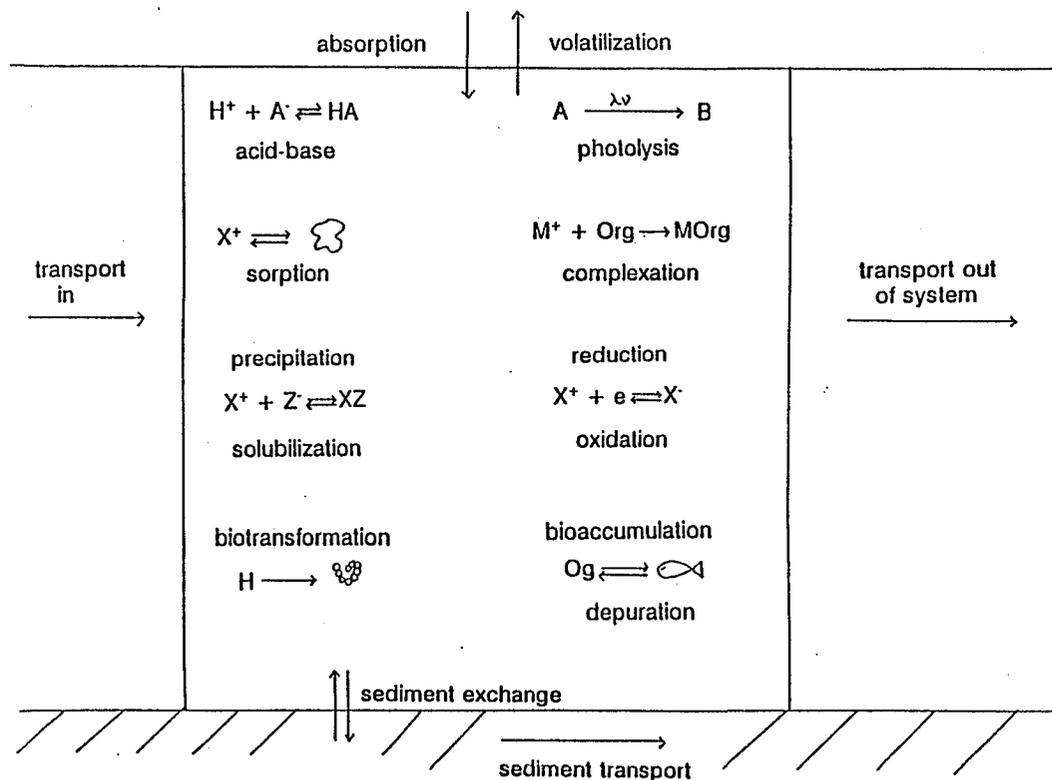




MINTEQA2/PRODEFA2, A Geochemical Assessment Model for Environmental Systems: Version 3.0 User's Manual



Factors Affecting Toxicity of Chemical Contaminant to Aquatic Organisms ◀ *Water Characteristics* ▶

Constituents in Water Can Affect Toxicity of Certain
Chemicals

- Hardness
- Alkalinity
- Suspended Solids & Colloids
- Organics

Tend to Reduce Toxicity of Chemical Contaminants

Water Quality Modeling ◀ *Water Quality vs. Water Chemistry* ▶

Most "Water Quality" Models Actually "Water Chemistry" Models
Will Not Predict "Water Quality"

Chemical Composition Not Direct Assessment of Water Quality

Chemical Contaminants Exist in Aquatic Systems in Variety of
Forms, Only Some of Which Are Toxic/Available to Aquatic Life
Generally Cannot Selectively Measure "Toxic" Forms with
Chemical Procedures

Criteria & Standards Developed for Toxic Forms

Total Concentration Grossly Overestimates Toxic Forms

Must Use Bioassays/Toxicity Tests

Toxicity of Chemical Forms

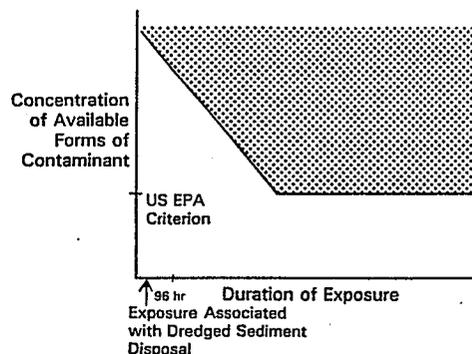
Generally Non-Toxic Forms

- Acids or Their Conjugate Bases
- Precipitates
- Moderate and Strong Complexes
- Sorbed Forms

