

# IAEA CAPACITY BUILDING IN NUCLEAR TECHNIQUES FOR ENVIRONMENTAL SUSTAINABILITY



The IAEA helps Member States use nuclear technology for a broad range of applications: from generating electricity to increasing food production, from fighting cancer to managing freshwater resources and protecting coastal areas and the ocean. Assistance provided through IAEA capacity building projects addresses specific national and regional problems. Expertise in the application of nuclear technology and knowledge of good practices are transferred via training activities, information exchange, coordinated research projects and the technical cooperation programme.

Sustainable and effective environmental management is a critical global challenge in the 21st century. Countries are requesting technical cooperation support to be able to understand, monitor and mitigate the dual impacts of climate change and ocean acidification. IAEA training in advanced nuclear techniques for environmental monitoring helps policy-makers frame responses that are based on scientific evidence. Well-trained and knowledgeable national scientific personnel enable Member States to formulate sound environmental policies and feasible strategies that protect

the vital ecological balance of healthy natural systems, on land and in the ocean.

In addition to these activities, the IAEA also helps to strengthen the capacity of Member States in quality assurance and quality control in their environmental laboratories to be able to provide accurate data that are comparable and based on a universally accepted system. This is especially important in regional projects involving several different countries.

The IAEA specializes in producing high-quality environmental reference materials. In fact, the IAEA is the world's largest supplier of reference materials for radionuclides in different 'matrices', such as fish, plants, soil, water or other matter. Some of these IAEA reference materials function as international measurement standards. The IAEA provides reference materials to laboratories worldwide to help them ensure that proper nuclear and non-nuclear analytical techniques are applied to achieve accurate, trustworthy and reliable results. Scientists in developing countries normally have no access to most reference materials, which are expensive to use. The IAEA, therefore, supports technology transfer to

Sound environmental policies are needed to protect the vital ecological balance of healthy natural systems, on land and in the ocean.

(Photo: iStockphoto)

developing countries and serves as a low cost provider of these materials for laboratories in developing economies.

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## IAEA Environment Laboratories Monitor Environmental Contaminants

The IAEA provides Member States with training in the use of nuclear and isotopic techniques to detect environmental contaminants and assess their impact on organisms and human health. Through this training, Member States are better able to detect environmental problems. Nuclear and isotope techniques can provide high resolution data that quantify the impact of elements and chemical processes in the environment. The IAEA Environment Laboratories use radionuclides and stable isotopes to study environmental processes, the effect of contaminants in ecosystems, atmosphere — ocean interactions, surface and groundwater systems, and the response of atmospheric, hydrological and marine systems to climate change.

Training courses conducted by the IAEA enable scientists to learn about nuclear and isotope techniques to identify and analyse the composition, migration and transport by ocean currents of contaminants and their impact on the environment. Over the years, the IAEA has conducted many regional training courses supporting capacity building in marine environmental protection in the framework of regional and interregional technical cooperation projects in different regions of the world.<sup>1</sup>

The threat to the environment from climate change and ocean acidification is a matter of global concern. In response, the IAEA Environment Laboratories in collaboration with Member State institutions are initiating projects to monitor, assess and forecast the impact of such change on the marine ecosystem and the coastal surroundings. At the same time, IAEA experts support Member

States in developing national analytical capacities to better analyse the effects of ocean acidification on coral reefs, fisheries and marine coastal ecosystems. The IAEA also assesses ocean acidification's potential negative effects on human, social and economic activities. In line with Member States' mounting concerns about the severity of these effects, the IAEA's training and research also take into account the associated ecological issues for coastal areas and marine life. The resulting data and new expertise are needed to plan actions to safeguard communities both now and in the future.

Nuclear techniques provide unique, precise tools to monitor ocean acidification. At the IAEA's radioecology facilities in Monaco, precise studies of the calcification rates of marine organisms are conducted using radiotracers. Studies in radioecology also investigate the effects of elevated levels of dissolved CO<sub>2</sub> and decreased pH of seawater on the bioaccumulation of trace metals and other pollutants in various life stages of molluscs and fish.

## IAEA Training for National Capacity Building

Activities under the IAEA's technical cooperation (TC) programme are tailored to address Member States' specific needs in meeting national development priorities and contribute to socio-economic progress. The programme is implemented in four geographical regions: Africa, Asia and the Pacific, Europe, and Latin America.

