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COAL ASH & TOXICITY, PART 1

Toxicity, Exposure, and Health Risk Basics

The Relationship Between Toxicity, Exposure, and Health Risk

Health risk refers to the likelihood of harm to human health from substances in people's surrounding. The likelihood of harm depends on their exposure (how much of the substance people eat, breathe in, or absorb through their skin) and the substance's toxicity (what kind of harm the substance might do to people if it is taken in, and how much of the substance it takes to cause this harm). The lower the toxicity, the lower the health risk. Similarly, the smaller the exposure, the smaller the health risk. If there is no exposure, there is no health risk.

Toxicity

Toxicity describes the ability of a substance to cause harm to human health. One way toxicity is measured is by the amount (or dose) of a substance that it would take to cause harm if it entered the body. Scientific studies are used to establish a reference dose, which indicates the amount of a substance that people can ingest, breathe in, or absorb through their skin without harm, including more sensitive individuals such as pregnant women and children. For substances that may cause cancer, a cancer slope factor is used to describe the relationship between dose and a lifetime risk of cancer.

Exposure

Exposure refers to the amount of the substance that gets into the body. Exposure depends on the amount of a substance taken in over some period of time, such as a day (daily dose), how often people may come into contact with a substance (exposure frequency), and how long people are in contact with the substance over time (exposure duration).

Risk Perception

Health risk assessment uses science and accepted methods to quantify risks. However, some things make risks seem larger than they are or make even small risks seem worrisome. For example, risks that are more uncertain, unfamiliar, or uncontrollable tend to cause more fear and concern than those that are common, accepted, or thought to be personally controllable. Risks affecting children, and risks of illnesses that are especially dreaded, like cancer, can also seem larger and more concerning.

Health Risk Assessment

Scientists calculate potential risks to human health by combining estimates of people's exposure with what is known about a substance's toxicity. Estimates of people's exposure are calculated in an exposure assessment. What is known about a substance's toxicity is described in a toxicity assessment. These two sets of information are combined to present a risk assessment that includes who might be at risk, how this could occur, what substances are a concern, and how serious or likely the risk may be. Risk assessments help communities determine whether and to what extent actions might be needed to protect health. Risk assessments do not calculate actual risks for individuals. Instead, they focus on estimating the upper limits of potential risk, so that current and future populations are protected.

Uncertainty

Evaluation of uncertainty is an important part of risk assessment. Uncertainty comes from what is or is not known about people's potential exposures and about toxicity of a substance. Using data from animals to predict effects in humans and using data from high exposures to predict the effects of lower exposure both introduce uncertainty into estimates of a substance's toxicity. Health risk assessments address uncertainty by including safety factors to account for knowledge gaps.

3002018058 March 2020

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