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Presenter's Manual for: "Superfund Risk Assessment and How You Can Help"

A 40-Minute Videotape

Acknowledgement

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TAB 2. VIDEO SEGMENTS: NOTES FOR THE PRESENTER

Purpose of the Videotape

EPA developed the 40-minute videotape "Superfund Risk Assessment and How You Can Help" to help explain in plain terms the Superfund human health risk assessment process and how communities can be involved. The videotape lays the groundwork for in-depth discussions on human health risk assessment, how it relates to cleanup, and how people can be involved. The community interviews in the videotape enhance the message that early community involvement is important to the Superfund cleanup program.

A 10-minute introductory videotape containing information extracted from the 40-minute videotape is also available and should be shown first to determine if the audience wants to know more about risk assessment.

Generally, it is best to show the videotapes before the risk assessment begins and at a time when the community is not focused on other site issues. The regional community involvement coordinator and risk assessor can help you decide which videotape to use and when.

The 40-minute videotape cannot replace discussions with a risk assessor. Although the videotape helps explain risk assessment, it is intended to be used with technical staff present to answer questions. Your efforts to communicate with the public may be hindered if you do not have the resources to answer questions during the session. Commit to responding to any unanswered questions quickly, preferably within a day.

You should schedule about two hours to show the 40-minute videotape and answer questions. Before starting the videotape, discuss your expectations and take a few minutes to explain how risk assessment fits into the Superfund process. Also note that EPA evaluates both health and ecological risks. Be upfront about how community input will be used and identify any limitations on that input.

The best way to show the 40-minute videotape is in segments. Because the videotape is long, plan to stop the tape periodically to reinforce key messages and give people a chance to ask questions. The pauses also offer an opportunity to talk about ways community members can be involved. The best places to pause are after data collection and evaluation, exposure assessment, and toxicity assessment. Ten-second pauses have been screened in at these points. If your audience wants more frequent interruptions, you may do so.

The end of the tape is another time to reinforce main messages, answer questions, discuss site-specific concerns, and talk about how and when follow up will occur. This is also an appropriate time to give viewers additional information, handouts, and a list of contacts in your region.

Essential Ingredients

- Risk Assessor
- Community Involvement Coordinator
- Knowing your audience
- Good preparation for site-specific issues
- Time to pause and discuss
- Follow up plans

Pause the Tape to

- Discuss technical concepts
- Answer questions
- Reinforce messages

This Manual Will Help You

- Reinforce key concepts
- Prepare for questions
- Generate discussion
- Plan for follow up

Purpose of this Manual

This manual highlights the key messages described in the videotape and other issues that audiences might raise. Results of field tests with community groups helped identify the questions and issues likely to come up when people view the videotape.

The information in this manual is intended as background information for presenters to use in explaining risk assessment concepts. These materials are not intended to be read verbatim to audiences.

(Tab 2) Video Segments: Notes for the Presenter contains key messages and additional information on topics that could not be addressed in the videotape. References are provided at the end of Tab 2. **(Tab 3) Common Questions and Answers** (Chun and Den, 1999) contains sample responses to questions often asked at public meetings about risk assessment. **(Tab 4) Handouts for Communities** includes a Glossary of Technical Terms in EPA's Risk Assessment Video, Community Tools, Diagram of Superfund NPL Remedial Process, and fact sheets on risk assessment. You should provide viewers with additional information about Superfund, assistance programs, and people to contact.

The materials in this manual are not intended to be read verbatim to audiences.

Unfortunately, most of the available references on risk assessment were written at the college level. Almost no easy-to-read information on risk assessment is currently available for citizens, many of whom read at basic grade-school levels (see below).

Facts About Literacy*

About 47 percent of the U.S. adult population (16 years old and older) reads only at the 5th to 8th grade levels (26 percent at a maximum of 5th grade and 21 percent at a maximum of 8th grade).

Among adult welfare recipients, reading skills are generally worse. In this group, 75 percent read at the 5th to 8th grade levels (50 percent at about 5th grade and 25 percent at about 8th grade).

*The National Center for Education Statistics' 1992 National Adult Literacy Survey (*http://nces.ed.gov/nadlits/*)

Tips

This section contains the following:

- Presenter's Checklist
- Getting the Most Out of the Videotape
- Sample Questions for Community Members

Presenter's Checklist

Presenter's Checklist

When presenting this videotape, be well prepared. Preparation is essential if you and the audience are to get the most from the videotape. The audience should have some familiarity with Superfund, ideally has already viewed the Superfund risk assessment "overview" videotape (a 10-minute videotape extracted from the longer videotape), and has a desire to learn more. The longer videotape covers some very technical concepts that are integral to an understanding of how EPA conducts Superfund risk assessments. People are likely to ask tough questions, and this Presenter's Manual will help you prepare for them.

