ENVIRONMENTAL ISSUES AND CHALLENGES

TOMORROW'S OCEANS

BY HUGH LIVINGSTON

In this UN Year of the Ocean – 1998 — multiple activities are focusing the attention of the public, policy-makers, and media on the planet's largest natural resource. As the new millennium approaches, there is an increasing urgency to highlight the ocean's role in a broad range of human activities and to heighten awareness about the need to preserve this vital resource for the future. The health and understanding of the oceans will continue to be of critical concern for the foreseeable future.

Among these many activities is a major event, led by the IAEA, to focus attention on the ocean — the International Symposium on Marine Pollution to be held in Monaco, 5-9 October 1998. *(See box, pages 4 and 5.)*

This article briefly reviews major issues being examined at the Symposium that affect the ocean's health and future, and highlights cooperative initiatives involving and the IAEA and its global partners. Other featured articles in this edition of the *IAEA Bulletin* present contemporary examples of how the IAEA's Marine Environment Laboratory (MEL) in Monaco is serving the interests of countries in matters pertaining to the quality of the ocean environment. They address not only the activities of MEL itself, but also those organized in association with other IAEA departments, UN agencies, and international organizations.

PROBLEMS OF OCEAN POLLUTION

The fact of oceanic pollution from human actions — whether globally or locally —is essentially a 20th century, post-industrial problem. Over the past few decades, several classes of pollutants have been recognized — whether as acute events following accidents or chronic pollution at the local, regional or global level. The impact of these pollutants has given rise to both real and perceived problems. Both types warrant study, but the solutions to each problem is very different. Real problems may require controls on the source terms or appropriate remedial action. Perceived problems can only be solved through educational campaigns by government or media.

The assessment of the impact of a specific pollutant on the marine environment — whether health-related or economic — has traditionally been difficult and subject to scientific, political, and public debate. This has led to changing attitudes on the prioritization of the various marine pollutants. There are inevitably differing points of view which in turn contribute to misunderstandings by the public and media. A mid-1990s perspective of the range and priority of various marine pollutants may be considered as a mainstream point of view.*

The top priority class includes sewage, nutrients and persistent organic pollutants, including plastics. Sewage can create a familiar spectrum of public health problems. Nutrients from agricultural fertilizers surpass sewage as a cause of eutrophication in enclosed ocean basins or seas.

The dangers of persistent organic pollutants, such as pesticides, have led to production restrictions. But these agrochemicals have wide use, especially in the developing world. Their great persistence means that they remain and accumulate in the ocean environment, in the marine sediment sink, and are available through recycling to biological systems. Plastics are essentially a litter problem but can pose danger to animal populations through entanglement.

**From an article "Human Impact on the Oceans: the 1990's and Beyond", by A.D.McIntyre, Mar.Poll.Bull., 31, Nos. 4-12, pp.147-151 (1995).*

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Operational oil discharges from ships are generally accepted as a larger threat to birds, marine life and beaches than accidental spills from larger tankers - despite the high visibility of these latter events. This form of pollution, while perhaps not at the top of current listings of marine pollutants, remains a broad concern.

Concerns over pollution from artificial radionuclides started with the input from nuclear weapons testing in the atmosphere, primarily in the 1950s and 1960s. The remaining known sources include discharges or disposals from the nuclear industry and from accidents. The IAEA's international regulations can be considered to have served as an effective protection against adverse effects on human or marine life. Even such revelations of newly discovered dumping of radioactive waste, such as by the former Soviet Union in the Kara, Barents, and Far Eastern Seas, have not been shown to have had significant adverse radioecological or human impacts.*

Heavy metals, including toxic elements such as cadmium or mercury, or organotin compounds are now well recognized. Regulations developed in the 1970s seem to have brought about a reduction of the earlier public health issues from their presence in seafood. They are unlikely to represent a global or regional problem and are only a concern in areas of higher levels that are near the sources of these elements.

**See the article in the IAEA Bulletin, Vol. 39, No.1, pgs. 21-28, 1997.*

IMPACTS OF MARINE POLLUTION

It is important to emphasize repeatedly that the areas most impacted by marine pollution are the shallow coastal zones and enclosed seas. These are the areas of highest contamination. It is well recognized that much (about 80%) of marine pollution originates from human activities on land, including sewage disposal in rivers and coastal ecosystems, industrial discharges, agriculturally derived nutrients (of nitrogen and phosphorus), heavy metals, persistent organic pollutants, and discharges of radionuclides from coastal nuclear plants. These first affect our rivers, beaches, estuaries, harbours, near-shore zones, and enclosed basins having restricted water exchange. In contrast, the open oceans are much less affected by land-based contaminants because of their sheer volume and active circulation, both horizontally and vertically.

