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Region 4

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UNDERSTANDING RISK ASSESSMENT AT NAVAL BASE CHARLESTON

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WHAT IS RISK?

Risk is the probability of injury, disease, or death under specific circumstances.

**THERE IS NO SUCH THING
AS ZERO RISK!**

We experience risk every day. For example, each time we drive our car, the lifetime chance of becoming involved in an accident or suffering some kind of loss or injury increases. Public health statistics indicate that the risk of each American contracting cancer in his or her lifetime is one in four.

Human health risk at a hazardous waste site is the likelihood that people living, working or playing nearby could experience health problems as a result of contact with, or "exposure" to hazardous substances from the site. Some chemicals are more harmful than others. The tendency of a particular chemical to cause harm is called its "toxicity."

The occurrence of potential health problems depends on the toxicity of the chemicals at a site, the amount of chemicals to which a person might be exposed and the length of time the exposure could last.

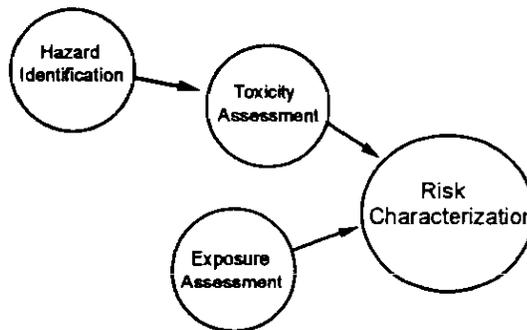
**REDUCING RISK IS EPA'S
FIRST PRIORITY!**

RISK ASSESSMENT

To evaluate the potential risks to human health and the environment at a hazardous waste site, EPA uses a procedure known as risk assessment. For example, experts are able to use the number of automobile accidents in past years to assess the actual risks of driving. EPA has no similar set of statistics for risk from hazardous waste and must make predictions of risk based on models and assumptions rather than actual measurements. This is the source of so-called uncertainty in risk assessment.

Because of uncertainty, EPA uses assumptions that tend to overestimate the predictions of risk. The actual number and seriousness of health problems will generally be lower than that predicted by EPA.

EPA'S RISK ASSESSMENT MODEL



EPA is using risk assessment to help guide cleanup and land re-use efforts at Naval Base Charleston.

THE FOUR STEPS OF RISK ASSESSMENT

The four step process used by the EPA for risk assessment is based on recommendations of the National Research Council, an independent advisory board that helps the government with scientific issues.

Step 1: Hazard Identification

Samples of water, soil, air, and sometimes plants or animals are obtained from the site and analyzed to determine what chemicals are present, their locations and their concentrations.

Step 2: Exposure Assessment

People may come in contact with chemicals through air, water, soil, food, or other "pathways." For each pathway, the amount of the chemical that could enter a person's body via the "routes" of the lungs, the digestive system or the skin is estimated.

Do people live or work on or near the site? Do children play on or near the site? Do people drink or shower in water contaminated with chemicals from the site? Do people eat fish from streams or lakes contaminated by chemicals from the site? Risk assessors attempt to model exposure by choosing assumptions to answer these and other questions related to peoples' contact with hazardous chemicals.

There may be hazardous chemicals at a site buried deep in the ground or otherwise unavailable for human contact. In such a case there is no exposure, and the pathway is considered incomplete.

**WITHOUT EXPOSURE,
THERE IS NO RISK!**

Step 3: Toxicity Assessment

Toxicity means the poisonous or harmful nature of a substance. Generally, EPA bases its predictions on animal studies because few human studies exist. Health problems varies depending on the chemical and the dose. EPA groups these health problems into two types: cancer and all others (non-cancer).

<i>Carcinogens:</i>	<i>Chemicals that cause cancer.</i>
<i>Non-carcinogens:</i>	<i>Chemicals that cause harmful effects other than cancer.</i>

Step 4: Risk Characterization

The results of the exposure and toxicity assessments are combined to estimate the risks at Naval Base Charleston and whether the risks are great enough to cause human health problems. For carcinogens, the estimate of risk is presented as a probability that a person will develop cancer over a lifetime due to exposure to chemicals present at the base. For non-carcinogens, a comparison is made between the predicted level of exposure and a threshold level that the EPA believes is safe. These threshold levels are called "Reference doses." Reference doses used in risk assessment are 10 to 10,000 times smaller than experimental doses found to be safe in a laboratory setting.

