

## **TOXIC CHEMICALS: SIMPLE CONCEPTUAL MODEL NARRATIVE**

*S.M. Marcy; 7/30/2007*

Human activities introduce large numbers of chemical compounds to the environment, making it impractical (scientifically and economically) to test for all possible contaminants in an impaired waterbody. Toxic chemicals and chemical mixtures can be significant stressors and ultimately contribute to biological impairment in aquatic ecosystems.

Human activities can introduce chemicals to aquatic environments via point and non-point sources. Point sources result in direct discharges of toxics into aquatic systems; examples include industrial or wastewater treatment plants. Non-point sources (e.g., runoff from agricultural fields) may introduce toxic chemicals to aquatic systems via soil transport, surface runoff, subsurface waters, and atmospheric deposition. Land cover and channel alterations (e.g., land clearing associated construction and development, increased channel incision) also can contribute to toxic contamination, by increasing surface runoff, erosion, and subsequent delivery of contaminants to surface waters.

Stress resulting from one or more toxic chemicals may be due to episodic or sustained increases in chemical concentrations. Episodic exposures can be especially difficult to assess, because measurements must be taken at very specific times to catch these short-term events. However, the distinction between episodic versus sustained increases in toxic chemicals is important, as it may influence the types of biological effects observed. Additionally, the bioavailability and toxicity of a toxic chemical is influenced to varying degrees by other factors (and/or stressors), including water temperature, pH, hardness, alkalinity, ionic strength, DO, suspended sediment, and dissolved organic matter.

Toxic chemicals, individually or in mixtures, may directly or indirectly impair aquatic plants, invertebrates, and/or fish assemblages. Impairments may include increased mortality, decreased reproduction, behavioral changes, or poor physiological condition, especially in sensitive taxa or life stages; these effects can serve as modes of action for community-based biotic effects. Decreases in condition can contribute to lower reproductive success, greater susceptibility to other stressors, or increased vulnerability to natural predation and climatic events, further altering population and community structure. Population dynamics may be influenced directly through emigration or through changes in community structure, which subsequently affect food webs and other biotic interactions.