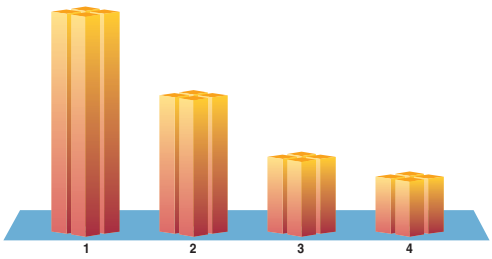
Protection of the Marine and Terrestrial Environments

Objective

To increase the capability of Member States in the identification and mitigation of marine and terrestrial environmental problems due to radioactive and non-radioactive pollutants.

Regular budget expenditure: $3 238 961
Extrabudgetary programme expenditure (not included in chart): $644 790



1. Measurement and Assessment of Radionuclides in the Marine Environment: $1 462 124
2. Transfer of Radionuclides in the Marine Environment: $905 350
3. Monitoring and Study of Marine Pollution: $499 655
4. Measurement and Assessment of Radionuclides and Non-Radioactive Pollutants in the Terrestrial Environment: $371 832

Key Issues and Highlights

- The underground counting laboratory for low level radionuclide measurements at the IAEA Marine Environment Laboratory (IAEA-MEL) was inaugurated in November 2002.
- Advanced aquaria facilities at IAEA-MEL were upgraded to incorporate tropical regimes for radiotracer studies of heavy metals arising from mining activities in sensitive tropical ecosystems.
- IAEA-MEL collaborated with the Caspian Environment Programme on a contaminant screening project with results that will guide environmental management in the Caspian Sea region.

Measurement and Assessment of Radionuclides in the Marine Environment

The IAEA-MEL Global Marine Radioactivity Database (GLOMARD) was used to estimate radiation doses to critical groups in the northeast Atlantic region arising from: civil nuclear site discharges; solid radioactive waste disposals in the northeast Atlantic Ocean; fallout from Chernobyl and past nuclear weapons testing; and naturally occurring radionuclides. The estimated radiation doses from marine pathways to critical groups in the region fell below the annual dose threshold for the public recommended by the Council of Europe.

A computer model, which can be used on a global scale for predicting the transport of radioactive discharges from nuclear facilities and for modelling emergency situations on a regional scale, was developed to estimate the dispersion of radionuclides in the world's oceans. Caesium-137 profiles in sea water, calculated using global fallout data, agreed well with experimental data obtained between the 1960s and 1990s at more than 150 sites, mainly in the Pacific and Atlantic Oceans.

Analyses of seawater samples collected during an expedition to radioactive waste dumping sites in the northeast Atlantic, organized in conjunction with the Institute of Radioecology in Hamburg, were completed. Measured concentrations of tritium, strontium-90, caesium-137 and plutonium isotopes in the water column did not show clear evidence of leakage from dumped containers of radioactive wastes.

Major concerns have arisen recently over the deteriorating environmental condition of the Caspian Sea, especially in terms of observed sea level changes. Recent climatological studies show that the sea level fluctuations are caused by variations in the river inflows, with lesser impacts from rainfall and evaporation. Oceanographic and isotopic investigations of the Caspian Sea were used to develop a model to explain past environmental changes, and in this way to help protect this unique ecosystem from the impact of human activities.

Prince Albert of Monaco inaugurated the IAEA-MEL Underground Counting Laboratory (UCL) in

November 2002. As an extension of existing facilities, UCL provides new and sensitive instrumentation for the detection of low level radioactivity in the ocean, in an environment that significantly reduces background radiation around the detectors. Detection limits for the analysis of radionuclides are improved by more than a factor of ten. This in turn allows measurements using smaller amounts of sea water, or other marine samples, significantly reducing sampling costs. Extrabudgetary contributions from the Governments of Monaco and Japan supported UCL's construction.

Assistance was provided to Member State laboratories in the framework of the Agency's Analytical Quality Control Services (AQCS) programme for the analysis of radionuclides in the marine environment. Intercomparison exercises, proficiency tests, provision of reference materials, and training in analytical quality management were organized (Fig. 1). Certification of the reference material IAEA-384 (Fangataufa Lagoon sediment) was completed and the material is now available to laboratories for quality assurance and quality control of analytical data.

