U.S. Army Corps of Engineers
Buffalo District

Building Strong ®

June 2012

Risk Assessment

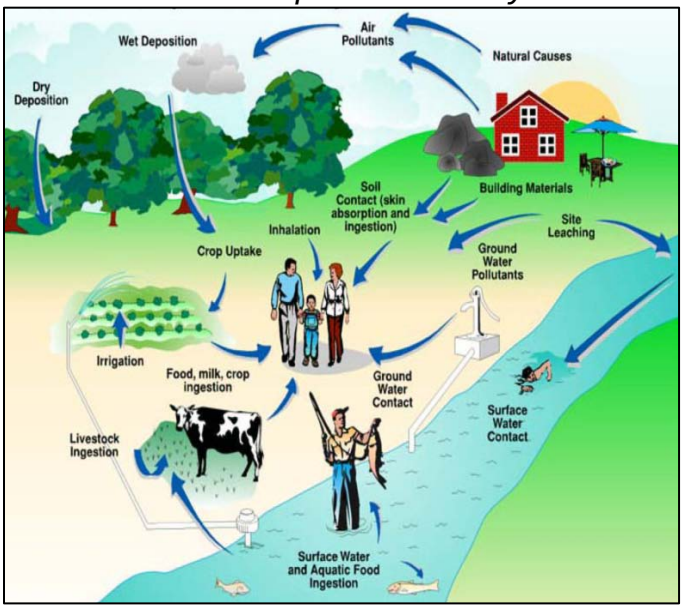
A risk assessment is performed for hazardous, toxic, and radioactive waste sites to estimate the potential risks to human health and the environment posed by radioactive substances and chemicals in the environment. Information from the risk assessment is used to determine whether action is necessary to address those radioactive substances or chemicals. Risk assessments are site specific and may vary in detail and in the degree of quantitative analysis used, depending on the site's complexity. The U.S. Environmental Protection Agency developed the procedures that the U.S. Army Corps of Engineers follows for the risk assessment process. These assessments are conservative estimates that ensure protection of human health and the environment.

How are human health risk assessments performed?

Human health risk assessments are performed in four steps:

Data Collection and Evaluation: In this phase, samples collected from the site are analyzed and the data evaluated to identify substances that will be the focus of the risk assessment. If substances have levels that are possibly harmful to humans, they are studied further in the risk assessment process.

Illustration of Exposure Pathways



Exposure Assessment: The exposure assessment estimates the amount of actual and/or potential exposures to site chemicals or radioactive materials. If there is no exposure, then there is no risk. Exposure is estimated by evaluating the ways that people might come into contact with these materials, and by considering the frequency and duration of potential exposures. The level of exposure is determined by the type of activity and land use taking place at the point of exposure. For example, a person that lives directly on a contaminated site will most likely experience a greater exposure to the contamination than a person who works at or only occasionally visits a contaminated site. Some exposure pathways commonly evaluated at hazardous, toxic, and radioactive waste sites include direct exposure to radiation, inhalation of vapors or of small soil particles, incidental ingestion of soil, and ingestion of water. Typically the assessment will consider both current and reasonable potential future uses of the property when developing exposure assumptions. Conducting the exposure assessment involves: identifying potentially exposed populations; identifying all potential pathways of exposure; estimating the chemical and radioactive material concentrations at the point(s) of exposure; and estimating the intakes for each chemical and radioactive substance for each complete pathway of exposure.

Toxicity Assessment: The toxicity assessment provides values for the amount of chemical or radioactive materials required to do harm to a person, and the types of effects that might result from exposure to the material. Typically risk assessments use existing toxicity values obtained from U.S. Environmental Protection Agency databases.

Risk Characterization: In the risk characterization the estimated exposure values from the exposure assessment are combined with the toxicity values from the toxicity assessment to generate human health risk values. Results generated for each substance and each exposure pathway are combined to determine a site-wide estimate. Non cancer-causing effects are expressed as a "hazard index," which is a ratio of estimated exposure deemed acceptable. Cancer-causing effects are expressed as a probability of contracting cancer due solely to exposures to site chemicals and radioactive materials. This value is the excess cancer risk over and above the estimated lifetime cancer risk for the general public of one in two for men and one in three for women (American Cancer Society). Risks from radioactive materials may also be expressed as total effective dose equivalent to allow comparison to regulations that address such exposures. The risk characterization also identifies the uncertainties associated with the risk assessment so that decision makers can have an understanding of what the results mean.

How are ecological risk assessments performed?

An ecological risk assessment is performed to determine whether site chemicals or radioactive materials are causing adverse effects to sensitive ecological features found at the site. Ecological features considered for evaluation are chosen by surveying the site and identifying plants, animals and habitat of local, regional or ecological importance. Toxicity levels are identified and evaluated for specific ecological features. These levels are compared to estimated exposures to determine whether there is potential for harm to the environment. In some cases further study may be necessary, such as tissue analysis or onsite toxicity tests, to determine whether the site is posing a threat to the environment.

How are the results of the risk assessment used?

The results of the risk assessment are used to determine whether the site poses an unacceptable threat to human health and/or the environment that requires action to mitigate. Assumptions from the risk assessment may also be used in conjunction with regulatory standards to determine safe levels for chemicals or radioactive materials at a site.

Legal Requirements

For hazardous, toxic, and radioactive waste sites, risk management decisions are primarily driven by legal requirements. The U.S. Environmental Protection Agency is responsible for developing risk assessment guidance for the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), which is more commonly known as Superfund, and its implementing regulation, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). For carcinogenic contaminants, the NCP considers the range of 1 in 10,000 (0.0001 or 10^{-4}) to 1 in 1,000,000 (0.000001 or 10^{-6}) excess lifetime risk of cancer to be acceptable. If the excess cancer risk is above 1 in 10,000, then an action must be taken to reduce the cancer risk from exposure to this contaminant. For contaminants which cause non-cancer illnesses, if the hazard quotient is above one, then an action must be taken to reduce the risk of adverse health effect from exposure to this contaminant.

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