SCCWRP #0259

Sources and Magnitude of Bias Associated with Determination of Polychlorinated Biphenyls in Environmental Samples

Robert P. Eganhouse[1], and Richard W. Gossett[1]

[1]*Southern California Coastal Water Research Project, Long Beach, CA*

ABSTRACT

Recently complied data on the composition of commercial Aroclor mixtures and ECD (electron capture detector) response factors for all 209 PCB congeners are used to develop estimates of the bias associated with determination of poly chlorinated biphenyls. During quantitation of multicomponent peaks by congener-specific procedures error is introduced because of variable ECD response to isomeric PCBs. Under worst case conditions, the magnitude of this bias can range from less than 2% to as much as 600%. Multicomponent peaks containing the more highly and the lower chlorinated congeners experience the most bias. For this reason, quantitation of Σ PCB in Aroclor mixtures dominated by these species (e.g. 1016) are potentially subject to the greatest error. Comparison of response factor data for ECDs from two laboratories shows that the sign and magnitude of calibration bias for a given multicomponent peak is variable and depends, in part, on the response characteristics of individual detectors. By using the most abundant congener (of each multicomponent peak) for purposes of Calibration, one can reduce the maximum bias to less than 55%. Moreover, due to cancellation of errors, the bias resulting from summation of all peak concentrations (i.e. ΣPCB) becomes vanishingly small (<1.3%). In contrast, bias associated with determination of ΣPCB as Aroclor equivalents by the traditional Aroclor method is potentially large (>200%) and highly variable in sign and magnitude. In this case, bias originates not only from the incomplete chromatographic resolution of PCB congeners but also the overlapping patterns of the Aroclor mixtures. Together these results illustrate the advantages of the congener-specific method of PCB quantitation over the traditional Aroclor Method and the extreme difficultly of estimating bias incurred by the latter procedure on a post hoc basis.