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 enhance the capability to develop strategies for the sustainable management of terrestrial, marine and atmospheric environments and their natural resources in order to address effectively and efficiently their environment related development priorities.

Support in Radiological and Nuclear Emergencies

The sustainable management of environmental resources requires fact based policies firmly rooted in scientific knowledge and reliable data. Nuclear analytical techniques can be used to monitor environmental contaminants such as radionuclides, toxic trace elements and persistent organic pollutants (POPs), but it is the quality of laboratory analyses that ultimately determines the reliability of results. In 2019, the Agency's proficiency tests enabled over 600 analytical laboratories in more than 70 Member States to assess the quality and reliability of their results on radionuclides and trace elements in the environment (Fig. 1).

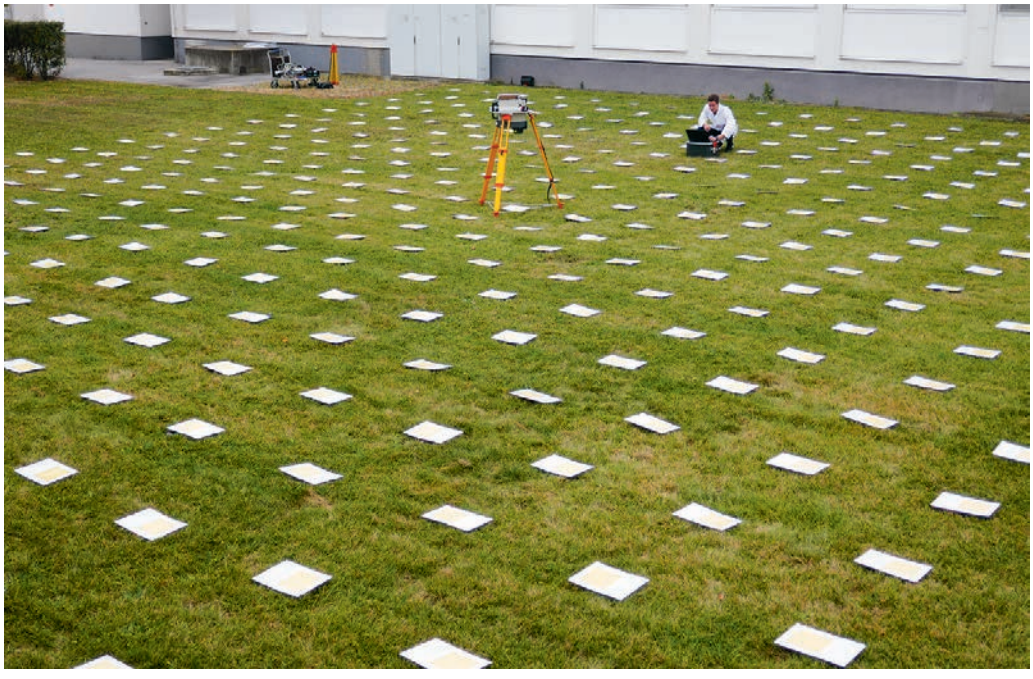

FIG. 1. Field calibration of gamma spectrometers using a novel technique of imprinting paper sheets with radionuclides; the technique, developed at the Agency, is now also used for proficiency testing.

During a radiological or nuclear emergency, many environmental samples — composed of unknown and unquantified mixtures of contaminants — need to be analysed in a very short time to support rapid emergency response decisions. The reliability of these data is critical, as their use could lead to decisions that may have significant socioeconomic implications and that may affect the well-being of humans and the environment. In an emergency, laboratories may face exceptional challenges. Adapted methodologies — from sample collection and preparation for testing to results analysis and reporting — are required to ensure rapid analysis. The Agency's worldwide network of Analytical Laboratories for the Measurement of Environmental Radioactivity (ALMERA), currently comprising 186 laboratories in 89 Member States, participated in the development and validation of rapid analysis methods. Through training, proficiency testing and coordination, the Agency supports ALMERA to develop and maintain excellence in the rapid reporting of reliable measurement results in the case of a nuclear or radiological emergency. In 2019, 106 ALMERA laboratories took part in an intercomparison exercise for fast and reliable screening of radionuclides on airborne particles, helping to refine atmospheric transport models.

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The IAEA Environment Laboratories designed and carried out a series of challenging proficiency tests to support the reliability of worldwide radionuclide measurements reported by laboratories during hypothetical radiological or nuclear emergencies, including an unprecedented integration of a test into a Level 3 Convention Exercise (ConvEx-3). The test samples used corresponded to typical emergencies that laboratories might face, including testing for a series of short-lived fission radionuclides and activation products that could be released to the environment from a damaged nuclear reactor. Over 450 laboratories participated in this series of tests. The test responses highlighted the need for further targeted testing, and led to the development of several training courses and workshops, held in 2019, that addressed gaps identified by Member States, including sampling, laboratory based analytical techniques and in situ measurements.

Understanding Our Oceans

The ocean currently contains a broad spectrum of plastic particles whose impact is still mostly unknown. Plastic particles are exposed to the corrosive force of seawater and release a suite of co-contaminants, such as plastics additives or select organics and trace elements. Isotopic and nuclear techniques are being developed at the IAEA Environment Laboratories in Monaco to reliably assess the environmental consequences of marine plastic particles. Current research activities are focused on studying the transport and fate of marine plastics in coastal and marine ecosystems and the secondary effects from sorbed co-contaminants (Fig. 2).

