



Derivation of environmental risk limits for polycyclic aromatic hydrocarbons (PAHs) based on internal residues

- Aquatic, benthic, and terrestrial toxicity data for PAHs (16 PAHs) were evaluated
- Toxicity data were expressed as estimated internal residues by equilibrium partitioning
- Risk limits were calculated based on internal residues
 - No differences between aquatic, benthic, or terrestrial species if expressed as internal residues
 - These results obtained by equilibrium partitioning support measuring dissolved water concentrations in all compartments

Objective

- Derivation of environmental risk limits for polycyclic aromatic hydrocarbons

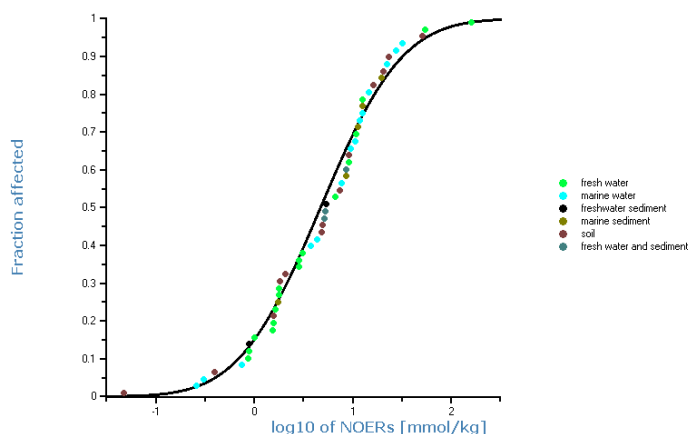
Methods

- More than 250 studies on ecotoxicity of 16 individual PAHs were evaluated
- Reliable data for aquatic, benthic and terrestrial species were selected
- Concentrations were translated to estimated internal residues
 - Organic carbon-water partition coefficients to calculate pore water concentrations
 - Membrane-water partition coefficients to calculate membrane lipid concentrations
 - Both PAH specific and dependent on $\log K_{ow}$
- Species mean internal residues were calculated
- Species sensitivity distribution (SSD) with internal residues (NOER or ER10) was performed
 - Hazardous concentrations to 5 or 50 percent of the species (HC5 or HC50) were calculated

Results

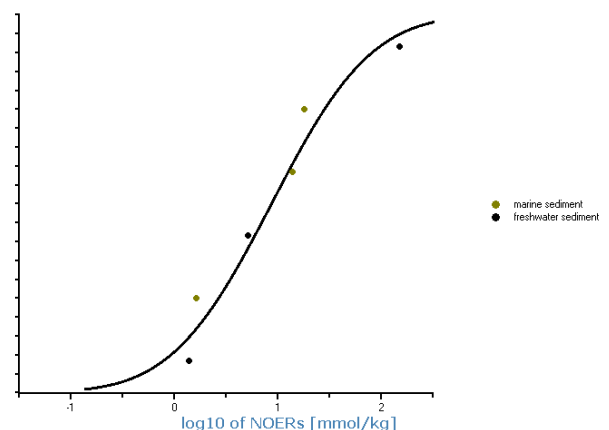
- Reliable data for 54 species
 - 17 (20) in freshwater, 14 in saltwater, 5 in freshwater sediment, 5 in saltwater sediment, 13 in soil
 - 10 taxonomic groups
- Toxicity data expressed as internal residues fit very well to a log-normal distribution for all species
 - Goodness-of-fit accepted at all levels by all tests
 - No significant differences observed between any of the 5 subsets for the different compartments
 - No apparent differences between individual PAHs
- SSD for PAHs resembles that of total petroleum hydrocarbons (TPH)
- According to the guidance document for deriving EQS (TGD-EQS) an assessment factor of 1-5 should be applied to the HC5 of chronic data: Factor of 5 needed to account for high acute toxicity due to phototoxicity

Polycyclic aromatic hydrocarbons (PAHs)



Verbruggen EMJ. 2012. RIVM report 607711007/2012
Available from www.rivm.nl

Total petroleum hydrocarbons (TPH)



Verbruggen EMJ, Beek M, Pijnenburg J, Traas TP. 2008.
Environ Toxicol Chem 27: 2436-2448.

Conclusions

- Method is less conservative and more coherent than applying assessment factors for individual PAHs
- Environmental risk limits were calculated for each compartment and each PAH by applying equilibrium partitioning in the reversed way
 - HC5/AF and HC50 serve different protection goals
- PAHs seem to have similar effect concentrations on internal residue basis: concentration addition should be applied
 - Comparable to total petroleum hydrocarbons
- Toxicity of PAHs is driven by bioaccumulation from the aqueous phase:
 - Monitoring could focus on measuring dissolved (pore)water concentrations