

Development of Guidance for Terrestrial Effects Assessment

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Within the OECD Chemicals Programme, priority has till recently been given to the development and harmonisation of strategies for the assessment of hazard and risk of chemicals in the aquatic environment, resulting in a Guidance Document for Aquatic Effects Assessment (Balk et al. 1993). The OECD Hazard Assessment Advisory Body (HAAB) has initiated the development of similar strategies for the terrestrial environment, and - with the aim of promoting discussions within the OECD member countries - a discussion document has recently been prepared (Samsøe-Petersen & Pedersen 1994).

Environmental effects assessment is part of environmental hazard and risk assessment of chemicals - the other part being exposure assessment. The aim of hazard and risk assessments is to protect the ecological structure and function of the environment as well as certain "key" species, which may be defined by ecological, commercial or conservational interests. In aquatic hazard and risk assessment, this aim is achieved by the calculation of a "Predicted No Effect Concentration" (PNEC) in the water, which is compared to the "Predicted Exposure Concentration" (PEC) in order to reach a "risk quotient" (PEC/PNEC), which can be used for an evaluation of the environmental concern for each chemical. The PNEC is most often derived from results of laboratory toxicity testing by extrapolation methods, based on empirical or statistical considerations. The PNEC is not a "level, safe for all organisms", but merely an estimation of the possibility of protecting most of the species in the environment.

The principles of environmental effects assessment for the aquatic environment are applicable for the terrestrial environment as well, but because of differences between aquatic and terrestrial environments, several issues need consideration before a guidance for terrestrial effects assessment can be fully developed. These issues are the topic of the present discussion.

1. Prerequisites for terrestrial effects assessment

In aquatic environments the water phase will disperse and dilute chemicals resulting in a relatively homogenous - compared to the terrestrial environment - exposure of the organisms to the chemicals. In terrestrial ecosystems non-volatile

chemicals may stay - even in high concentrations - where they originally were released without being dispersed/diluted except through the action of wind, rain or living organisms. The fate and transport of volatile chemicals in terrestrial environments may be comparable to that of water soluble chemicals in aquatic environments.

While the primary exposure of aquatic organisms to chemicals is via the water, the exposure of terrestrial organisms is a combination of four routes: uptake from surfaces, (pore) water, (pore) air and food.

These differences imply that the foundation of procedures for effects assessment of chemicals in the terrestrial environment includes considerations concerning the relevance of terrestrial effects assessment for different types of chemicals as well as for different organisms. The relevance for chemicals is depending on the types of chemicals that will reach terrestrial environments, and which types and compartments of terrestrial environments they will reach. The relevance of terrestrial effects assessment for different organisms is depending on their place and way of living, which are determining their possibilities of exposure.

Furthermore, the choice and development of testing procedures must be considered, including the testing strategy, the choice of species and the standardisation of experimental conditions. Finally, the extrapolation methods for derivation of the PNEC must be considered.

2. The relevance of terrestrial effects assessment for different types of chemicals

2.1. Routes of emission of chemicals

The chemicals that may be released to and exert effects in terrestrial environments can follow aerial, aquatic or solid phase routes to the ecosystems. Most chemicals will arrive through several routes. Based on the character of the emission, the chemicals can be divided into two groups: those that are produced to be deliberately applied to the environment (the agricultural chemicals) and those that are not intended to reach the environment but are emitted as a consequence of different activities (the contaminants).

The primary differences between pesticides and other chemicals are basically due to differences in the patterns of use and release. Pesticides are designed to have toxic properties. They are produced and applied deliberately to the environment to exert toxic effects on living organisms, whereas industrial chemicals are designed, produced and used for quite different purposes and any toxic property they may have is - in most cases - unintended.

Chemicals contaminating the terrestrial environment via disposal of waste products or via deposition from the atmosphere have some features in common.