The results of the risk assessments performed at Naval Base Charleston help EPA and the state of South Carolina decide whether to undertake cleanup. Generally, EPA does not require cleanup if cancer risks are lower than one-in-ten-thousand and the exposure levels of non-carcinogens are less than the reference dose.



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RISK ASSESSMENT & RISK MANAGEMENT AT NAVAL BASE CHARLESTON

January, 1996

RISK MANAGEMENT

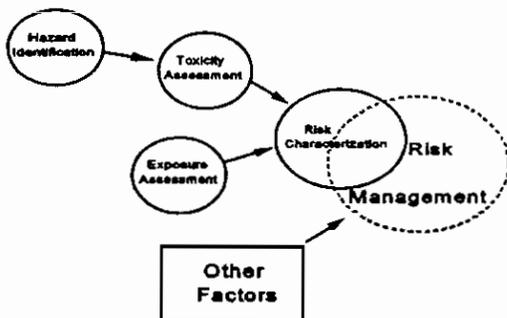
The process of decision-making at hazardous waste sites is known as "risk management." Risk management includes not only the results of the risk assessment but also factors such as cost, technical feasibility and community acceptance.

By law, the EPA's responsibility is the protection of human health and the environment. Because of the uncertainty inherent in the assumptions underlying EPA's risk estimates, EPA has chosen assumptions that tend to overestimate the predictions of risk. The actual risks at a site will probably be less than predicted by EPA.

RISK MANAGEMENT QUESTIONS:

- Should cleanup be undertaken?
- What should cleanup levels be?
- What cleanup method should be used?

It is vital that risk management considerations such as cost are not considered in the risk assessment in order to obtain an unbiased estimate of site risks. Risk management questions should be examined with an evaluation of site risks in hand.



NINE CRITERIA FOR REMEDY SELECTION

Some areas of Naval Base Charleston may require an environmental cleanup, commonly called a remedy. The nine factors or criteria used in remedy selection are shown below.

NINE EVALUATION CRITERIA

Protection of Human Health
and the Environment

Compliance with State
and Federal Standards

Long-term
Effectiveness

Reduction in Toxicity,
Mobility or Volume

Short-term Effectiveness

Implementability

Cost

State Acceptance

Community Acceptance

Threshold
Criteria

Balancing
Criteria

Modifying
Criteria

GLOSSARY:

Chemicals of Potential Concern (COPCs) - Chemicals found at a hazardous waste site that have potential human health impacts. Determination of COPCs is the initial step in a risk assessment.

Chemicals of Concern (COCs) - Chemicals shown by the risk assessment to have human health impacts. Risk management decisions address the presence and levels of COCs.

Upper Confidence Limit (UCL) - a conservative statistical estimate of the mean or average concentration in a given environmental medium.

Receptor - a human or animal that might contact a hazardous substance.

Applicable and/or Relevant and Appropriate Requirements (ARARs) - Federal or State standards such as those in the Safe Drinking Water Act or Clean Air Act that may serve as cleanup goals.

Naturally occurring background levels - Ambient concentrations of chemicals present in the environment that have not been influenced by human activities. Generally considered only with inorganic chemicals such as iron, aluminum or manganese.

Intake - A measure of exposure expressed as the mass of a substance contacted per unit body weight per unit time, i.e. mg/kg-day. Generally, intakes are averaged over a long time, up to a lifetime.

Exposure - Contact of an organism with a chemical or physical agent. Exposure is quantified as the amount of the agent available for absorption by the organism.

Exposure Assessment - The determination or estimation of the magnitude, frequency, duration and route of exposure.

Exposure Pathway - The course a chemical takes from a source to an exposed organism. An exposure pathway includes a source, a transport medium, an exposure point and an exposure route. It is a unique mechanism by which a receptor is exposed to chemicals originating from a site.

Exposure Point - A location of potential contact between a receptor and a chemical.

Exposure Route - The way a chemical enters the body of a receptor, i.e. ingestion, inhalation or dermal contact.

Reference Dose (RfD) - An estimate of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime.

Carcinogenic Slope Factor (CSF) - also called a potency factor. A plausible upper bound estimate of the probability of a response per unit intake of a chemical over a lifetime. The CSF is used to estimate an upper bound probability of an individual developing cancer as a result of exposure to a particular level of a carcinogen.

Hazard Quotient (HQ) - The ratio of a single substance exposure level to the RfD for that substance.

Hazard Index (HI) - The sum or more than one HQ for multiple substances and/or multiple exposure pathways.

Cancer Risk - a unitless probability representing the incremental chance of an individual contracting cancer over a lifetime.