



## Protecting surface waters from combined effects of chemical contaminants

**Surface water is considered** to be of good ecological quality if the Maximum Permissible Concentrations (MPCs) of contaminants in the water are not exceeded. However, new research suggests that even when each individual contaminant does not exceed its MPC, water quality may be compromised by the combined effects of contaminants.

**MPCs are concentrations** of contaminants in water, above which the risk of adverse effects is considered unacceptable. They are typically chosen as the environmental quality standard for evaluating surface waters. However, MPCs are established for individual compounds and do not account for combined effects of chemical mixtures.

Supported by the EU project NoMiracle<sup>1</sup>, the researchers compared the MPCs of 23 pollutants (nine PAHs, seven metals and seven pesticides) found in Dutch surface waters by studying their individual and combined effect on water fleas exposed to the waters.

Models used to predict the effect of chemical mixtures on the survival of water fleas use the No Effect Concentration (NEC) instead of the more frequently used No Observed Effect Concentration (NOEC). Below the NEC there is no effect on survival even after lengthy exposure. The researchers compared the NECs for the survival of water fleas with the MPCs and the actual measured concentrations in water samples.

Overall, the study suggests that exceeded MPCs for some individual contaminants, such as some metals and pesticides, do not necessarily cause water fleas to die. However, due to the combined effects of chemicals, some mixtures of contaminants may lead to death even if individual MPCs are not exceeded.

Where there is a safe (i.e. large) margin between the NECs and MPCs, as was the case with the PAHs, the study suggests the MPCs provide adequate protection and slight exceedence of the MPCs would not lead to extinction of the water fleas population.

However, the differences between the NECs and MPCs for the metals and pesticides varied widely. For some, the difference was very small and even a slight exceedence of the MPC can result in the death of the water flea population. For example, the researchers calculated that waters containing the metal cadmium in concentrations close to its MPC, together with other metals found in typical concentrations, would cause water fleas to die within 30 hours after the start of the exposure, even though none of the MPCs had been exceeded.

As water fleas are not considered to be especially sensitive to the toxic effect of chemicals, the researchers suggest that if water flea populations can become extinct, other species might not be adequately protected by MPCs.

1. NoMiracle was supported by the European Commission under the Sixth Framework Programme, under the theme 'Global Change and Ecosystems'. See: <http://nomiracle.jrc.ec.europa.eu/default.aspx>

**Source:** Baas, J., Kooijman, B. (2010). Chemical contamination and the ecological quality of surface water. *Environmental Pollution*. 158:1603–1607.

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**Theme(s):** Biodiversity, Chemicals, Water, Risk assessment