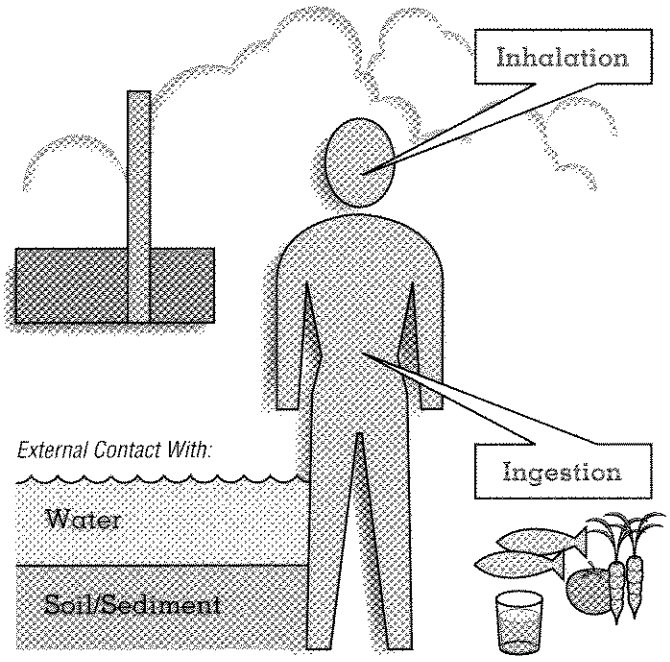
Technical Topics:

RISK to Human Health and the Environment

What is risk?

A common definition of risk is the "possibility of suffering harm or loss; danger" (Webster's II: New Riverside University Dictionary, 1988). This general definition can apply to any type of risk, including sources of potential risk to human health or the environment.



What is environmental risk?

Environmental risk generally refers to the increased chance that biological or ecological damage could occur as a result of exposure to hazardous substances present in the environment. Any living organism can be affected.

What is human health risk and why does it exist?

Human health risk, or the increased chance that an individual's health may be affected by a hazardous substance, exists when an individual is exposed to that substance. A person can be exposed, and thus be at risk, by breathing contaminated air, eating contaminated food, drinking contaminated water, or direct contact with or penetration of a substance through the skin. If there is no chance that people will be exposed to a source of contamination, risk does not exist .

Technical Topics: This series of papers explains the research design, methods and terminology used in the State of Colorado's health studies related to the Rocky Flats Plant. For information about this ongoing research to identify past contaminant releases from the plant and assess potential health risks, call the Colorado Department of Health at (303) 692-2640 or 692-2652.

COLORADO DEPARTMENT OF HEALTH

How do scientists estimate risk?

The National Academy of Sciences adopted a four-step risk assessment process that is the universally accepted scientific method and is used by regulatory agencies to assess potential human health risks. The process combines analysis and mathematical calculations to:

1. Identify the types of hazardous materials and estimate the quantities released.
2. Analyze the potential exposure pathways, or ways in which substances could be transported through air, water or soil to locations where humans could be exposed.
3. Assess the toxicity, or possible harmful effects, resulting from human exposure to the estimated concentration of each substance.
4. Calculate the increased risk of adverse health effects based on steps 1, 2 and 3.

Does risk assessment identify only present risks or can it be used to estimate past or future risks?

The risk assessment process can be used to estimate past, present or future risks. For example, the U.S. Environmental Protection Agency uses risk assessment to predict present and future risks at a contaminated site if it is not cleaned up. This information is used to determine criteria for cleanup actions necessary to protect human health and the environment. The U.S. Department of Energy is estimating the present and future risks posed by the existing contamination at the Rocky Flats Plant to determine requirements for environmental restoration.

Risk assessment can also be used to evaluate past contaminant releases, as in the State of Colorado's two-phased study. First, the researchers are identifying routine and accidental contaminant releases from the Rocky Flats Plant that occurred from 1952 through 1989. After analyzing how people in nearby locations might have been exposed during this period, the study team then estimates the potential human health risks due to past Rocky Flats operations.

Can one source of risk be compared to another?

Yes, but the comparisons may not be appropriate. Comparisons of risk from different sources are sometimes used to provide a frame of reference to help us understand the degree of risk. The most appropriate comparisons are those between similar types of risk, such as driving a car versus taking a commercial jet flight. Most people agree that is not appropriate to compare a voluntary risk, such as smoking a cigarette, with an involuntary risk, such as air pollution from an industrial plant. In some cases, estimates of health risk from man-made contamination are compared with "background" risks from naturally-occurring sources, such as solar radiation or

minerals in the soil and water. The purpose of such comparisons is not to prove that a source of risk is or is not acceptable, but to provide information so that people can form their own conclusions.

Can all risks be evaluated the same way?

No. Some risks, such as the risk of dying in an automobile accident, can be calculated by counting numbers of accidents. In contrast, health risks related to exposure to chemicals must be estimated for several reasons: actual data on the occurrence of health effects are not always available, the relationship between cause and effect may be unclear and diseases such as cancer often have long latency periods. Individual scientists often use varying assumptions to calculate risks to populations, resulting in different estimates of risk for the same source.

How is population risk different from individual risk?

Not every individual's risk is the same as the overall risk to a population group. For example, one computes the average risk from dying in an automobile accident after counting the actual number of deaths from such accidents in the specified population. An individual's risk of dying in an automobile accident, however, depends on a number of factors. These include the type and condition of the vehicle; how, where and what distance the person drives; the driver's training and experience; age, sex and use of alcohol or drugs.

Likewise, risk to individuals living near an industrial facility that has released contaminants varies according to a number of factors such as age, lifestyle, personal health condition and the length of time the person lived in that location. Partly because individual risks vary considerably, risk estimates are usually expressed not as single numbers but as ranges of possible risks. An individual's health risk is likely to fall somewhere within the range of estimated risks. See the technical topics paper entitled "Uncertainty in Analyzing Health Risks" for additional discussion of this issue.

How much risk is acceptable?

As individuals, we make judgments about how much risk is acceptable from various sources. Individuals' perceptions of risk are often influenced by personal experience and other factors, such as fairness, morality and control. We are surrounded by sources of risk. Some we can control, others we cannot. Risks taken voluntarily are more acceptable than risks caused by factors outside our control. Some people may feel that no level of health risk is acceptable, if it comes from a source outside their control. However, it is seldom possible (technically and/or economically) to eliminate all risk.

How can risks be managed and reduced?

Government agencies work to regulate, manage and reduce risks from both voluntary and involuntary sources that threaten public health and safety. In some cases, such as using seat belts, a combination of individual action and state laws have worked to reduce traffic deaths.

We rely on government regulation to manage sources of risk that are outside individual control. However, decisions about risk reduction are most effective when input from all stakeholders is considered.

Environmental agencies set limits on the amounts of hazardous substances in drinking water, air and soil that are conservative or strict enough to protect human health and the environment, based on research on toxicologic effects. Municipal drinking water must be tested for a number of substances and treated, if necessary, to make sure that the concentrations fall within acceptable limits. Cleanup options for hazardous waste sites are based on reducing risk from contaminants to provide an extra margin of safety and protection for human health and the environment.

Will the state's research on past contaminant releases from Rocky Flats be used to make decisions about reducing current or future risks?

No. Those decisions will be based on the results of the risk assessments for the environmental restoration of Rocky Flats. Environmental restoration to reduce current and future risks is the responsibility of the U.S. Department of Energy, with oversight by the U.S. Environmental Protection Agency and the State of Colorado.

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