

Active substances are under the spotlight

Industry has conducted a myriad of laboratory tests into how active substances interact with the environment

Several popular ballast water treatment (BWT) systems use active substances such as chlorine. But these substances pose a risk to the environment unless they are effectively neutralised.

The Netherlands-based Institute for Marine Resources and Ecosystem Studies (Imares) has carried out research into the risks that they pose. Andrea Sneekes, project leader on ecotoxicology at Imares, explained that IMO guideline G9 on testing of BWT systems using active substances assesses the ecological risk to the receiving environment.

This assessment is based on the results of bioassays, biological tests in which an organism is exposed to a concentration series of a substance or to whole effluents (WET-testing). Since species vary in sensitivity to toxicants, the guideline prescribes that different trophic levels of organisms such as algae, crustaceans and fish should be used for these bioassays to assess the potential risk of treated ballast water in the receiving water.

Standard laboratory tests used in the approval process are limited, however, because they only take into account a few test species and conditions. This shortcoming resulted in development of guidance for multispecies tests in experimental ecosystems, called mesocosms.

Current procedures for multispecies testing are based on the addition of small amounts of a substance from a stock solution. The volume added is negligible compared with the total volume of a mesocosm. To achieve realistic testing of the discharge of a ballast water management system, the active substance, or by-product, is already diluted in the water. A large volume must be added, causing significant dilution of the community in the mesocosm. This dilution is



Andrea Sneekes (Imares) sampling in the mesocosms

an effect in itself, but a distinction should be made between this and the effect of the active substance.

Imares has started to develop procedures for testing in stagnant marine mesocosms as part of the North Sea Ballast Water Opportunity Project. These procedures are aimed at addressing how to discriminate between the effects caused by replacement of a large proportion of the water in a test system and the direct effects of the active substance. They also seek to explain how predictive laboratory toxicity tests are of the effects of a discharge of treated ballast water on an experimental ecosystem.

Three treatment levels were created by treating sea water with Peraclean Ocean, five days (BW-d5) and one day (BW-d1) prior to dosing and directly before dosing (BW-d0). This treated 'ballast water' was used to replace 10 per cent of the water in the mesocosms. As the active substance, peracetic acid was rapidly broken down, significant effects were expected following the application of BW-d0 water, less significant ones following BW-d1 water, and none following BW-d5 water.

Imares concluded that replacement of water without remaining active substances is not free from effects, but these dilution effects can be separated from direct toxic effects. However, the effects seen in bioassays are not directly copied in mesocosms. Results might be affected by increased food availability, species interactions and recovery processes. **BWTT**