Through its TC programme, the IAEA helps Member States build expertise in using nuclear and isotopic techniques to monitor and manage the marine environment and to address the degradation of the coastal ecosystems. The IAEA facilitates the transfer of useful and tested techniques and supports training in these techniques.

Regional TC project RLA/7/012, 'Use of Nuclear Techniques to Address the Management Problems of Coastal Zones in the Caribbean Region', supported integrated coastal zone management in the wider Caribbean region from 2008 to 2012.

Another regional capacity building project<sup>2</sup> was set up to assist in evaluating the toxicity of harmful algal blooms (HABs) using nuclear

techniques, as well as in designing and implementing early warning systems. This project aimed to create awareness of the dangers HABs pose for humans and marine organisms, and the damage HABs cause to ecosystems, the tourism industry and fisheries in the Caribbean region. HABs produce potent toxins that can kill fish, shellfish, marine mammals and birds, and may directly or indirectly cause illness or even death in people. This project was undertaken in collaboration with the Intergovernmental Oceanographic Commission of UNESCO<sup>3</sup>. The IAEA is also in the process of establishing a Caribbean Observing Network for Ocean Acidification that will focus on the use of nuclear and isotopic techniques to monitor climate change related issues affecting the coastal zone, such as ocean acidification, including their interactions with HABs.

With the support of the IAEA and other partners, the Cienfuegos Environmental Studies Centre (CEAC) laboratories were recently refurbished to provide advanced technical capacities to produce certified data for policy-makers to help them develop plans for better environment management, including nuclear techniques to solve various environmental problems in Cuba's coastal marine ecosystem. The success of this joint collaboration is illustrated in a photo essay on page 18 in this edition.

The Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (RCA) is an intergovernmental agreement for the Asia and the Pacific region that provides a framework for Member States to intensify regional partnerships. RCA projects focus on specific shared needs for research, development and training in nuclear sciences and technologies in the region. The IAEA and RCA support activities to enhance regional capacity to effectively apply nuclear techniques evaluate and respond to pollution in coastal waters and to marine environmental problems. The small island States of the Pacific are especially dependent upon ocean resources, and therefore vulnerable to the negative impacts of multiple environmental stresses. Although not part of the RCA, they have benefitted from the nuclear technologies training being offered under the RCA project.

As threats to the environment, such as ocean acidification, become a matter of increasing concern, the IAEA continues to work closely with Member States in providing cutting edge

nuclear and isotope techniques to monitor and evaluate challenging environmental problems. The IAEA Environment Laboratories transfer and disseminate nuclear and isotopic knowledge to Member State laboratories. The IAEA Environment Laboratories provide training, strategic advice, methodological harmonization and quality support for the monitoring and assessment of marine contaminants. The advanced nuclear techniques offered by the IAEA are able to validate and generate wider awareness of the extent and severity of ocean acidification, HABs and other emerging conditions. The expertise and assistance of the IAEA enables Member States to prepare and implement appropriate actions to protect coastal zones and marine life to preserve valuable natural resources and services.<sup>4</sup>

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<sup>1</sup>These projects include interregional project INT/7/018, 'Supporting Capacity Building in Marine Environmental Protection', as well as regional projects in Africa, Asia and the Pacific, and Latin America.

<sup>2</sup>TC project, 'Designing and Implementing Systems for Early Warning and Evaluation of the Toxicity of Harmful Algal Blooms in the Caribbean Region, Applying Advanced Nuclear Techniques, Radioecotoxicological Evaluations and Bioassays (ARCAL CXVI) (2009–2013).

<sup>3</sup>A guide for field monitoring of harmful microalgae has been produced by the IOC-UNESCO, in collaboration with the IAEA (available in Spanish at [ioc-unesco.org/hab](http://ioc-unesco.org/hab)); a manual of methods for the detection of harmful algal toxins using radioligand receptor binding assays is being prepared under the interregional TC project INT/7/017 by the IAEA in collaboration with US National Oceanic and Atmospheric Administration and IOC-UNESCO.

<sup>4</sup>For more information on IAEA's ocean acidification related activities, visit the Ocean Acidification International Coordination Centre (OA-ICC) website at [www.iaea.org/nael/OA-ICC](http://www.iaea.org/nael/OA-ICC)