The IAEA Environment Laboratories are also developing new analytical procedures for Member States to extract and measure plastic-derived contaminants. In one experiment, corals showed an adverse effect when exposed in a laboratory setting to microplastic particles commonly found along most beaches (Fig. 3). Laboratory experiments that examine the cumulative effects of complex multi-stressors such as ocean warming, ocean acidification and marine plastics can accurately simulate processes that occur in nature. Such data can provide meaningful information to resource managers tasked with developing science based decisions to protect marine ecosystems.

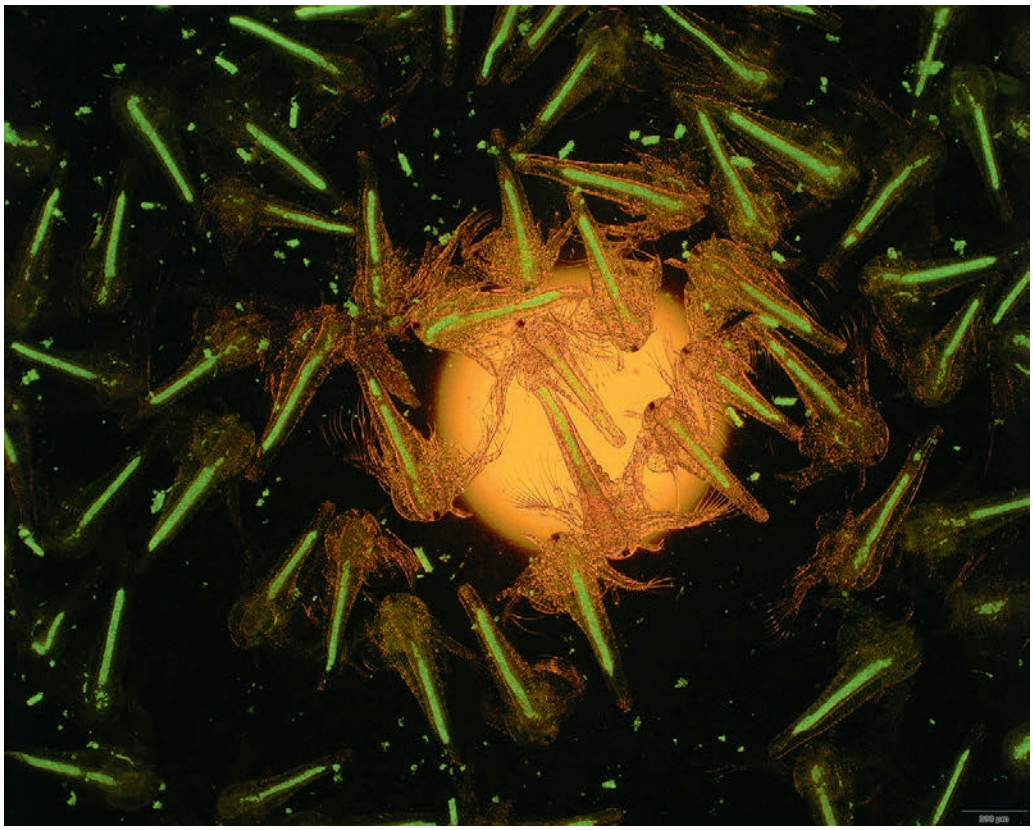

FIG. 2. Fluorescent microplastic particles line the stomach of artemia (small aquatic crustaceans) that are used as food for fish in experimental exposure studies.

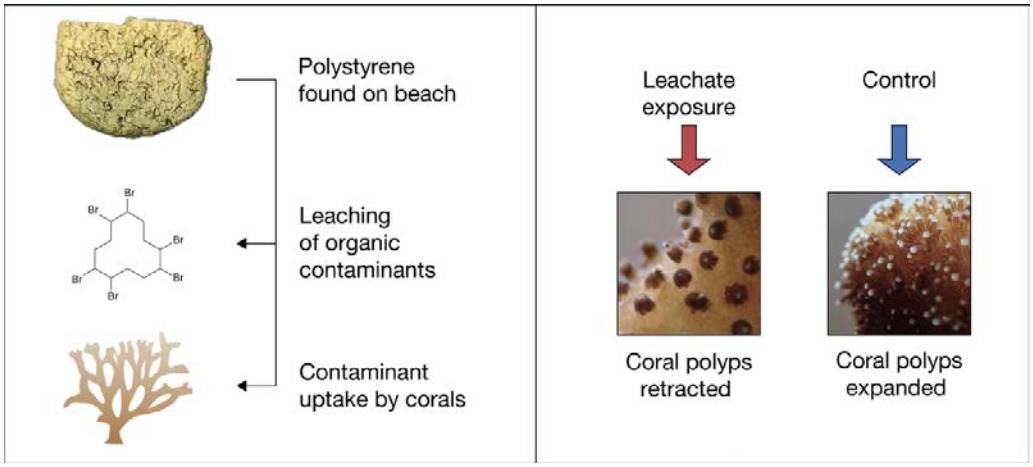

FIG. 3. Some organic contaminants leached out of strongly weathered polystyrene found on beaches cause coral to retract their polyps.