Environment

Objective

To enhance the capacity for understanding environmental dynamics, and the identification and mitigation of problems in the marine and terrestrial environments caused by radioactive and non-radioactive pollutants using nuclear techniques.

Ocean Acidification

Ocean acidification refers to the ongoing decline in the pH of the Earth's oceans caused by their uptake of human made (anthropogenic) carbon dioxide from the atmosphere. The Agency focused during 2010 on the role of radiotracers to better understand ocean acidification effects on marine biota, in particular vulnerable environments such as the Arctic, tropical coral ecosystems and temperate coastal regions (Fig. 1). The results that were published by the Agency were archived at the World Data Center for Marine Environmental Sciences as a resource to be used by the scientific community and presented to the IPCC in support of their assessment of the environmental impacts and socioeconomic consequences of ocean acidification.

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In related work, the Agency convened an international workshop in Monaco on bridging the gap between ocean acidification impacts and economic valuation, to more comprehensively assess the socioeconomic impact of ocean acidification on fisheries and aquaculture, marine biodiversity, and the tourism industry. The workshop participants concluded that the major economic impact of ocean acidification will likely be on finfish and shellfish fisheries, and on coral reef ecosystems. The impact on human welfare cannot yet be quantified and evaluated in monetary terms. For this, special tools will be needed to guide policy makers in ascertaining the economic impact of ocean acidification and the economic value of different adaptation strategies.

Environmental Gamma Spectrometric Data Quality

Environmental radioactivity laboratories are facing growing data quality requirements and increased difficulty in reliably analysing gamma emitting radionuclides in the environment. The difficulty is related to the currently low levels of

FIG. 1. Ocean acidification simulations included a transplantation experiment at volcanic carbon dioxide vents at Ischia Island in the Gulf of Naples using the commercially important mollusc Mytilus galloprovincialis.

anthropogenic radionuclides in the environment at large, as well as to advances in detector technology which require adapted calibration and analysis approaches for both natural and human made radionuclides.

A technical visit on coincidence summing and geometry corrections in gamma spectrometry was organized at the Agency's Laboratories, Seibersdorf, in July 2010, where advanced training allowed 32 participants from 20 Member States to tackle theoretical and practical aspects of advanced gamma spectrometry.

Characterization of Radioactive Particles

Radioactive particles have a major impact on human health, as well as significant ecological impacts. In the past, serious analytical problems have hindered the full assessment of such impacts. In response, an Agency CRP on 'Radiochemical, Chemical and Physical Characterization of Radioactive Particles in the Environment' developed standardized analytical methodologies to identify and characterize particles to support source term identification.

In 2010, the Agency conducted research using synchrotron radiation based X ray techniques (involving the determination of compositions and chemical states/forms of these elements) and radiometrical methods (that is, radionuclide and radioactivity compositions). The results from these experiments are essential for radiological work and modelling. The radioactive particles originated from sites where contamination has occurred from different release scenarios such as nuclear weapon tests, nuclear accidents and releases from nuclear installations. In 2010, the Agency designated the National Accelerators Centre in Seville, Spain, as an IAEA Collaborating Centre to focus on 'Accelerator Based Analytical Techniques for the Study of Long-Lived Radionuclides in Marine Samples'. Radioactive particles from nuclear weapon accidents in Palomares, Spain, in 1966, and in Thule, Greenland, in 1968, were investigated using the particle induced X ray emission technique. Collaboration with the Institute for Transuranium Elements, in Karlsruhe, Germany, was reinforced. In order to reveal the source term and the nuclear fingerprint of contaminated sites, micrometre size radioactive particles from these sites were

