

MARINE RISK ASSESSMENT



What is risk and how is it assessed?

Risks associated with the use of any chemical are determined by the substance's hazard properties—adverse effects caused through exposure. Risk assessment is a systematic process to assess the properties of a chemical for their potential to cause adverse effects; quantities at which these adverse effects are not triggered (Predicted No Effect Concentrations or PNECs), and the likely exposures (Predicted Environmental Concentrations or PECs) resulting from production, use and disposal of the substance.

The types of hazard investigated, usually through laboratory tests, range from short-term (2-4 days) acute ecotoxicity tests on standard organisms such as fish, waterflea and algae to longer-term (2-4 weeks) chronic tests. Occasionally longer-term multi-species tests are done, for example microcosm (aquarium with sediment layer) or mesocosm (pond or artificial stream) studies.

Generally if a 'PEC' is greater in value than a 'PNEC' for a substance, the risk assessment concludes that exposure to the chemical can cause adverse effects. More detailed studies are then required to refine the assessment or introduce management measures to reduce risks to an acceptable level. These range from improved handling to restrictions or substance bans.

The methodology for carrying out risk assessments has been developed and established through international bodies including the European Union (EU) and the Organisation for Economic Co-operation and Development (OECD). It can be used as the basis to assess risks across a range of scenarios or for specific applications of a substance. In the past, the main focus has been on the inland environment considered at risk from urban or industrial development. However, EU authorities in cooperation with the OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic have argued that the marine environment is particularly sensitive to chemical substances.

This publication reviews the regulatory aspects and the scientific implications of marine risk assessments.

Regulatory aspects

The authorities list the following reasons for specifically carrying out marine risk assessments:

- To assess the impacts of chemicals entering marine environments, either directly from factory emissions or use of a chemical at sea, or indirectly from inland discharges of a substance transported to the sea via rivers or air.
- To support regulations and regulatory bodies that focus on the marine environment, such as the Strategy on Hazardous Substances of OSPAR.

The EU Technical Guidance Document (TGD) for risk assessment was revised in 2003 to try and update the EU requirements for risk assessment whilst recognising the objectives established by the OSPAR Strategy on Hazardous Substances. According to the TGD, this has resulted in 'new approaches that were elaborated

based on a sound scientific understanding of the problems and taking account of the precautionary principle.'

Scientific implications

The TGD identified the accumulation of hazardous substances as the main specific concern for the marine environment. It claimed that the effects of accumulation are unpredictable in the long-term and that these would be difficult to reverse.

Additionally there is concern that the remote areas of oceans should remain untouched. Principally such concerns are related to chemicals considered as Persistent, Bioaccumulative and Toxic* (PBT). The TGD also suggests that if risks based on 'PEC' and 'PNEC' cannot be properly derived, a qualitative risk characterisation should be conducted.

The scientific basis of these concerns is heavily disputed. The EU Scientific Committee on Toxicity, Ecotoxicity and the Environment (CSTEE), for example, issued a critical review of the TGD marine risk section. In contrast, with the TGD the CSTEE states it is possible to carry out risk assessments on substances for the marine environment as well. These should be carried out irrespective of the intrinsic properties of the substance and the environment likely to be exposed.

Euro Chlor shares CSTEE's opinion that the PBT approach is not risk based. It should, therefore, not be part of the TGD risk assessment methodology. Both organisations recognise however, that the PBT approach could be a useful tool for prioritisation, provided a number of scientific shortcomings are resolved. CSTEE highlights the inadequacy of bioconcentration measurements which do not take account of the oral uptake route, essential for *bioaccumulation**. The committee also concludes that current biodegradation tests are inadequate to determine the kinetics needed to decide whether a substance meets *persistence* criteria.

For the risk assessment methodology, the CSTEE explicitly states that there are no scientific grounds to assume a different sensitivity for toxicants between freshwater and marine organisms. The TGD claims a higher sensitivity of marine organisms and introduced larger safety factors in the PNEC derivation to take this into account.

Euro Chlor marine risk assessments

Whilst the official methodology for conducting marine risk assessments is only now (2003) being finalised, considerable practical experience has been gained by the scientific community in the past. For example scientists working for Euro Chlor have conducted risk assessments for the marine environment for 23 chlorine industry related chemicals. The methodology applied by Euro Chlor followed a pragmatic approach by using ecotoxicity data for both freshwater and marine organisms. Monitoring data was used for the exposure assessment. The results of these risk assessments can be found at www.eurochlor.org.

Further reading: <http://ecb.jr.it/tgdoc> (revised TGD, 2003)

*: Key Science Information Sheets (KSIS) are available on various topics, including PBTs and POPs (Persistent Organic Pollutants) and bioaccumulation.

KEY SCIENCE INFORMATION SHEET

Fifth information sheet in a series Euro Chlor is publishing to improve understanding by non-scientists of scientific issues. Each publication focuses on health or environmental aspects of the production, use and disposal of chlorine and its derivatives. *MARINE RISK ASSESSMENT* can be found on the <http://www.eurochlor.org> where subsequent information sheets will be posted as and when they become available.