

. ESTUARINE IMPACTS OF PAHS: AN INTEGRATED RISK ASSESSMENT

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Predicting the significance and effects of polycyclic aromatic hydrocarbons (PAHs) in aquatic receiving waters requires an integrated approach to understand sources, mass loads, fate and linkages with potential biological responses. Sediment concentrations of PAHs in urban estuaries and harbours are expected to increase with continuing urban development. However, the presence of strong modifiers of bioavailability, such as soot carbon, may markedly affect predictions for adverse effects thresholds. A case study for integrated assessment in the Auckland, New Zealand estuarine environment is presented. Presently, sediment PAH concentrations already exceed existing sediment quality guidelines in many locations. Nevertheless, PAH accumulation in benthic macrofauna (as observed in shellfish ("musselwatch") biomonitoring, for example) can often be several orders of magnitudes less than predictions based on equilibrium partitioning between pore waters and the fraction of sedimentary organic carbon (SOC). Recent evidence has shown that bioavailability of combustion-derived (pyrogenic) PAHs can be significantly lower than that of petroleum-derived PAHs. We have compared the extractability of PAHs from a variety of natural and man-made organic carbon matrices, using extraction with dichloromethane and sodium dodecylsulfate (SDS, used to mimic conditions of the digestive tracts of deposit feeding macrofauna). This showed PAH extractability to differ by nearly two orders of magnitude depending on organic carbon matrix. Only 15% of the PAHs in field-collected sediments were extractable by mild SDS solutions, suggestive of poor bioavailability to digestive uptake by benthic biota.

Risks to water column-dwelling species, particularly early life-stage larvae, are increased by UV photoactivation of PAH toxicity. These findings have significant implications for understanding bioavailability, interpreting biomonitoring programs and for the implementation of urban storm water mitigation programs.