Risk Assessments

We are all concerned about reducing our risks. EPA and other organizations have evaluated environmental risks and have ranked them on the basis of magnitude.

Since cancer is of great concern to people, shown below are various cancer risks from environmental agents:

Cancer-Causing Agents or Situations	Approximate Lifetime Risk of Cancer
1. Exposure to the Sun(skin cancer)	1 in 3
2. Cigarette smoking (based on smoking a pack or more per day)	8 in 100
3. Natural radon in indoor air at home	1 in 100
4. Outside radiation (radon and cosmic rays)	1 in 1,000
5. Persons in room with a smoker	7 in 10,000
6. Human-made chemicals in indoor air at home	2 in 10,000
7. Outdoor air in industrialized areas	1 in 10,000
8. Human-made chemicals in drinking water*	1 in 100,000
9. Human- made chemicals in most foods (a) 2 oz. Of peanut butter per week (naturally occurring aflatoxin present) (b) one meal per year of small Lake Michigan trout	1 in 100,000 or less 8 in 100,000 1 in 100,000
10. Chemical exposure at most uncontrolled hazardous-waste sites	1 in 10,000 to 1 in 1,000,000

Table after U.S. EPA, Region 5, Environmental Risk
*Some chlorinated waters may have slightly higher risks. Chlorination is used to destroy disease-causing organisms often found in drinking water.

As you can see from the chart, the greatest risk of contracting cancer is from exposure to the sun. Although most skin cancers are not fatal, one type of skin cancer, called melanoma, yields a high risk of 2 in 1,000. This means that if 1,000 people are exposed, 2 may die of skin cancer over their lifetime. Doctors now strongly recommend using protective clothing and sunblocking agents to reduce the risk of skin cancer. It is most important to avoid a sunburn because even a single sunburn in one's lifetime may cause serious, and often fatal, forms of skin cancer.

Smoking cigarettes over a lifetime yields a voluntary risk of 8 in 100 of contracting cancer. The most common form of cancer from cigarettes, lung cancer, is not readily curable. It is important to note that nonsmokers, in the presence of smokers, also experience a very high risk of cancer--7 in 1,000, or only about 10 times less than the smoker. Quitting smoking not only reduces the risks to smokers, but also to those around them.

An extremely high risk of cancer (an average of 1 in 100) results from naturally occurring radiation, in the form of radon in the home. It is estimated that 4,000-5000 deaths per year occur in the Great Lakes Region (Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin) due to radon exposure in homes. EPA has frequently recommended that people test their homes for radon, but less than 5 percent have done so nationally. Yet exposure to radon, like smoking cigarettes, is known to cause lung cancer.

Studies show that people are less concerned about natural risks, such as radon, than they are about unfamiliar risks, such as living near an uncontrolled hazardous waste site. Most hazardous waste sites before cleanup pose cancer risks ranging from one in a million to one in ten thousand--or 100 to 10,000 times less than posed by radon in homes. But people are far more concerned about getting cancer from hazardous waste sites, even if cancer risks are as small as one in a million. The hazardous waste site is human-made, less understood, and is therefore perceived to be more threatening than radon in homes. However, radon in homes presents far greater danger than most hazardous waste sites. Fortunately, simple measures exist to reduce radon. EPA encourages homeowners to test their homes and, if necessary, take steps to reduce radon. (For more information write to: Radon
Publication Coordinator, EPA Region 5, 77 West Jackson Blvd., Chicago, IL 60604.)

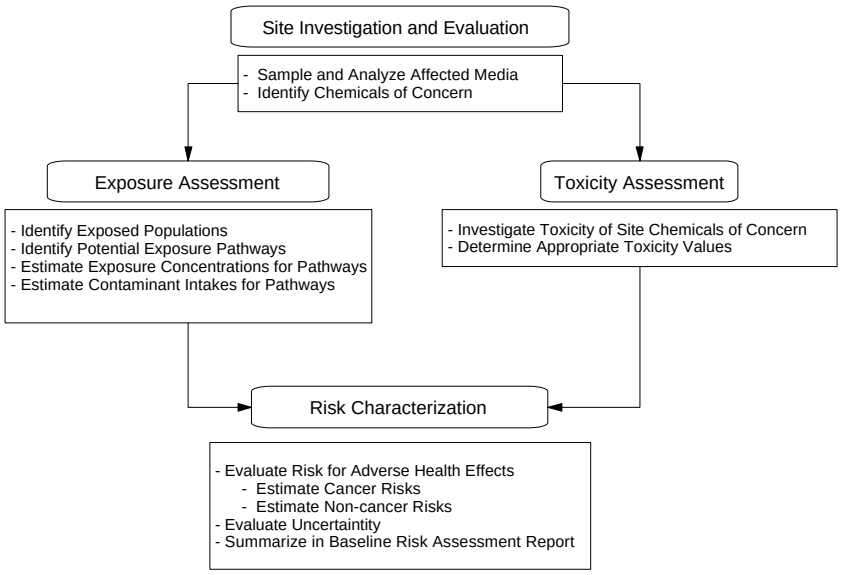
US EPA Baseline Risk Assessments

The U.S. EPA has developed guidance manuals for conducting a baseline risk assessment at Federal environmental sites. The guidance is contained in *Risk Assessment Guidance for Superfund* (RAGS) 1989, and *Soil Screening Guidance* 1996.

