

forming dense stands of plants and crowding out native marsh plants and by impeding normal surface water flow in wetlands.

Knowing the existing biological stressors at a contaminated site and in the vicinity of the site will help risk assessors distinguish the types of impacts related to the chemicals in question compared to effects from introduced species. Information on biological stressors in the area also may provide insight to the stability of species populations or the entire ecosystem that would help to direct potential options or methods for the ecological risk assessment process, including mitigative measures (e.g., planting vegetation to control erosion) for remedial actions.

1.7.3 Chemical Stressors

Chemical stressors include hazardous waste, industrial chemical, pesticides, and fertilizers. Ecological risk assessments are most commonly used for examining chemical stressors under programs such as CERCLA, RCRA, and the CWA. The effects of chemical stressors can be categorized as occurring at the organism, population, community, or ecosystem levels. Examples of the types of effects at each of these organizational levels includes:

- *Organism level* - mortality, behavioral changes, physiological impairment,
- *Population level* – changes in birth rates and mortality rates, increased dispersal, local extinction, and
- *Community or ecosystem level* - changes in community structure and functional components, habitat destruction.

The effects of contaminants on ecological systems can be influenced by a variety of environmental factors. These factors can alter the outcome of contamination by chemically changing the contaminant to make it more or less toxic, affecting the bioavailability (see Section 2.1) of the contaminant, and by affecting the tolerance that organisms have for a contaminant. Examples of factors that can affect toxicity include temperature, pH, salinity, water hardness, and soil characteristics. Temperature affects the chemical activity of contaminants and the physiological processes of organisms, thus affecting toxicity. The pH within the soil, surface water, or groundwater can affect the form, reactivity, solubility, and toxicity of some contaminants. The tolerance of organisms to salinity can also be affected by the presence of certain contaminants. Hardness refers to the amount of calcium, magnesium and ferric carbonate in water. Hardness can affect the toxicity of some contaminants, especially many heavy metals. This is why state and Federal water quality criteria and standards are sometimes dependent on hardness, pH, or salinity.

In terrestrial ecosystems, soil characteristics such as clay content and amount of organic matter commonly affects toxicity and bioavailability. In addition, the nature of the soil can affect the mobility of the contaminant to other areas or media.