Generally Toxic Forms

- Aquo Species

Aquatic Toxicology



Factors Affecting Toxicity of Chemical Contaminant to Aquatic Organisms

◀ Duration of Organism Exposure ▶

(continued)

Current & Proposed US EPA Criteria List 2 Criteria Exposures

1-hr Average - Acute - CMC (Criterion Maximum Concentration)

4-day Average - Chronic - CCC (Criterion Continuous Concentration)

Arbitrary, Off-the-Cuff, Worst-Case, Based on Estimate of Rate of Organism Response to Ammonia

- Not Even Appropriate for Ammonia
- Not Peer-Reviewed

None of Criteria Applicable to Intermittent Exposure

Assume Continuous Exposure to Average Concentration

Issues of Copper in San Francisco Bay

Prime Example of Water Quality Evaluation and Management
Without Proper Application of Aquatic Chemistry and Toxicology

Only Very Limited Number of Copper Species Are Toxic

Inappropriate to Regulate Cu Based on Total Cu Analyzed

No Chemical Test Directly Measures Toxic/Available Forms

Must Ask Organisms - "Is the Cu in This Water Toxic?"

NAS/NAE 1992 Conclusion - Cannot Regulate Heavy Metals
Based on Chemical Concentrations. Must Use Toxicity Tests

(continues)

Issues of Copper in San Francisco Bay (continued)

US EPA Water Quality Criterion for Cu (2.9 µg/L) Grossly
Overprotective for Most Waters

Exceedances of Cu WQO Set Off Regulatory Process

- Site Specific Objectives
- Waste Load Allocation
- TMDL
- Arbitrary - Phased Approach
- Need Available-Cu-Load - Response Model
- Cu Concentration in San Francisco Bay Water Cannot Exceed WQO by Any Amount More Than Once in 3 Years

WQO Cannot Be Achieved for Total or Soluble Cu Even If All
External Sources of Cu Terminated

Cu Stirred into Water Column from Sediments

Is Exceedance of Cu WQO Causing Real Water Quality Problem?
Copper Adversely Affecting Numbers, Types & Characteristics
of Aquatic Life in San Francisco Bay and Its Tributaries?

Is Cu Causing Toxicity in Sacramento River, Delta, and San
Francisco Bay Waters?

Toxicity Testing Using Sensitive Organisms Including *Mytilus*
Larvae (Organisms Basis for 2.9 µg/L Criterion)

What Is the Problem Due to Cu?

Water Quality? - No

Administrative? - Yes

Solution: Develop Different, Appropriate Regulatory Approach

Properly Incorporate Aquatic Chemistry and Aquatic
Toxicology into Regulatory Process

Diazinon - Toxicity

Diazinon Concentrations Cause Toxicity Pulses in Delta
Each Winter

Issues That Need Attention

- What Do These Toxic Pulses Mean to Fishery Resources of Delta and San Francisco Bay?
- Impact on Endangered Species?

If Unimportant, Then Grossly Over-Regulating Toxicity
from Point Source Discharges from Municipal & Industrial
Wastewaters

Need to Develop Water Quality Model That Relates
Zooplankton Toxicity to Impact on Fishery Resources

Delta Nutrient (N & P) Issues

Fishery Resources of Delta and San Francisco Bay Said to
Be Algal/Food Source-Limited
Fewer Algae and Zooplankton Than Desired

Water Utilities Using Delta Water Stored in a Reservoir for
Periods Find Excessive Algae-Caused Taste & Odors
Cu Used to Control Algae

TTHM's

Role of Algae as TTHM Precursor

Need to Better Understand Relationships between N & P
Loads to Delta & Fishery Resources, & Water Supply
Water Quality