

Regulatory Science: Correctly Analyzing Censored Toxic Chemical Concentration (Newsletter)*

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Toxic metals and organics commonly occur in very low concentrations in water, sediments, soils, and rocks. These concentrations are so low they cannot be quantified by analytical chemists and today's instruments. Censored data are commonly mis-analyzed with potential costly, unnecessary, or harmful results. EPA regulations and guidelines often tell data analysts to ignore (drop) censored data or substitute an arbitrary value. The results of dropping or substituting arbitrary values are wrong. Policies and regulations based on these wrong analyses can result in environmental and economic harm.

Statistical methods to correctly analyze data sets containing censored values are readily available. These methods are used to describe and summarize data sets, compare 2 or more temporal or spatial data sets, evaluate associations (correlations), quantify cause and effect (regression), and determine trends over time. Correctly analyzed, the results are technically sound and legally defensible. There is no reason not to apply these statistical models to all data types: binary, ordinal, or measured concentrations.

Understanding how to identify valid from invalid geochemical data analyses is explained in non-technical language (no math or environmental science involved) in the white paper, "Censored Geochemical Data Analysis for Non-Scientists" available for downloading and reading from the library page on the Applied Ecosystem Services' web site, [www \[dot\] appl-ecosys \[dot\] com](http://www.appl-ecosys.com).

The paper contains many comparisons of incorrectly and correctly analyzing censored data. These include correctly summing congener toxicity equivalent concentrations (TECs) to obtain a total TEC for a class of compounds such as polychlorinated dioxins, furans, and biphenyls as part of a Superfund ecological risk assessment (ERA), determining whether trichlorethylene (TCE) concentrations in shallow ground waters differ in areas of low, medium, and high residential housing densities, and comparing zinc (Zn) concentrations in ground waters from two different areas of the San Joaquin Valley.

It is important for all consumers of analyzed geochemical data to be able to identify when reports use incorrect methods and have confidence in knowing

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there are multiple options for selecting a statistical method that will answer any question asked of geochemical data.

Correctly analyzing censored geochemical data is a component of sound regulatory science.

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