

# Appropriate Incorporation of Chemical Information in a Best Professional Judgment • Triad • Weight of Evidence Evaluation of Sediment Quality

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# Abstract

There is increasing support for the use of a best professional judgment, non-numeric, triad weight of evidence approach for evaluating aquatic sediment quality. This approach is based on an integrated use of sediment toxicity/source of bioaccumulatable chemicals, organism assemblages, and chemical information to determine the potential for constituents in sediments to be adverse to the beneficial uses of the waterbody in which the sediments are located. This triad approach is a far more reliable approach for evaluating whether a chemical constituent(s) associated with a sediment is adverse to sediment/water quality than a chemical-specific numeric sediment quality guideline. Significant problems occur, however, with the use of this approach by some in incorporating chemical information into the triad. The use of total concentrations of constituents and/or the exceedance of a co-occurrence-based so-called "sediment quality guideline" is technically invalid. Such an approach can distort the triad sediment quality evaluation because it incorporates information into the triad that is not related to the impact of the chemicals on aquatic life-related beneficial uses. The chemical information that should be used in a triad evaluation includes the chemical forms and concentrations of the constituents of concern in the sediments that can be adverse to aquatic life or that can lead to bioaccumulation. Sediment TIE information and information about the source of bioaccumulatable chemical should be used as a chemical component of a triad.

# Unreliable Approach for the Use of Chemical Information in a BPJ Triad WOE

- Total Concentrations of potential pollutants  
For many chemicals only part of the total concentration is bioavailable/toxic
- Co-occurrence-based “sediment quality guidelines” technically invalid approach for assessing the water quality impacts of chemicals in sediments
- Incorporating chemical information that is not related to impacts on aquatic life distorts the WOE BPJ leading to unreliable results
- Only chemical information that is related to impacts on aquatic life (cause of toxicity and the concentrations of toxic components) and the concentrations of bioavailable/bioaccumulatable forms of chemicals should be used as the chemical information in a BPJ WOE

## Examples

### State of California Bay Protection and Toxic Cleanup Program (BPTCP)

Used total concentrations and co-occurrence based guidelines values to identify the cause of toxicity and the potential source of chemicals in sediments

### Santa Monica Bay Estuary Program

Used the exceedance of a co-occurrence based lead value in Santa Monica Bay sediments to justify spending 40 million to control lead and other heavy metals in Santa Monica Bay watershed stormwater runoff

### US EPA National Sediment Quality Inventory

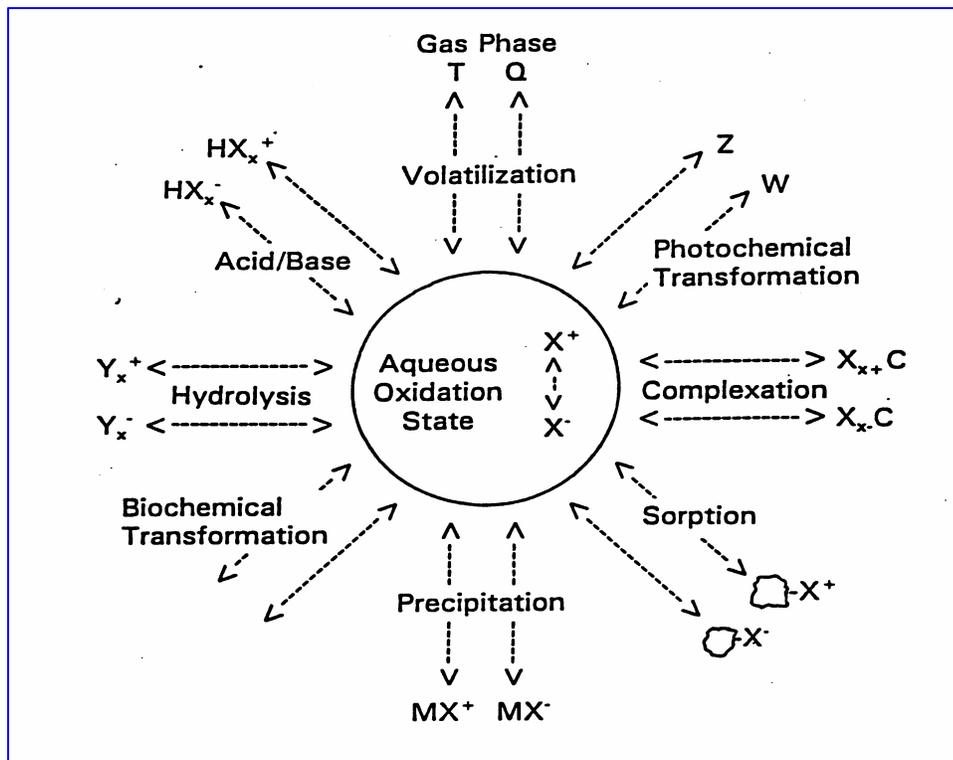
Used co-occurrence based values to report to Congress on the quality of the nation's aquatic sediments