Transfer of Radionuclides in the Marine Environment

Nuclear techniques have significant advantages in the evaluation of the behaviour, transport, fate and impact of radionuclides and conventional contaminants in the marine environment. IAEA-MEL studied these processes, focusing on tropical and other pollution sensitive coastal ecosystems. Radiotracer experiments were carried out to investigate the bioaccumulation and retention of radionuclides and toxic heavy metals in key marine biota from tropical coastal environments exposed to metal contamination from land based mining activities. Contamination of lagoon ecosystems in New Caledonia, where mining is the main resource of the island, was selected as a model case study, and a joint research effort was carried out in collaboration with the French Institute of Research for Development (Noumea IRD Centre). The findings suggest that certain lagoon organisms could be excellent bioindicators of metal and radionuclide contamination, which is important for decision makers involved in establishing coastal zone monitoring and management criteria.

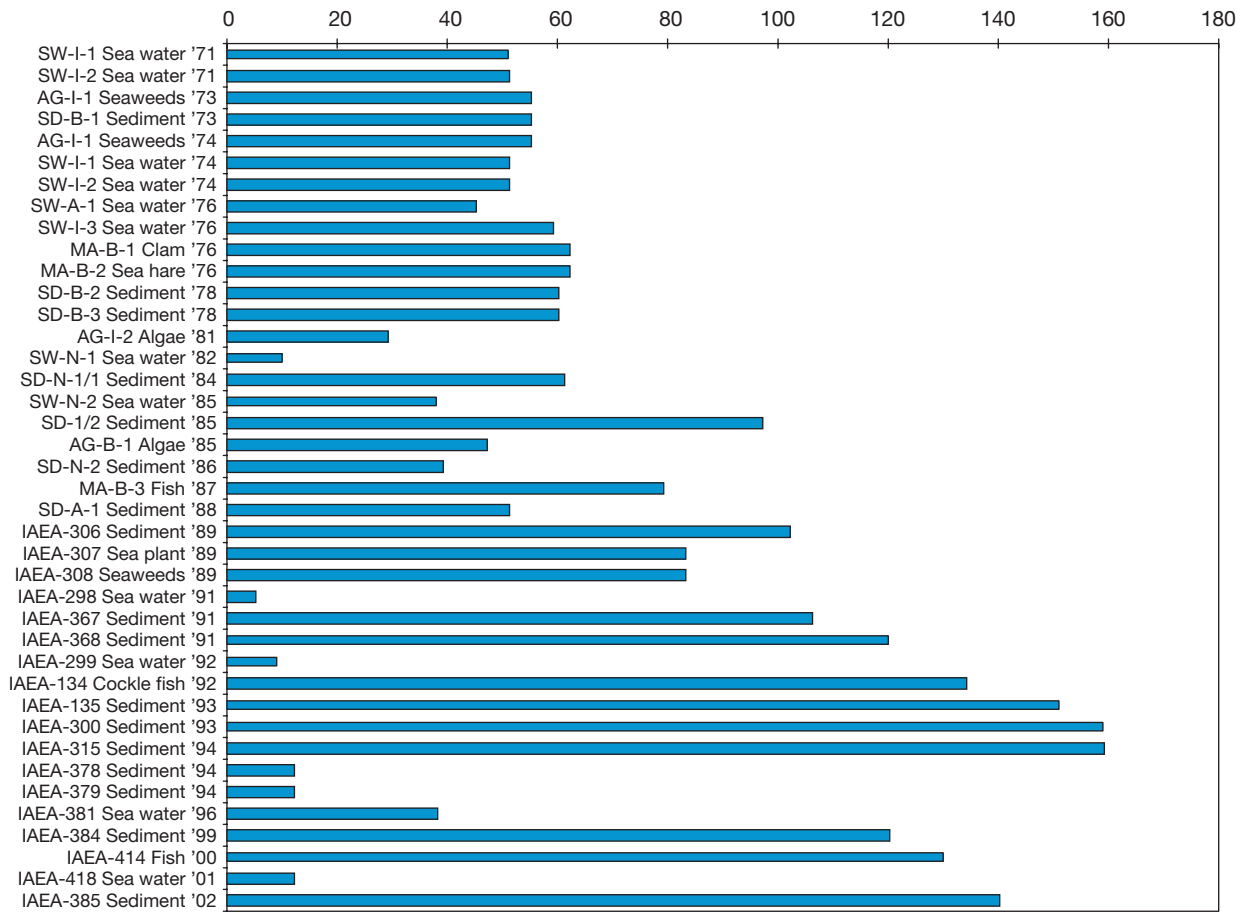


FIG. 1. Number of laboratories participating in intercomparison exercises and proficiency tests organized by IAEA-MEL for radionuclides in the marine environment.

The surface microlayer of the sea, i.e. the upper few hundred micrometres of its surface, is an important — but also one of the least understood — regions of the marine environment. It is generally enriched in metals, organic matter and contaminants, yet its role in the transfer of pollutants to underlying waters, or to the atmosphere, is not well known. In a project supported by the European Union and various institutes, IAEA-MEL carried out field experiments to examine the structure and role of biological communities involved in the transfer of persistent pollutants at the air–sea interface, and to assess the importance of the surface microlayer as an accumulator of radionuclides. Measurements have already demonstrated that particulate carbon and polonium fluxes at 40 cm below the surface microlayer were closely related, confirming the strong affinity of polonium for organic matter. Knowledge of the behaviour of such natural radionuclides in the surface microlayer can furnish clear insights into the transfer and fate of other metal contaminants.

Financial losses to fishing industries from harmful algal bloom (HAB) events are significant, often reaching several million dollars per event in areas with extensive wild or cultured shellfish industries. The incidence of HABs is increasing, and has additionally led to illness and loss of life. Two national technical co-operation projects, in Chile and the Philippines, received technical support from IAEA-MEL, as did a regional