Ironically, it is the most heavily affected near-shore zones that host the marine resources of primary concern. The higher productivity of the continental shelf regions makes them the major focus of harvesting seafood. Recreational use of beaches and coastal areas needs a high standard of pollutant protection for both health and aesthetic considerations. Although these considerations are well recognized, much work needs to be done to improve marine environmental quality in these areas. This is especially the case in developing countries, where economic constraints impede the implementation of plans to make their coastal zones safe and healthy.

INTER-AGENCY COOPERATION

The scale and variety of marine pollution issues are a daunting challenge to coastal nations and international organizations. The response to this challenge requires major efforts in cooperation and coordination. Many initiatives started at the national level or by individual agencies benefit from coordination activities to make them more effective and to avoid duplication.

A major role for coordinating activities of UN agencies is vested in the Administrative Committee on Coordination (ACC) and its sub-committees. The relevant body with responsibilities for marine pollution issues is the ACC Subcommitee on Oceans and Coastal Areas. Since 1994, it has had the dual role of monitoring and facilitating the implementation of Chapter 17 of Agenda 21 (the document adopted at the UN Conference on Environment and Development in 1992), and of reporting through the Inter-Agency Committee on Sustainable Development (IACSD) to the Commission on Sustainable Development.

A major initiative for inter-agency cooperation overseen by this ACC Sub-Committee is the Global Programme of Action (GPA) for the Protection of the Marine Environment from Land-Based Activities. Marine pollution issues fall squarely into the GPA's area of responsibility, and the IAEA, through MEL in Monaco, is playing and will

INTERNATIONAL SYMPOSIUM ON MARINE POLLUTION:

Symbolically held in the UN International Year of the Ocean, a major Symposium on Marine Pollution in Monaco in October 1998 will highlight key issues the world is facing, and how countries are responding to them.

The Symposium is being organized by the IAEA and hosted by the Principality of Monaco; co-sponsors are the United Nations Environment Programme (UNEP), the Intergovernmental Oceanographic Commission (IOC) of UNESCO and the International Maritime Organization (IMO). It is being convened in cooperation with the International Commission for Scientific Exploration of the Mediterranean Sea (ICSEM). During the week, the new premises of the Marine Environment Laboratory in Monaco, the only marine laboratory in the UN family, will be officially inaugurated.

The Symposium's main aim is to review recent achievements in identifying the sources of pollution in the marine environment, and the behaviour and fate of contaminants in water, biota, and sediments. Studies on pollutant transfer and transport processes in the sea, computer modelling and information systems, assessment of radiological doses, biological effects, and potential impacts of non-nuclear pollutants on marine systems will be addressed. Developments in high-sensitivity analytical measurements of contaminants, with emphasis on nuclear and isotopic methods, will be highlighted. The Symposium will provide information for inter-agency sponsored global pollution programmes, and also enable participants to interact with leading experts and to discuss future trends in marine pollution studies.

A Marine Milestone. The Symposium and its proceedings will represent a significant milestone in reviewing current issues and understanding of marine pollution.

Specific objectives are to:

- synthesize data on present levels of pollutants in the marine environment, derive information on spatial/temporal trends, and recognize early warning signals so as to better manage pollution related risks;
- provide new information on the behaviour, transport and distribution of key contaminants (important radionuclides, trace elements and organic compounds) in the marine environment;
- present a comprehensive review of sources of radioactive and non-radioactive pollutants in the oceans and seas;
- review radiological consequences through release and transfer of artificial radionuclides in food chains, and to provide present dose levels to the world population based on the consumption of seafoods, following intentional and accidental releases to the sea;
- review current understanding of the transfer, fate, and biological effects of non-nuclear pollutants, and assess their potential impact on marine organisms and ecosystems;
- review progress in the methodology of marine pollutant monitoring, e.g. highly sensitive nuclear and isotopic techniques, remote sensing, biomarkers and bioindicators;
- review the Analytical Quality Control Services provided by international and national organizations for analyses of contaminants in marine matrices, and to identify future priorities;
- provide a forum for presentation of computer models which will predict dispersion of pollutants from local sources and describe their global distribution;
- enhance the interest of governments in marine pollution studies through a better understanding of global and regional programmes including the Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities and other inter-agency programmes, thereby strengthening international collaboration; and
- address future activities and requirements to evaluate and mitigate the effects of regional and global contamination of seas and oceans.

