



Cancer Risk and Noncancer Hazard Index

Fact Sheet for Contaminated Sites in California

November 2020

Chemical contamination in soil or groundwater has the potential to harm the health of people living or working in or near contaminated areas. This fact sheet explains some terms and processes commonly used to evaluate the health threats that people may face from exposure to the contaminants.

What is cancer risk?

Cancer risk is the likelihood that a person will develop cancer. A person's cancer risk may be increased due to exposure to a chemical contaminant from a site. Cancer risk also depends on other factors, such as a person's diet, lifestyle, and genetic background.

For contaminated sites, the cancer risk estimate describes the extra risk a person may face from exposure to contaminants found at the site. The cancer risk estimate does not include a person's background risk, which is the risk a person faces of developing cancer due to other causes.

The cancer risk is expressed in terms of a person's chance of developing cancer over a lifetime from exposure to a chemical contaminant. If a person is exposed to multiple cancer-causing chemicals from a site, the risk from each chemical is added up to calculate the person's cumulative cancer risk.

According to state and federal guidance on contaminated sites, a cancer risk that is at or below 1 chance in a million (or 1×10^{-6}) is not a public health concern. This means that no more than one person in a population of one million people exposed to the same level of chemical contaminant(s) at the site would develop cancer over a lifetime.

On the other hand, based on this same guidance, a cancer risk above 1 chance in 10,000 (or 1×10^{-4}) is generally unacceptable. This means that more than one person out of 10,000 people with the same exposure would develop cancer over a lifetime. When the risk lies in between these two figures (1×10^{-6} and 1×10^{-4}), state regulators consider a variety of factors at the site to determine whether the risk should be reduced.

What about health impacts other than cancer?

Harmful health effects other than cancer can result from exposures to chemicals from a contaminated site. These effects are evaluated separately from cancer. A noncancer **hazard quotient** signals whether such chronic health effects are likely from exposure to one chemical. If there are exposures to multiple chemicals, the hazard quotient for each chemical is added up to calculate a **hazard index**.

When the hazard index or hazard quotient is less than 1, non-cancer health effects are not expected for people exposed to chemicals from the site. When the number is greater than 1, non-cancer health effects are possible, but not certain.

How are the cancer risk and noncancer hazard index calculated?

A **human health risk assessment** is used to evaluate the nature and likelihood of harmful health effects on people who are exposed to contaminants at a site. This process involves four steps:

1. Collecting data: Scientists sample groundwater, soil, and/or air. These samples indicate which chemicals are present, and the locations and amounts of the chemicals.
2. Estimating exposure levels: The data collected in step 1 is used to estimate how much of the chemicals people breathe, ingest, and/or touch. This estimate takes into account the ways that contaminants can move through air, soil, or groundwater. The estimate is also based on how often, how long, and how much people are in contact with the air, soil, or groundwater.
3. Assessing toxicity: State and federal chemical evaluations are used to indicate how much exposure to a chemical it would take to produce a harmful effect. These evaluations are based on findings from laboratory studies of animals, and/or studies of human exposure.
4. Estimating cancer risk and noncancer hazard index: The information from steps 2 and 3 is combined to calculate the cancer risk and hazard index.

The final calculations of cancer risk and noncancer hazard index account for the fact some people are especially sensitive to the health effects of chemicals. These include children, pregnant women, and individuals with health issues.

What happens if the cancer risk or hazard index is too high?

When state regulators determine that an estimated cancer risk or non-cancer hazard index is too high at a particular site, they may require actions to reduce people's exposure to the contaminants. For example, they may require that the contamination be cleaned up. Or, they may require that barriers be installed to keep the chemicals away from people.

Ultimately, what state regulators do depends on several factors at each site. Regulators have to consider how confident they are in the human health risk assessment, and how technologically feasible and costly the different remedies may be.

For more information:

US Environmental Protection Agency (US EPA)

[Superfund Risk Assessment](#)