

Evaluation of Three Measures of Exposure Concentration: A Case Study of Surface Sediment Concentrations in the Passaic River

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ABSTRACT

Arithmetic and lognormal means historically have been used as estimates of exposure concentration for both human health and ecological risk assessment. Past risk assessment guidance has emphasized the need to include all available information, particularly regarding the spatial and temporal aspects of data and exposure. One estimate of exposure concentration that includes spatial information is the 95% upper confidence limit (UCL) of the area-weighted mean. An area-weighted mean is calculated using weightings based on the ratio of the area associated with a sample location and the total area of the study area. Currently, U.S. Environmental Protection Agency (USEPA) risk assessment guidance recommends the use of the 95% UCL of the arithmetic mean as the most appropriate measure of exposure concentration for soil and sediment in human health and ecological risk assessments. The purpose of this study was two-fold: (1) to evaluate the use of the 95% UCL of the area-weighted mean vs. the 95% UCL of the arithmetic mean for the lognormal distribution and the normal distribution using a large data set from a recent riverine sediment characterization study, and (2) to evaluate the potential associated with the different approaches for reduction in surface sediment exposure concentrations for 2,3,7,8-TCDD and coplanar polychlorinated biphenyls (PCBs) for several subsets of the data. The results of this evaluation indicated that there was no significant reduction in exposure concentrations of the study area surface sediments after any of the selected higher concentration data points had been removed from the various data subsets. In addition, this evaluation indicated that, due to its dependence on the variance of the data, the 95% UCL of the arithmetic mean for a lognormal distribution produced subset exposure concentrations that were higher than the calculated concentrations of the full data set and produced the smallest percent changes in concentration compared to the other two measures.