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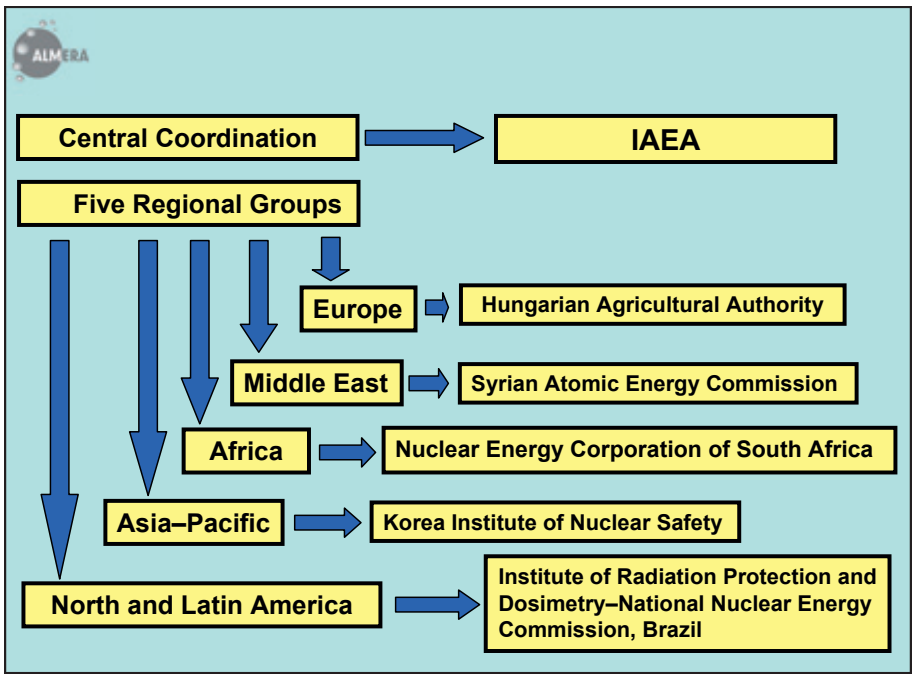

FIG. 2. Structure of the ALMERA network.

sampled and analysed using secondary ion mass spectrometry.

ALMERA Network

The IAEA's network of Analytical Laboratories for the Measurement of Environmental Radioactivity (ALMERA) was established in 1995 to maintain a worldwide collaborative group of radioanalytical laboratories. The network is subdivided into five regional groups that are intended to work together in the case of an event of international significance. Each regional group is coordinated by an ALMERA regional coordinating centre (see Fig. 2).

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In 2010, the ALMERA network reached 125 members covering all regions. Quality assurance activities, for example regular proficiency tests and provision of Agency recommended analytical procedures, support the operability and comparability of participating laboratories.

Production of Reference Materials

The Agency's Environment Laboratories in Monaco produce reference materials for terrestrial and aquatic environments as well as reference materials characterized for stable isotopes (Fig. 3). In 2010, the storage and dispatch facilities at the Agency's Laboratories, Seibersdorf, were expanded. An interactive web portal for purchasing, tracking and reporting of results was launched (*http://nucleus.iaea.org/rpst/ReferenceProducts/About/index.htm*). Around 2000 units of reference materials were ordered in 2010.

Understanding and Protecting the Terrestrial and Atmospheric Environments

In 2010, the Agency issued two publications: *Protecting the Terrestrial and Atmospheric Environments* and *Handbook of Parameter Values for the Prediction of Radionuclide Transfer in Terrestrial and Freshwater Environments.*

The Agency supported several training events, including a regional training course on radioecology and radiation protection of the environment and an international workshop on dissemination of modern experience in remediation of areas affected by the Chernobyl accident. The workshop stressed the importance of applying modern remediation strategies in affected areas to return them to normal use.

FIG. 3. Reference material storage at the Environment Laboratories in Monaco.

Low Level Long Lived Radionuclides and Trace Elements in Marine Samples

The Agency's development in 2010 of low level methods for isotopic and elemental analysis, based on the metrological concepts of uncertainty, traceability and validation, represents an important step in better understanding the quality of the measurement data related to studies on the pollution sources of long lived radionuclides and trace elements in the marine environment. Some of the analytical methods developed in 2010 are based on isotope dilution sector field high resolution inductively coupled plasma mass spectrometry (ID–ICP–MS). Measuring low level uranium and mercury in seawater using ID–ICP–MS leads to more accurate results even at very low concentration levels, which are typical of marine waters.

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