

# Assessment and Management of Marine and Terrestrial Environments

## Objective

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

## Contaminant Uptake Studies on Caspian Sea Sturgeon

The presence of contaminants in seafood can endanger valued marine species themselves, their export value, as well as human health. Several types of marine fish are being investigated for their capacity to accumulate contaminants and transfer them to their eggs. In particular, sturgeon (and their seafood products) from the Caspian Sea — a valued natural resource — are under threat from a variety of environmental impacts, including pollutants such as cadmium from industrial facilities, which might also affect their reproduction. A series of radiotracer studies on sturgeon carried out in 2006 by the Agency determined how sturgeon accumulate a range of metals from water under the varying salinities that occur in the Caspian Sea and from foods contaminated by metals in sediments.

## Natural Radium Tracers for Coastal Processes

The four radium isotopes found in the ocean — radium-223, radium-224, radium-226 and radium-228 — have half-lives varying from 3.7 days to 1600 years, which match the timescales of coastal, oceanic and climate change processes. They can therefore be used as tracers of estuarine flows, coastal and ocean mixing, submarine groundwater discharge and ocean circulation (see Fig. 1). The shorter lived isotopes (radium-223 and radium-224) can be selectively measured in the environment. Following successful trials in waters around the world, the Agency hosted an international workshop to critically assess the analytical challenges and environmental applications of the use of short lived radium isotopes which will enable Member States to better understand coastal ecosystems.

## Climate Change

Oceans cover about 70% of the Earth's surface and play an essential role in regulating the global climate system, particularly through their ability to sequester a significant fraction of atmospheric carbon dioxide. Understanding the mechanisms by which the surface

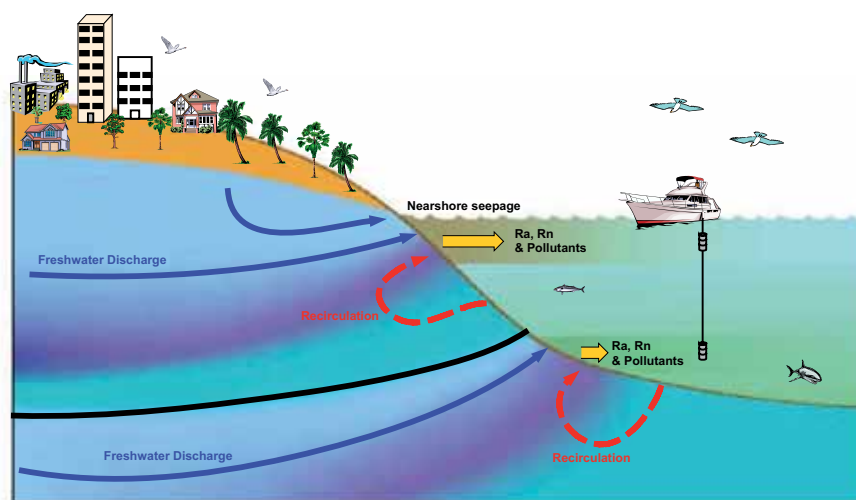


FIG. 1. Radium isotopes can be used as tracers in the study of water flows and circulation (Ra: radium; Rn: radon).

of the oceans absorbs carbon dioxide and transfers it to the depths of the sea is important. The Agency used natural radionuclides and isotopes to study carbon removal by the oceans and to study the role of biology and marine particles on these removal mechanisms.

Using natural radiotracers it could be demonstrated that the carbon-containing fast sinking particles in the ocean contribute more to carbon removal from the atmosphere than do more slowly sinking particles (Fig. 2). These new findings contribute to a more precise understanding of the processes involved in carbon packaging and removal from the ocean's surface, and support efforts for better modelling of future climate change.

The Agency participated in the Japanese Southern Hemisphere Ocean Tracer Studies (SHOTS) project, which aims to quantify the absorption of carbon and heat in this climatically critical region of the world through measurements of radionuclides from past weapons testing since these radionuclides can be used to study ocean mixing and deep sedimentation. Preliminary results show that surface waters are

transported from the North to the South Pacific and the Indian Ocean where caesium-137, carbon and some pollutants are stored for decades in large

ocean circular flows, while some waters from the Indian Ocean have also been detected in the South Atlantic. New concepts of ocean circulation in these regions are being developed from the study of global fallout radionuclides and the use of global

circulation models, which will lead to better insights into the relationships between oceans and climate.

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## Reference Materials for Trade and Interlaboratory Comparisons

It is necessary to determine accurately radionuclides in many types of samples for a variety of reasons, including the trade of food products, pollution assessments and remediation. The extensive trade in fish and other seafood products, for example, requires the assessment of, among other pollutants, radionuclides. Assistance



FIG. 2. Sampling of seawater and particles for the measurement of natural radiotracers.

to Member States is provided to measure marine radioactivity through the production and launch of a new reference material for radionuclides in fish. This exercise brought together 90 laboratories from 43 Member States, and the material will contribute to quality control/quality assessment for support to radiological assessments of food safety.

In an emergency, Member States may need to provide radionuclide measurements both quickly and with a high degree of confidence in their accuracy. The Agency therefore coordinated an interlaboratory comparison exercise with members of the ALMERA (Analytical Laboratories for the Measurement of Environmental Radioactivity) network, which included 40 laboratories from 32 Member States, that tested capabilities for rapid analysis and reporting of results. The participating laboratories were sent samples containing known activities of radionuclides in three matrices (soil, grass and water), which were tested and the results returned to the Agency within three days of their receipt.

The third coordination meeting of ALMERA members was held in the Republic of Korea in October, at which a proposal for the establishment of three regional groups was discussed by representatives from member laboratories. This development aims to facilitate interactions between the ALMERA network laboratories so that in an event of international significance occurs they will be ready and able to work together.

Approximately 400 laboratories took part in the first worldwide interlaboratory comparison exercise for gamma emitting radionuclides in environmental matrices (soil, water, etc.) and several additional interlaboratory comparisons were conducted at the regional level, which included an exercise for the Gulf region laboratories as part of the Radionuclide Measurements Cross-Calibration Project. Under a technical cooperation project on air pollution monitoring in the Mediterranean region, an exercise on the determination of radionuclides in air filters was carried out in collaboration with the US Department of Energy and the European Commission 'Clean Air Asia' project.

## Services of the Agency's Laboratories, Seibersdorf

The Agency's Laboratories, Seibersdorf, support the implementation of the Agency's scientific and technical programmes covering such areas as: applications of radiation and isotopes in food and agriculture; nuclear instrumentation; radiation dosimetry; nuclear techniques for monitoring radioactive and other contaminants in the environment; and nuclear verification. The laboratories are also a training centre for scientists from developing countries. An example of the experimental facilities and services provided is the Safeguards Analytical Laboratory

(SAL), which provides for sample analysis for the Agency's safeguards verification activities. In 2006, SAL analysed approximately 900 nuclear material samples, with the Clean Laboratory of SAL analysing 551 routine environmental safeguards samples and eight special samples. In addition, 853 sample kits were prepared and provided to safeguards inspectors.

The laboratories hosted 107 scientific fellows for training in the area of food and agriculture, environment and radiochemistry and received 676 visitors, including governmental and non-governmental representatives (Fig. 3). ■

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FIG. 3. Visit of HSH Prince Albert II of Monaco to the Agency's Laboratories, Seibersdorf.