RCA project and another interregional project. The goal in all of these efforts was to assist in toxin testing by transferring technology, specifically the use of radiolabelled receptor binding assays, for harmful algal toxins. Under the interregional project (and in close collaboration with the Agency's Laboratories at Seibersdorf), development work began on the technical aspects of radiolabelling these toxins with tritium.

Monitoring and Study of Marine Pollution

Quality assurance programmes promoted by the Agency assist Member State laboratories and regional laboratory networks in gathering reliable environmental data. Worldwide intercomparison exercises are implemented that utilize specific marine samples for use as reference standards. For example, an Agency sediment sample (IAEA-417) was distributed to laboratories for the analysis of chlorinated pesticides and petroleum hydrocarbons. Ninety-seven laboratories in 46 countries participated, including 74 laboratories belonging to the UNEP Regional Seas laboratory network.

The analytical capability and efficiency of the Marine Environmental Studies Laboratory (MESL) was improved in 2002 by the acquisition of a unique ultra-sensitive solid sample analyser (AMA-254) for mercury, a heavy metal poison of increasing concern in marine foods. This ability to track inorganic, organic and radioactive forms of mercury in the sea has made MESL an international centre of excellence in marine pollution.

The Caspian Environment Programme (CEP) is an intergovernmental initiative involving the five Caspian littoral states, namely Azerbaijan, the Islamic Republic of Iran, Kazakhstan, the Russian Federation and Turkmenistan. IAEA-MEL collaborated with the CEP on a contaminant screening project, and assisted in an overall assessment of marine pollution in the region which resulted in some important and hitherto unknown findings that will impact on environmental management in the Caspian Sea region.

Measurement and Assessment of Radionuclides and Non-radioactive Pollutants in the Terrestrial Environment

In support of a special reserve fund technical co-operation project on the 'Assessment of the Radiological Situation in Kuwait with Respect to Depleted Uranium (DU) in the Environment', the Agency's Laboratories at Seibersdorf carried out an evaluation of the existing DU data in the Kuwaiti database and organized an intercomparison exercise with the counterpart Kuwaiti Radiation Protection Laboratory. The evaluation and intercomparison results led to an International Advisory Group recommendation that a comprehensive sampling campaign be undertaken, in collaboration with UNEP, to support the assessment. A summary report containing all Agency and UNEP results is being prepared and will be included in the assessment.