Environment

Objective

To support Member States in identifying environmental problems caused by radioactive and non-radioactive pollutants and climate change using nuclear, isotopic and related techniques, and to propose mitigation and adaptation strategies and tools. To support Member States in enhancing their capability to develop strategies for sustainable management of terrestrial, marine and atmospheric environments and their natural resources in order to effectively and efficiently address their environment related development priorities.

Beginning the Process for Accreditation of the IAEA Environment Laboratories as a Producer of Environmental Reference Materials Characterized for Gamma Emitting Radionuclides

The Agency has been supporting Member State laboratories by providing reference materials for analytical data quality assurance worldwide since the mid-1960s. Gaining accreditation to underpin laboratory services is an increasing trend in Member States. This is accompanied by an increasing demand for certified reference materials produced by an accredited provider. Therefore, the Agency determined that its IAEA Environment Laboratories should obtain accreditation for reference material production (Fig. 10). For this purpose, a quality management system was established in accordance with international standards. The accreditation initially sought will cover the production of reference materials comprising a selection of environmental matrices certified for activity concentrations of defined gamma emitting radionuclides. The IAEA Environment Laboratories were audited by independent external experts in 2021 and subsequent corrective actions were implemented in a timely manner. The accreditation process is expected to be completed during the first half of 2022.

Support to Sri Lanka to Develop and Implement a Comprehensive and Long Term Programme for Identifying and Monitoring Post-spill Marine Pollution in Coastal Environments

In May 2021, the container ship X-Press Pearl caught fire off the coast of Sri Lanka, and sank, causing enormous environmental damage (Fig. 11). The ship's cargo included highly corrosive and hazardous chemicals, tonnes of oil/lubricants and billions of plastic pellets (nurdles) that have created one of the worst environmental disasters in Sri Lanka's history. Following a request by the Sri Lanka Atomic Energy Board, the Agency began mobilizing emergency support to procure materials and expert virtual assistance to support national efforts to identify, assess and monitor the pollution. The assistance includes the provision

FIG. 10. Reference materials are essential to Member State laboratories in their environmental, climate, radiation and food safety related monitoring and research programmes.

of sampling equipment for microplastics, seawater and sediments; multiparameter meters; and immersion fluorometers to measure the presence of oil in the seawater. Furthermore, the Agency provided marine robotic solutions including underwater remotely operated drones to visually monitor subsurface conditions around the shipwreck; a compact Fourier transform infrared spectrometer to characterize large marine microplastic and plastic debris; and an elemental analyser, to track and understand changes in the marine environment. As a precautionary measure, even though there were no known radioactive substances on board, the Agency is also procuring an underwater in-situ gamma ray spectrometer to help identify, localize and address any radioactivity associated with either the shipwreck or the ship's containers.

FIG. 11. Burned-out wreck of the X-Press Pearl after the sinking of the ship in the shallow waters of Sri Lanka. (Photograph courtesy of the University of Sri Jayewardenepura, Sri Lanka.)

CASE STUDY

Protecting Brazil's Coastal and Marine Ecosystems Using Isotopic Techniques

In late 2021, a red tide event stretched across more than 200 km of Rio de Janeiro's coastline. It lasted more than eight weeks and coloured the clear blue waters a dark, reddish brown, which drove away bathers on the Arraial do Cabo coast. In the high tidelines at the Praia Vermelha beach, dead jellyfish were observed, prematurely assumed by bathers to be related to the effects of the red tide event.

But were they? Support by the Agency has enabled scientists to assist Brazilian authorities in answering this question and to adopt strategies to monitor, mitigate and protect the coastal and marine environments impacted by natural disasters, including red tide events or harmful algal blooms (HABs). The authorities established that the occurrences were due to a widespread HAB event and were able to pinpoint the various species known for forming the micro-algal blooms that caused the changing tides throughout November and December.

To respond to the emergency situation, the Agency trained Brazilian specialists in the use of radioisotopes and stable isotopes and related nuclear techniques through its technical cooperation programme in Latin America and the Caribbean. The Fluminense Federal University in Niterói has been equipped with targeted isotopic and nuclear equipment, and its staff trained on advanced analytical technology, such as X ray fluorescence and elemental and stable isotope fingerprinting techniques.

"The training and equipment provided are helping Brazil to identify triggers and monitor HABs more effectively," said Dominika Zahrer, the Agency Programme Management Officer coordinating the activities with Brazil. The origins of the cooperation date back

Praia Vermelha beach, popular among tourists in the state of Rio De Janeiro, Brazil, where lifeless jellyfish and contaminated water are being left behind. (Photograph courtesy of R. Coutinho/Admiral Paulo Moreira Institute for Sea Studies.)

to when the Fundão tailings dam in Mariana, the oldest city in the state of Minas Gerais, collapsed in 2015, and the disaster left two villages devastated, with 19 lives lost and around 200 homes destroyed, she added.

This support helped characterize and determine the composition of materials and evaluate heavy metal pollution in the estuarine impacted sediments. This enabled Brazilian experts to assess the impact of the Fundão tailings dam burst on coastal and marine environments to help monitor, protect and recover these environments. Their knowledge and equipment have come in handy several times since then, including during last year's red tide event.

"Without the integrated use of stable isotopes and nuclear techniques, it would have been extremely difficult to assess the origin of the pollution and the environmental impact caused by the Fundão dam collapse and now identify the HABs triggers," said Imma Tolosa, research scientist at the Agency. The information produced and disseminated by Fluminense Federal University is allowing the Ministry of the Environment to improve its emergency action plan for protecting fauna, improve water quality and focus on the continuous recovery of the coastal and marine environments.

"We must continue to assess coastal management tools and the long term effects of pollutants, monitor the effectiveness of management actions to reduce further contamination to lakes, bays and the ocean as well as to identify the triggers of HAB events and other pollutants," said Roberto Meigikos dos Anjos, physicist at Fluminense Federal University.

Brazil's coastline is also seeing an increase in oil spills and plastic pollution, which is harming marine life. Techniques similar to those used to identify HABs and assess the dam collapse are now being implemented to increase the resilience of Brazil's coastal ecosystem to pollution, and to develop a course of action to minimize the effects of an oil spill and plastic debris.