C50 Characterizing Human Health Risk: Art or Science?

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After attending this presentation, the participant will begin to understand why the characterization or assessment of human health risk is more art than science. Dr. Smith will use three examples to illustrate how different risk assessors might use information, methodology, and professional judgment to paint very different pictures of health risk associated with chemical exposure at a hazardous waste site.

This paper has three objectives: 1) to introduce the practice of characterizing human health risk to chemical exposure; 2) to illustrate the role of information, methodology, and professional judgment in human health risk characterization; and 3) to demonstrate that the characterization of human health risk is art, not science.

One role of Federal and State government is to protect human health from the harmful effects posed by exposure to chemicals. Regulatory Agencies like the U.S. Environmental Protection Agency ("U.S. EPA") have developed programs for responding to chemical releases in the environment. Federal and State Agencies use well-established chemical risk assessment principles and procedures, described by the National Academy of Sciences ("NAS") to determine whether a chemical in the environment poses a "significant" health risk to exposed persons.

The NAS risk assessment model integrates five (5) separate components: hazard identification; dose-response or toxicity assessment; exposure assessment; risk characterization; and uncertainty assessment. Risk assessors typically rely on regulatory Agencies for hazard identification and dose-response or toxicity information. In contrast, a risk assessor may have little, if any, specific information about the potential exposure of people to chemicals in soil, water, biota, and/or air. In such cases, the risk assessor must identify potentially exposed populations and choose appropriate parameters to represent the magnitude and frequency of exposure for each population identified. Exposure assessments can vary greatly in the amount and quality of site-specific information used to quantify exposure. Health risk estimates, calculated using exposure and toxicity information, are compared to socially acceptable target risks. Finally, the risk assessor identifies and describes the uncertainty inherent in the process of risk characterization.

Risk characterization is an art, not science. An appropriate definition of art is the use of a system of principles and methods in the performance of a set of activities. In contrast, science is defined as the observation, identification, description, experimental investigation, and theoretical explanation of phenomena. Risk characterization uses exposure assumptions and toxicity information and the principles and procedures established by the NAS to describe the probability of a future health condition in an exposed population. The art of the risk assessor is to apply these principles and methods to characterize human health risk associated with chemical exposure.

Dr. Smith illustrates how three different risk assessors, given the same basic exposure and toxicity information, can achieve very different human health risk characterization results. For each risk assessor, Dr. Smith identifies commonly used default exposure parameters, regulatory guidance, and site-specific information used in the characterization of human health risk. A simple comparison of the resulting quantitative estimates of human health risk with applicable regulatory target risks determines whether there is significant human health risk associated with the site and whether remedial action is required. Dr. Smith uses three different risk assessors to illustrate the art of applying NAS principles and methods to human health risk characterization, demonstrating that the characterization of human health risk is an art, not science.

Art, Assessment, Characterization, Risk

 ** Presenting Author*