Agenda Topics. Specific topics on the agenda include:

- Sources of contaminants in the marine environment (dumping, past nuclear weapons testing, land-based discharges, atmospheric and riverine inputs);
- Pollution from ships (oil spills, deballasting waters, antifouling agents);
- Monitoring, transport, and distribution of radionuclides (contaminant levels, bioindicators, biogeochemical cycles, speciation);
- Monitoring, transport, and distribution of trace elements and organometals in the marine

environment (contaminant levels, bioindicators, biogeochemical cycles, speciation);

- Monitoring, transport, and distribution of organic contaminants in the marine environment (persistent organic pollutant levels, bioindicators, biochemical cycles, fingerprinting, degradation processes);
- Chemical and biological processes in the water column (scavenging, colloidal processes, bioaccumulation, coastal dynamics);
- Global circulation patterns (large scale transport of pollutants, circulation in oceans);
- Dynamics of pollutants in sediments (mixing, resuspension, bioturbation, bioavailability);
- Marine radiological assessment studies (dose assessment for nuclear contaminants, enhanced natural background radioactivity from non-nuclear industries);
- Biological effects of pollutants (effects on organisms, communities, and ecosystems);
- Computer modelling of dispersion of pollutants (compartmental, dispersion and sediment dynamics models; local, regional, and global modelling);
- Marine pollution information systems (GIS, databases, time trends, predictions);
- Analytical developments in marine pollutant measurements (radiochemical and nuclear analytical techniques, chromatography, mass spectrometry, accelerator mass spectrometry);
- Remote sensing of marine pollution (underwater monitoring, aerial and satellite monitoring, among others);
- Analytical Quality Control Services for marine pollution monitoring (reference materials, intercomparisons, proficiency testing, quality management, capacity-building);
- Risk assessment and management of marine pollution (including case studies);
- Global and regional marine pollution studies of special interest (Arctic, Mediterranean, and Black Seas, Mururoa Atoll, Far Eastern seas, "Mussel Watch").

For information about obtaining Symposium proceedings, contact the IAEA Division of Publications in Vienna, or the Marine Environment Laboratory in Monaco.

Photo: Sampling fish in the aftermath of an oil spill off Saudi Arabia's coast. *(Credit: IAEA-MEL)*

continue to play a major role in providing the IAEA's Member States with services and analytical capacity for marine environmental protection.* A more specific and relevant inter-agency activity is the Inter-Agency Programme on Marine Pollution. MEL's Marine Environmental Studies Laboratory — under an agreement between the IAEA, United Nations Environment Programme, and the Intergovernmental Oceanographic Commission of UNESCO — conducts monitoring, assessment, training, quality control and technology transfer activities in the area of non-nuclear marine pollution. This has been extremely useful to several Regional Seas Programmes such as MEDPOL, the Black Sea Environmental Programme, and international cooperative programmes such as the Global Investigation of Pollution in the Marine Environment. *(See article, page 7.)*

The potential enhancement of MEL's programmes, following the opening of the state-of-the-art laboratory in new premises generously provided by the Government of Monaco, helps to guarantee a bright future for such inter-agency marine pollution programmes.

Other productive efforts with a marine environmental focus are the joint projects between the IAEA and the European Union on Mediterranean marine studies. *(See article, page 18.)* Their focus is on processes underpinning the transport and fate of radionuclides and other contaminants in the Mediterranean. The fate of contaminants from the Po, Rhone, and Ebro rivers were the subjects of some studies. Others involved part of the carbon cycle (export of particulate carbon from the euphotic zone), as well as fluxes of materials around shallow hydrothermal vents.

MEL also has been historically involved in collaborative projects on the international level with various Member States. An example of a current major international project is the end of the century's assessment of radionuclide levels in the world's oceans and seas. *(See article, page 11.)* This project, initiated and supported by Japan, is an historic opportunity to measure and describe the distributions of anthropogenic radionuclides in the world's oceans as a reference point for the future.

Finally, MEL participates in many collaborative projects on the oceans with other divisions and departments within the IAEA. Such projects encompass the recently concluded radiological study of the Mururoa and Fangataufa atolls, the site of former nuclear testing; such studies, and MEL's role, are being featured in a forthcoming edition of the *IAEA Bulletin.*

The collaborative projects further cover studies of pesticides in the tropical marine environment that illustrate how IAEA coordinated research programmes can lead to progress. *(See article, page 24.)* As major persistent organic pollutants, pesticides can be expected to remain a concern for many countries. Through cooperative projects, these countries can acquire the capability for conducting reliable assessments of conditions in their coastal regions.

Other activities involve the IAEA's technical cooperation programme, which can have a major impact on a regional basis. *(See article, page 31.)* The Black Sea is an enclosed basin which has undergone serious environmental degradation in recent decades. Changed circumstances offer the nations bordering the Black Sea an opportunity to work together to find ways to reverse the recent trend. This project is an example of effective technology transfer. The recipients can use the acquired information and technologies to understand, and eventually control and remedy, the sources of pollutants which are causing the deterioration of the Black Sea. ❐

**See the detailed account of the GPA and MEL's contribution as reported in the IAEA Bulletin, Vol.39, No.1, pages 9-16, 1997.*

Photo: Efforts to protect our oceans and seas help to sustain all our marine resources.