The baseline risk assessment contributes to the site characterization and selection of an appropriate response to site conditions. Conceptually, the results of the base line risk assessment are used to:

- Help determine whether additional response action is necessary at the site;
- Modify preliminary remediation goals;
- Help support selection of the “no-action” response, where appropriate;
- Document the magnitude of risk posed by environmental conditions and the causes of that risk.

Baseline risk assessments are site-specific and therefore may vary in both detail and extent to which qualitative and quantitative analyses are used, depending on the complexity and particular circumstances of the site, as well as the availability of applicable and appropriate requirements (ARARs) and other criteria, advisories and guidance. A an initial planning stage, there are four steps on the baseline risk assessment process: site investigation and evaluation; exposure assessment; toxicity assessment; and risk characterization. The relationship of the four steps is indicated in the chart below.



The **Site Investigation and Evaluation** involves gathering and analyzing soil and groundwater data that may be relevant to the human health evaluation and identifying the substances present at the site. An **Exposure Assessment** is conducted to estimate the magnitude of actual and/or potential human exposures and the pathways by which humans are potentially exposed. In the exposure assessment, reasonable maximum estimates of exposure are developed for both current and future land use assumptions. An exposure assessment involves analyzing contaminant releases; identifying all potential pathways of exposure; estimating exposure point concentration for specific pathways, based on environmental monitoring data and predictive chemical modeling results; and estimating contaminant intakes for specific pathways. The results of this assessment are pathway-specific intakes for current and future exposures individual chemicals. The **Toxicity Assessment** component of the baseline risk assessment considers: 1. the types of adverse health effects associated with chemical exposures; 2. the relationship between magnitude of exposure and adverse effect; and , 3. a related uncertainties such as human-applicability of toxicity data. Typically, the site risk assessments rely heavily on existing toxicity information developed for specific chemicals and available through specific risk assessment databases, such as EPA's Integrated Risk Information System (IRIS) and Health Effects Assessment Summary (HEAST). The **Risk Characterization** summarizes and combines outputs of the exposure and toxicity assessments to characterize baseline risk, both in quantitative expressions and qualitative statements. During risk characterization, chemical-specific toxicity information is compared against both measured contaminant exposure levels and those levels predicted through fate and transport modeling to determine whether current or future levels at or near the site are of potential concern.

An Overview of RISC

The Indiana Department of Environmental Management (IDEM) has developed a draft manual for risk assessment guidance for Indiana state environmental sites, *Risk Integrated System of Closures*, (RISC), 1999. The state guidance RISC, borrows methods from both the U.S. EPA guidances, however is intended as an overarching system of procedures for investigation and decision-making at state environmental sites. Although underdevelopment for more than three years, when implemented RISC will be a system of site a system of procedures for site characterization and decision making.

Purposes for the RISC program include:

- *To allow the use of traditional remedial approaches while expanding the types of remedies available.*

All remedial techniques currently in use and accepted by IDEM are still available as options under the RISC program. These include removal of contaminants and reduction of contaminant concentrations by chemical, biological, and/or physical means. The range of options has been expanded to include exposure-prevention remedies.

- *To focus the endpoint of remediation on uniform, risk-based goals.*

RISC standardizes the risk-management goals used for all non-emergency, contaminant-release sites. These goals are a target risk level of 10^{-5} for carcinogens and a hazard quotient (for single-chemical exposures) and hazard index (for multiple-chemical exposures) of 1.0 for non-carcinogens. The agency considers these levels to pose a negligible risk.

- *To present a range of options for site closure that are supported by policies and procedures.*

RISC presents many workable options for closure that may reduce costs and save time. These options are integrated with procedures for site screening, site characterization, and remedy selection. All sites pass through the same decision-making process, but responsible parties do not need to choose the same level of risk assessment or same type of remedy for all sites.

- *To recommend a standard approach to site cleanup that will apply across the entire agency.*

Standardizing such elements as remedial goals and the site-characterization process ensures that all sites attain a sufficient health-protective level before closure, and it presents a unified position to the regulated community.