Determination of BSAFs for freshwater fish and derivation of sediment standards for PCBs: a case study of the Rhone basin

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Introduction: The publication of guidelines for dioxins and related compounds in foodstuffs by the European Commission in 2006 [1, 2] prompted in France inventories of dioxins (PCDDs), furans (PCDFs) and polychlorobiphenyls (PCBs) contamination of freshwater fishes in rivers and lakes. Dioxin-like PCBs represent in fact most of the toxic load, and are well correlated to the sum of indicator-PCBs [3]. Fish consumption advisories were promulgated accordingly, in particular in the Rhone river basin, and relevant sediment quality guidelines (SQGs) for these compounds have been required as a component of a management plan. Most of the SQGs for PCBs available in the literature deal with the protection of benthic invertebrates from direct effects [4-6]. Their reliability for the protection of top predators, including fish consumers, is therefore at least questionable.

Methods: Tissue concentrations associated with adverse effects can be combined with site-specific biota-sediment accumulation factor (BSAF) to calculate sediment concentrations that would be expected to produce these effects [7]. Such an attempt was recently performed for the lake Ontario, on the basis of monitoring data [8]. Deriving SQGs accounting for bioaccumulation at a large spatial scale raises the question of BSAFs variability. We explore this variability in the Rhone basin, using the abovementioned fish contamination inventory and sediment monitoring data. Because these data sets were constituted independently, there is no obvious way to get fish-sediment data pairs, but site by site random bootstrapping in the respective sets.

Results: We will present the procedure developed in R-software and the resulting BSAFs distributions for 11 freshwater fish species. BSAFs are higher at sites where the current regulatroy threshold for fish consumption (8 or 12 pg TEQ.g^{-1} wet weight) is exceeded. SQGs proposals can be derived accordingly, using this information and the relationships among PCB congeners, and among the fish content in terms of indicator-PCBs and the dioxin toxicity equivalent (TEQ) content [3].

Discussion: We will discuss the sources of BSAFs variability, and their respective implications for SQG derivation.

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