

Fanny Ennever

Abstract:

Chemical risk assessment is the process of correlating the amount of exposure with the amount of harm. Risk assessment consists of four steps: hazard identification, exposure assessment, quantitative toxicological assessment, and risk characterization. Risk management comes after risk assessment and involves decisions about what actions, if any, to take to reduce risk. Important toxicological concepts are that any substance is toxic if dose is high enough, but only some chemicals can cause cancer, that protecting against the most sensitive non-cancer effect protects against all effects, and that any dose of a carcinogen carries some risk, but the smaller the dose, the smaller the risk. Hazard identification has numerous controversies, particularly the relevance of animal and *in vitro* tests to human cancer. Exposure assessment relates the dose of a chemical to an individual on the chemical's concentration in air, water, soil, etc. Quantitative toxicological assessment finds the threshold or "safe" dose for non-cancer toxicity and the (assumed) multiplicative relationship between the dose of a carcinogen and the resulting risk of cancer. Risk characterization determines whether the dose is above or below the "safe" dose for non-cancer effects and the numerical risk of cancer. Risk management uses these numbers, but decisions about whether to act are also influenced by cost-benefit analysis and risk perception. Because of ubiquitous uncertainties and assumptions inherent in risk assessment, it can never give the "right" answer. More modest goals are for risk assessments to be consistent (so water in Michigan is evaluated in the same way as soil in Florida) and to be transparent (so anyone can backtrack where the numbers came from).

QUESTION: How can chemical risk assessment be improved?