

# Environment

## Objective

*To enhance the capacity to understand marine, terrestrial and atmospheric environmental processes and identify problems caused by radioactive and non-radioactive pollutants and climate change using nuclear techniques and isotopes.*

## Strengthening Laboratory Analyses in Member States

The Agency provides about 100 reference materials in the fields of environmental radionuclides, stable isotopes, trace elements and organic pollutants according to ISO Guides 34 and 35. In 2012, new potential reference materials for radionuclides were characterized for environmental emergencies, for example, with regard to milk powder, soil and hay with slightly enhanced radionuclide levels. In order to assist Member States in strengthening the data quality assurance of their marine pollution monitoring programmes, three new reference materials were produced for trace elements and methyl mercury in marine sediments, and one reference material was produced for organic contaminants in marine biota (clams) (Fig. 1).

The Agency organizes annual proficiency tests to assess, on a voluntary basis, the quality and performance of analytical laboratories around the world. In 2012, a special proficiency test was organized, upon request, for 20 Japanese laboratories to evaluate and upgrade their



*FIG. 1. Marine reference materials for radionuclides to support Member State analytical capabilities for the determination of radionuclides in the marine environment.*

analytical capabilities for environmental radionuclide analysis.

As part of the Agency's quality assurance scheme for laboratories in the ALMERA (Analytical Laboratories for the Measurement of Environmental Radioactivity) network, robust analytical procedures are developed and tested to improve the capabilities of these

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laboratories for reliable measurement of radionuclides in the environment. Three new procedures for improved measurement of radionuclides in the environment were finalized in 2012 and are ready to be issued. The first is a procedure for the rapid determination of radium isotopes in drinking water, while the other two procedures improve the analysis of radionuclides of plutonium, americium, strontium, polonium, lead, thorium, uranium and radium in environmental samples (Fig. 2).



*FIG. 2. Cutting a sediment core collected in the Kara Sea into vertical layers in order to investigate the historical contamination of radionuclides near dumped nuclear waste.*

A proficiency test for radionuclides was conducted with over 200 participants from environment laboratories all over the world. Another test involved 50 participants from laboratories in the ALMERA network. A steady improvement in the performance of the ALMERA laboratories was noted, as well as the fact that they significantly outperformed other similar laboratories in radioanalysis and in reporting results with higher precision.

In June, the Agency hosted the 13th international symposium on Biological and Environmental Reference Materials (BERM 13). About 200 representatives from leading Member State institutions that produce reference materials, as well as their recipients, discussed the provision of analytical tools to laboratories around the world. Individual sessions focused, inter alia, on safeguards, environmental emergency preparedness and stable isotope applications.

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In collaboration with regional seas organizations such as HELCOM, OSPAR, ROPME and MED POL,<sup>1</sup> the Agency conducted three proficiency tests for radionuclides, trace elements and organic contaminants for ROPME. In addition, two proficiency tests were organized for UNEP’s Mediterranean Action Plan for the Barcelona Convention for organic contaminants and for trace elements in marine samples. These types of proficiency test are necessary to improve the quality of monitoring data in order to jointly

<sup>1</sup> HELCOM: Helsinki Commission, the governing body of the Convention on the Protection of the Marine Environment of the Baltic Sea Area; OSPAR: OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic; ROPME: Regional Organization for the Protection of the Marine Environment (comprising Bahrain, the Islamic Republic of Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates); MED POL: Programme for the Assessment and Control of Pollution in the Mediterranean Region.

assess the marine environmental status in the Arctic, Baltic, Mediterranean and North Seas, as well as areas of the Gulf.

Two worldwide interlaboratory comparisons for trace elements in sediments were conducted with the participation of 105 laboratories. Five hundred sediment samples certified for the mass fraction content of 16 trace elements were produced and sent to the Korea Ocean Research and Development Institute, in the Republic of Korea, to be used for local proficiency tests. Furthermore, 70 bottles of certified reference materials for trace elements and organic contaminants were distributed free of charge to Member State laboratories for the validation of analytical methods and to achieve traceability of the results.

A proficiency test exercise was organized in the framework of a technical cooperation project entitled ‘Marine Benchmark Study on the Possible Impact of the Fukushima Radioactive Releases in the Asia–Pacific Region’ to test the analytical performance of regional laboratories in the determination of radionuclides in sea water. The exercise was initiated to support Member States in the region in analysing sea water in relation to the Fukushima Daiichi nuclear accident. A total of 23 laboratories in 17 countries participated in the exercise, including seven laboratories from Europe. Based on the results submitted by the participating laboratories, their performance of the analyses was evaluated in relation to the target value and in relation to the other participants. The overall evaluation of the caesium-134 and caesium-137 results showed that the majority of the reported measurement results fulfilled the criteria of acceptability, although a significant number of measurements did not meet these criteria. Improvements in the analytical procedures are planned for future proficiency tests.

The annual meeting of the ALMERA laboratories was held in Ankara, Turkey, to define future activities of the network in relation to proficiency tests, training and methodological developments. Members expressed their interest in increasing the network’s response capacity to emergency situations. This was followed by a training course on the estimation of the uncertainty of measurement results.

## Behaviour of Radionuclides and Non-radioactive Pollutants in the Environment

An update of a 20 year old manual on remediation strategies for radionuclides released into the terrestrial environment (originally prepared after the Chernobyl accident) was published in 2012. The manual compiles scientific advancements in the field over the last two decades. In addition, two reports on the behaviour of radium in the environment and on radon releases from naturally occurring uranium and thorium were completed and are ready to be published.

New analytical methods were developed to assist laboratories in the Mediterranean Sea region in accurately measuring hazardous substances and elements in the marine environment. One method in particular involves the determination of mercury and methyl mercury in marine biota using inductively coupled plasma–mass spectroscopy. Other methods focused on the selective extraction, separation and determination of organotin compounds in marine sediment and biota; determination of petroleum hydrocarbons in marine samples (biota and sediments); determination of total mercury in marine samples based on atomic absorption and solid sampling with an advanced mercury analyser (AMA); and selective extraction of organic mercury in biota followed by solid sampling analysis with AMA.

### Building Capacity in Member States

Through its Environment Laboratories in Monaco, the Agency provides technical support to Member States in the form of: training courses; national, regional and interregional technical cooperation projects; and the preparation of methodologies and training manuals. For example, the radioligand

receptor binding assay for harmful algal bloom toxins was accepted as an official method of AOAC International. Scientists from Bosnia and Herzegovina, Croatia, Egypt, Greece, Iraq, Israel,

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Jordan, Lebanon, Mali, Mongolia, Montenegro, Pakistan, Qatar, Saudi Arabia, the Syrian Arab Republic, Tunisia, Turkey and Yemen were trained at the Agency’s Environment Laboratories on the application of suitable analytical techniques for the determination of radionuclide trace elements and organic contaminants in marine and terrestrial environmental samples (Fig. 3).



FIG. 3. Participants in a training course on the determination of chlorinated pesticides, polychlorinated biphenyls and petroleum hydrocarbons in marine biota are shown dissecting fish muscle samples for analysis.