Protection of the Marine and Terrestrial Environment

Objective

To enhance the capability of Member States in the use of nuclear techniques for the identification and mitigation of environmental problems caused by radioactive and non-radioactive pollutants.

The Marine Environment

The measurement and assessment of radionuclides in the marine environment helps to study trends and oceanographic processes. In this connection, IAEA–MEL joined a sampling mission sponsored by Germany to the North East Atlantic Dumping Site, which in the past had received radioactive waste immobilized within specially designed containers. Previous results from sampling in 2002 from the same area had suggested some release of radioactive material into the marine environment. In 2005, samples of sea water, particles and biota were collected to identify potential releases, and analyses are in progress.

In June, based on an agreement with the Helsinki Commission's Project Group for the Monitoring of Radioactive Substances in the Baltic Sea, a set of new data was added to the Agency's MARIS (Marine Information System) web site (*http://maris.iaea.org*). These data provide Member States with information on the distribution and dynamics of radionuclides in the Baltic Sea environment going back to before the time of the Chernobyl accident in 1986.

The bioaccumulation by aquatic organisms of toxins from harmful algal blooms (HABs), or 'red tide', radionuclides and metal contaminants is a matter of concern to many Member States because seafood consumption is a major source of exposure to humans of marine contaminants. An Agency study assessed the accumulation of one specific toxin from sea water in jellyfish. This particular toxin, originating from HABs, has recently been identified as the cause of dolphin and turtle deaths following their consumption of jellyfish.

Over the last ten years, high levels of paralytic and diarrhetic shellfish poisoning have been reported in southern Chile, resulting in the closure of some natural shellfish beds and the initiation of costly monitoring programmes. The Agency has been assisting Chile in the development of national capabilities for receptor binding assay (RBA) in order to provide early information on the presence of saxitoxins — a potent poison produced by HABs — to national authorities and local producers. Through this project, basic capabilities for RBA have been established in certain laboratories, rapid assessment of the presence of saxitoxins has been made possible, allowing for quick and effective remedial actions by authorities and producers, thereby reducing the health risks to the population, and confidence has been created in the shellfish market through the certification of products for the national and international markets.

Radiotracers of toxic metals, for example cadmium and zinc, have revealed unexpectedly high uptake rates in cartilaginous fish, such as shark, as compared with bony fish such as turbot. This has prompted studies to determine the susceptibility of the embryonic stages of fish to contamination and radiation exposure. The Agency's studies, using dogfish embryos as an experimental model, have shown the important role of the egg case in accumulating high levels of radionuclides, which as a consequence enhance radiation exposure of the enclosed embryo. These radiotracer data will permit risk assessments to be made under real environmental conditions of economically important seafood.

Global climate models rely in part on quantifying carbon export, which refers to the loss of organic material from the surface waters of the ocean to deeper waters. The Agency participated in an expedition sponsored by France (BIOSOPE) to measure the export of carbon in waters of different depths and biological activity, from the open ocean 'deserts' to the fertile, nutrient rich waters off Chile. Comparisons were made between a radiochemical technique and classical sediment trap methods, with a view to better understanding carbon loss processes under varying oceanic regimes.

For 30 years the Agency has been collaborating with the UNEP–Mediterranean Action Plan, providing a data quality assurance programme and training pollution chemists from the region. Collaborations with both the Black Sea Ecosystem Recovery Project and the Caspian Environment

Programme were renewed as the Global Environment Facility (GEF)–UNDP projects moved into new implementation phases. The Agency also started a new partnership under a GEF project in the western Indian Ocean region. Contributions included a survey of marine pollution laboratories in seven countries, organizing regional proficiency tests and providing assistance with formulating a regional monitoring programme.

The Agency conducted a regional survey of various organochlorine compounds (agrochemical pesticides, industrial polychlorinated biphenyls (PCBs)) in fish, oysters and coastal sediment of Bahrain, Oman, Qatar and the United Arab Emirates. The results were found to be amongst the lowest reported for surface sediments and contributed to the sparse regional database for organochlorinated compounds in the marine environment. The survey showed that the levels of DDT in the rock oysters from the Gulf of Oman, while relatively low, have remained uniform; there has been an irregular but generally decreasing trend in concentrations of PCBs over the last two decades.

The Terrestrial Environment

Capacity building for Member States in radioecology is facilitated by the provision of training at the Agency's Laboratories, Seibersdorf. Terrestrial radioecology expertise, analytical assessments of contaminated sites, environmental impact assessments and provision of advice, guidelines and training are offered. Fifteen fellows received training in nuclear analytical techniques in 2005. This included training in quality control and quality assurance practices.

Guidelines on methods for the analysis of radionuclides in environmental samples were published for use by Member State laboratories. Also included was an estimation of the uncertainty components associated with gamma ray spectrometry for air filters and a contribution to the recommendations of the International Union of Pure and Applied Chemistry on terminology for soil sampling. Standard methods for analysis of radionuclides in environmental samples, suitable for use by Member State laboratories, are being developed.

The membership of the ALMERA (Analytical Laboratories for the Measurement of Environmental Radioactivity) network increased from 73 to 104. Proficiency tests or intercomparison trials are organized by the Agency to monitor the performance and analytical capabilities of network members (Fig. 1). Through such activities confidence is built that Member States can accurately measure soil pollutants, meet international norms for trade and harmonize emergency responses. The current status of ALMERA network laboratories was evaluated to improve their technical competence through harmonization of sampling, monitoring and measurement protocols, and through staff training. The structure of the ALMERA network and the operation of future proficiency tests and intercomparison trials were also reviewed to maintain and improve the quality of analytical measurements. For example, a soil sampling intercomparison exercise was conducted where the different soil sampling protocols used by the ALMERA laboratories were compared to establish a common ALMERA approach to sampling and sample treatment. Such comparability is important for decision makers, especially in emergency situations.

In a sampling mission to Azerbaijan, samples of sediments and aquatic plants were collected from the Araksz and Kura Rivers and analysed for natural and human-made radionuclides. The project provides Azerbaijan with an independent assessment of radionuclide levels in the rivers, as well as providing training in sampling strategies and techniques.

Agency's Laboratories, Seibersdorf

The Agency's Laboratories are located in the vicinity of the village of Seibersdorf, in Lower Austria, about 35 km southeast of Vienna. The

FIG. 1. An ALMERA field sampling exercise in Italy in November 2005.

Laboratories help to implement the scientific and technical programmes of the Agency through experimental facilities and services. In connection with the Agency's verification activities, the Safeguards Analytical Laboratory (SAL) analysed 706 routine inspection samples and 197 non-routine samples, and the Clean Laboratory of SAL analysed 559 routine environmental safeguards samples, as well as 81 non-routine samples. In addition, 474 sample kits were prepared and provided to safeguards inspectors.

The Laboratories also hosted 78 scientific fellows for training in the Agriculture and Biotechnology Laboratory and Physics, Chemistry and Instrumentation Laboratory, and received 513 visitors, mainly from Permanent Missions in Vienna, Member State officials and media representatives.

A study carried out in 2005 to track the movements of fellows who had been trained at the Agency's Laboratories revealed that of the 149 trained in 2001–2002, 72% went back to work in the field in which they received their training. Most of the trainees (97%) believed that they had acquired knowledge that was useful or very useful for their job. The development of contacts for information exchange after the fellowship programme was an important factor in the career of fellows and in the development of the home institution. It was found that most fellows were involved in other Agency activities later in their careers. ■