development in Rio. It covers several areas of mutual interest and cooperation:

- generating essential information for marine pollution assessments and follow-up activities for implementation of international conventions and cooperative programmes;
- assistance in building the technical capacity of regional laboratories for assessing non-nuclear marine pollution;
- provision of emergency assistance; and
- establishment of Regional Technical Support Centres.

Collaboration between the IAEA, UNEP and IOC in these areas has permitted progress in several Regional Seas Programmes such as the Mediterranean Action Plan/MEDPOL, the Black Sea Environmental Programme, and international cooperative programmes such as the Global Investigation of Pollution in the Marine Environment. Also, the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities, for which UNEP acts as Secretariat, aims, specifically, at identifying and assessing the severity and impacts of contaminants. The attainment of such goals largely relies upon the capacity of regional laboratories to monitor and assess contamination of the marine environment.

In order to produce reliable scientific results, monitoring laboratories need to follow a quality assurance/quality control system that includes regular measurement of contaminants in reference materials and participation in intercomparison exercises. These services are provided by MESL. *(See box.)*

Reference materials are marine samples certified for certain analytes (chlorinated hydrocarbons, trace metals, radionuclides, etc.). The analysis of the samples by the laboratories enables routine checks of whether their results compare with the certified values. For years, MESL has been producing marine reference materials and supplying them to laboratories in Regional Seas Programmes.

Intercomparison samples of suitable matrix (sediment, fish, algae, etc.) are also periodically prepared, tested for homogeneity, and distributed to laboratories around the world. Results of analyses reported by the laboratories are then statistically evaluated and compared. The final results of the intercomparison exercise allow the laboratories to verify the accuracy of their results in the analysis of a "blind" sample.

Reference methods are also distributed by UNEP and MESL. The *Reference Methods for Marine Pollution Studies* series was set up to facilitate adoption of tested and reliable methods by the laboratories. Adoption of the methods permits saving time and money and fosters adoption of common methodologies and the generation of comparable data by regional laboratories.

MESL also carries out research and collaborates with programmes and laboratories around the world in such issues as pesticide residues in tropical marine environments, speciation, and cycling of trace metals and contamination by petroleum hydrocarbons.

These and other services for improving data quality are fundamental to the accuracy of marine pollution measurements for protection of the marine environment. The IAEA, UNEP and IOC encourage international projects, regional laboratories, and analysts to cooperate with MESL and participate in programmes for quality assurance. ❑