### US EPA Region 9 Sediment TMDL Goal for Upper Newport Bay Sediments

Established as a goal for controlling excessive bioaccumulation of organochlorine "legacy" pesticides and PCBs co-occurrence based sediment quality guidelines for the critical concentrations of DDT, Chlordane, and PCBs in upper Newport Bay sediments

- Hundreds of millions of dollars could be spent unnecessarily in sediment remediation projects based on technically invalid use of chemical information in sediment quality evaluation

- Real, significant sediment problems could be missed because of not using biological effects-based approaches for evaluating sediment quality



Many Chemicals Exist in Aquatic System in Several Chemical Forms

Only Some of the Forms Are Toxic/Available

“Hub” Total Concentrations Not Reliable to Predict Water Quality Impacts

Must Work with “Rim” Chemical Species in BPJ WOE Evaluation of Sediment Quality

## Fundamental Background Issues

- Aquatic sediments are sinks (reservoirs) for a number of potential pollutants of water quality concern.
- Total concentrations of a chemical are not reliable for estimating the water quality impacts of sediment-associated chemicals.
- Co-occurrence-based sediment quality guidelines are technically invalid and unreliable for this purpose.
- Measured sediment toxicity is not interpretable in relation to the impact of toxicity on beneficial uses of waterbodies.
- Recommend use of non-numeric, best professional judgment (BPJ) triad weight of evidence (WOE) sediment quality evaluation.
  - Aquatic organism toxicity using a suite of sensitive test species
  - Integrated use of aquatic organism assemblages  
Reference stations; habitat
  - Gradient analysis from potential pollutant sources or "hot spots"
  - Chemical information  
TIEs to identify the cause of toxicity and to assess the concentration of toxic components  
Source of bioaccumulatable chemicals

## **Do Not Attempt to Use Numeric Weight of Evidence Approaches**

Numeric weight-of-evidence approaches, in which arbitrary scale factors are assigned to each of the three components of the triad, should not be used.

Such approach is technically invalid, since the arbitrary scaling that is used for characterizing each of the parameters bears no relationship to the significance of the magnitude of each of those factors in relating the presence of a chemical constituent in a water or sediments and its impact on the water quality-beneficial uses of a waterbody.

## **Implementation of BPJ WEO**

Best professional judgment weight-of-evidence should be based on the consensus of a panel of experts

Experts consider the information available, define what additional information is needed, and then render an opinion as to the integrated assessment of the information available on the significance of a particular chemical constituent in impacting the beneficial uses of a waterbody, in public, interactive, peer-review process.

Full public interactive peer review integral to process

Multiple public review sessions

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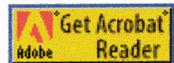
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Dr. G. Fred Lee and Dr. Anne Jones-Lee have prepared professional papers and reports on the various areas in which they are active in research and consulting including domestic water supply water quality, water and wastewater treatment, water pollution control, and the evaluation and management of the impacts of solid and hazardous wastes. Publications are available in the following areas:

- [Landfills and Groundwater Quality Protection](#)
- Water Quality Evaluation and Management for [Wastewater Discharges](#), [Stormwater Runoff](#), [Ambient Waters](#) and [Pesticide](#) Water Quality Management Issues, TMDL Development, Water Quality Criteria/Standards Development and Implementation
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