Advanced Statistical Tools for Estimating Wildlife Exposure. Dwayne R.J. Moore, The Cadmus Group, Inc., 411 Roosevelt Ave., Suite 204, Ottawa, Ontario. K2A 3X9. Tel: 613-761-1464. Fax: 613-761-7653. email: dmoore@cadmusgroup.com

In many Superfund and other contaminated sites in the United States, tissue residue or other environmental media data have been collected for use as inputs to exposure models for wildlife predators. There are several questions, however, that must be answered before contaminant levels data can be used to derive deterministic or probabilistic estimates of exposure:

- *Do the contaminant levels in the dataset represent the levels to which predators are exposed?* Often sampling programs are targeted to the most contaminated areas (e.g., to help delineate areas requiring remediation). Wildlife predators may, however, 'sample' the environment in a quite different way (e.g., avoiding contaminated areas or foraging preferentially in other habitats). In such cases, exposure estimates based upon the raw contaminant levels data would likely be highly inaccurate. Spatial and habitat weighting techniques are available to 'correct' the contaminant levels data and ultimately develop more reliable exposure estimates for wildlife predators. Several such techniques will be briefly described in this presentation.

- *Is the dataset adequate to confidently estimate exposure?* Because of budget and other limitations, datasets on contaminants levels in water, soil, sediment or tissues are often small or otherwise compromised (e.g., datasets with high proportions of non-detected values). The estimates of centrality or variability for contaminant levels will be uncertain with small datasets. This uncertainty can be numerically expressed and carried through to the exposure estimates using probabilistic techniques that separate variability and uncertainty. For example, higher-order techniques such as second-order Monte Carlo analysis and probability bounds analysis can be used to determine the relative importance of variability and uncertainty. In second-order Monte Carlo analysis, every replication is itself a result of a separate Monte Carlo analysis. This type of nested simulation has been used to explore the effect of uncertainty about the parameters used to define the input distributions (e.g., means and standard deviations for tissue residue levels) in exposure analyses. Probability bounds analysis represents an uncertain input distribution with an entire class of probability distributions that conform to the available empirical information about the variable. These techniques will be illustrated with a simple case study in the presentation. The major strengths of both techniques are their ability to: identify the most important and reducible sources of uncertainty and to express analyst confidence about exposure predictions.

A variety of other statistical techniques are available to deal with other issues that commonly arise in wildlife exposure assessments, e.g., random walk models to account for spatial and temporal averaging of exposure by wildlife predators. These techniques will be briefly touched upon in the presentation. The ultimate goal of using the above and other statistical techniques to manipulate input data is to improve the reliability of our exposure estimates and ultimately our ability to define which areas require remediation and to what level.