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The Effect of Export to the Deep Sea on the Long-Range Transport Potential of Persistent Organic Pollutants

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Abstract

Background. Export to the deep sea has been found to be a relevant pathway for highly hydrophobic chemicals. The objective of this study is to investigate the influence of this process on the potential for long-range transport (LRT) of such chemicals.

Methods. The spatial range as a measure of potential for LRT is calculated for seven PCB congeners with the multimedia fate and transport model ChemRange. Spatial ranges for cases with and without deep sea export are compared.

Results and Discussion. Export to the deep sea leads to increased transfer from the air to the surface ocean and, thereby, to lower spatial ranges for PCB congeners whose net deposition rate constant is similar to or greater than the atmospheric degradation

rate constant. This is fulfilled for the PCB congeners 101, 153, 180, and 194. The spatial ranges of the congeners 8, 28, and 52, in contrast, are not affected by deep sea export. With export to the deep sea included in the model, the spatial ranges of the heavier congener are similar to those of the lighter ones, while the intermediate congeners 101 and 153 have the highest potential for long-range transport.

Conclusions. Transfer to the deep ocean affects the mass balance and the potential for LRT of highly hydrophobic chemicals and should be included in multimedia fate models containing a compartment for ocean water.

Keywords: Deep sea export; exposure modeling; long-range transport; multimedia model; PCBs; persistent organic pollutants (POPs)