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.

Evidence of Positive Effects of Global Restriction of Contaminant Releases

Regulating pollution in coastal environments is vital to reducing ecosystem degradation; however, monitoring the effectiveness of such regulation remains a challenge. In 2020, the Agency coordinated a report of the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) — an independent instrument of ten United Nations organizations — evaluating contaminant levels in coastal ecosystems. The report revealed that, while the diversity and volume of contaminants are increasing at an alarming rate, the strict regulation of toxic and persistent organic contaminants such as polychlorinated biphenyls (PCBs) and mercury is effective in decreasing contamination levels. This illustrates the success of national policies and regulations, international agreements such as the Stockholm Convention on Persistent Organic Pollutants and the Minamata Convention on Mercury, and heightened environmental awareness. For the report, GESAMP Working Group 39 on Global Trends in Pollution of Coastal Ecosystems: Retrospective Ecosystem Assessment examined data extending back to the pre-industrial period. The dating of sediment at such timescales can be achieved using radionuclides that are present in the environment, such as excess lead-210, caesium-137 and plutonium isotopes. In late 2020, a new GESAMP Working Group — initiated by the Agency and supported by the Intergovernmental Oceanographic Commission, the International Maritime Organization, the United Nations Environment Programme and the World Meteorological Organization — was established to focus on climate change and greenhouse gas related impacts on contaminants in the ocean.

FIG. 1. Oil spill reaching the coast of the Île aux Aigrettes, a small island off the coast of Mauritius of high ecological value. (Photograph courtesy of the Mauritian Wildlife Foundation.)

Mauritius Oil Spill Emergency Response to Assess Effects on Coral Reef Ecosystems and Seafood Safety

The Agency, at the request of the Government of Mauritius, initiated an emergency response to support activities to address potential environmental consequences of an oil spill along the country's coast (Fig. 1). After technical consultations, the Agency advised the Government of Mauritius to develop and implement a comprehensive long term programme to monitor the impacted coastal waters, sediment, biota and air. Each oil spill sample has a unique 'fingerprint' characterizing a mixture of chemicals that can potentially be toxic to marine life. These petroleum residues can be identified using specialized gas chromatography coupled with mass spectrometry. The procurement of dedicated laboratory equipment combined with specialized training of local staff will ensure that the national laboratories are capable of monitoring the oil spill in the marine environment and associated volatile organic compounds in the air, and of assessing their potential toxicological impacts. Many of these contaminants, like polycyclic aromatic hydrocarbons, usually persist in the environment and can potentially be toxic to marine life and humans.

CASE STUDY

Agency Research Records Dramatic Increase in Microplastic Pollution in the Eastern Tropical Pacific Ocean

Eight million tonnes of plastic waste end up in the oceans each year, damaging ecosystems and wildlife. To help anticipate and better address marine pollution scenarios in the eastern tropical Pacific Ocean, scientists from the Agency and Ecuador have completed a decade long study of plastic particle abundance in the country's coastal waters.

The eastern tropical Pacific is home to some of the world's most unique marine reserves, including Cocos Island in Costa Rica, the Galapagos Islands in Ecuador and the Coiba National Park in Panama — all on the World Heritage List. This research has revealed that microplastic pollution in the eastern tropical Pacific is set to continue to increase in the coming decades. Plastic particles below 5 mm in length — called microplastics — can be consumed by marine organisms and thus make their way to the food chain.

The amount of microplastics in the region is expected to increase by some 3.9 times by 2030 compared with 2008 levels. By 2050, it could almost double again, rising by 6.4 times compared with 2008 levels. And by 2100, the amount of plastics in the ocean is projected to be more than ten times higher than in 2008, unless action is taken to change this trajectory.

One of the crucial findings of this study, published in 2020, is that the change in the microplastic abundance over time increases systematically and identically at all the sampling sites. This implies that the source of microplastics pollution is not local, but rather regional and maybe even global in scale.

Plastic waste on the Galapagos coast. Sunlight, wind and waves break down large plastic debris into smaller and smaller pieces to become microplastics. In addition, some very tiny pieces used as exfoliants in the health and beauty industry and synthetic fibres from clothes are contributing to microplastic pollution.

"It is sad but not surprising to see such a steep increase of microplastic abundance in the region," said Rafael Bermúdez Monsalve, Investigator Scientist from Ecuador. "This data is crucial for the understanding of future oceanic scenarios, and such studies can help policy makers on the implementation of adequate plastic life cycle management."

Plastics are by design tough and resistant to degradation and have been found even in the deepest marine trenches. In our oceans, plastic fragments are broken down continuously by ultraviolet light, by the corrosive nature of seawater and by the constant physical erosion due to waves and shear. This continuous degradation supplies a stream of tiny micro and nano-sized plastic particles that can be consumed by marine organisms and introduced into the food chain.

Some of the particles have been found to travel as far as 10 000 kilometres in the Pacific Ocean, polluting pristine waters around the Galapagos Islands.

"As we continue to develop our research on marine plastics, nuclear and isotopic techniques are playing a particularly important role in advancing both the science and knowledge on the subtle, sustained impacts of microplastic pollution in the marine realm," said Peter Swarzenski, Head of the Agency's Radioecology Laboratory.

By using radiotracers such as carbon-14, Agency researchers study how pollutants 'attach' themselves to microplastics in the environment and whether they can dissociate or 'detach' from these plastics when ingested by marine animals. Agency researchers also use radiotracers to study the movement and fate of microplastics within the animals to understand how exactly these are taken up.