Here are some tips:

- ❑ Schedule about two hours to show the videotape and answer questions
- ❑ Set up the room to facilitate viewing and discussion (e.g., U-shaped)
- ❑ Make sure the room temperature and accommodations are comfortable
- ❑ Have a flip chart(s), markers, and tape on hand to record notes and to list questions to answer later
- ❑ Make sure you have a working TV, VCR, and any other necessary equipment
- ❑ Make copies of handouts appropriate to the audience (for suggestions, see Tab 4 of this Presenter's Manual)
- ❑ Before presenting the videotape, you should familiarize yourself with it and this Presenter's Manual
- ❑ The videotape is approximately 40 minutes long and includes built-in pauses for audience questions and site-specific discussions:

Introduction	6 minutes
Data Collection and Evaluation (Pause)	14 minutes
Exposure Assessment (Pause)	9 minutes
Toxicity Assessment (Pause)	7 minutes
Risk Characterization	4 minutes
Closing	1 minute

- ❑ Because it is critical to have knowledgeable staff on hand to respond to questions, we recommend showing this videotape only when a risk assessor is present
- ❑ Encourage discussion and have fun

Getting the Most Out of the Videotape

Before showing the videotape

- Discuss expectations
- Explain how risk assessment fits into the Superfund process, and that EPA evaluates both health and ecological risks
- Be up front about how community input will be used and any limitations
- Show the 10-minute videotape first

During the videotape

- Pause the tape for questions and answers
- Reinforce key messages
- Talk about ways community members can be involved

After

- Reinforce main messages
- Discuss how and when follow up will occur
- Give viewers additional information, handouts, and list of contacts

Show the 10-minute videotape first to determine if the audience wants to learn more about risk assessment.

Show the videotapes at a time when the audience can focus on risk assessment and not on other issues that have developed at the site.

Sample Questions for Community Members*

Scoping the Risk Assessment

- Do you know of any area on or near the site where there is pollution?
- Are you aware of any spills or dumping on or near the site?
- Who uses the site now or used the site in the past for work, play, or other activity?
- Who else in the community should the site team contact to be sure nothing is overlooked?

Data Collection and Evaluation

- Do you know how the site was used in the past? If not, who would know?
- Are there specific chemicals you know were used at the site?
- Do you worry about any particular dangers from the site?
- Do you have any reason to suspect that there is pollution in the (*name the area*) where we plan to take samples for background levels of contaminants?
- How do you think the land will be used in the future, considering the past history of the site?

Exposure Assessment

- Do people fish, hunt, garden, pick berries, play, swim, or hike on or near the site? If so, how often do they do these activities?
- What types of animals are hunted or fished?
- What types of foods are grown in the garden?

Toxicity Assessment

- Have you or your neighbors had any health problems that you think could be related to the site?
- What do you want to know about the toxicity assessment process?

Risk Characterization

- Is the risk assessment understandable to you?
- Do you understand how the risk assessment is being used?

*Source: EPA (1999) Risk Assessment Guidance for Superfund, Volume I Human Health Evaluation Manual, Part A. Community Involvement in Superfund Risk Assessments

OVERVIEW OF RISK ASSESSMENT --- 6 MINUTES

The first part of the videotape briefly describes the Superfund program, explains the importance of community involvement, and introduces several important messages, which are summarized below. You may want to underscore these messages during and after showing the videotape. The next two pages contain questions risk assessors might ask community members, more detailed information on some of the key messages, and other risk assessment topics that are commonly misunderstood.

Superfund is a government program that cleans up hazardous waste sites.

The goal of Superfund is to reduce risks to a safe level.

KEY MESSAGES

- **Early community involvement is important.** Getting involved early in the scoping of the risk assessment is ideal, but people can be involved at any stage of risk assessment. For instance, in the videotape, the community in Fort Valley, Georgia, led EPA to several areas that needed to be sampled, including a neighborhood that had been flooded and a drainage ditch that contained kaolin, which was used by some people as a medicinal clay.

- **Risk assessment answers four basic questions:** Is there a risk, who is at risk, how great is the risk, and what is causing the risk. People who live near the site can help EPA answer questions about who is exposed, how they get exposed, and where.

- **EPA evaluates both human and ecological health threats.** This videotape focuses on human health risk assessment. Superfund assessments evaluate risks for current and future site land uses.

Community input can help EPA prepare a thorough risk assessment.

- **Risk is the chance of harm or loss.** At Superfund sites, risk is the chance that chemicals from a site will cause health and ecological problems.

- **Risk assessment is the method EPA has chosen to help make decisions.** Risk assessments are used to decide what needs to be cleaned up, where, and to what level.

- **EPA's bottom line is protect public health and the environment.** People do not have to be sick for EPA to take action.

Sample Questions for Community Members

Scoping the Risk Assessment

- Do you know of any area on or near the site where there is pollution?
- Are you aware of any spills or dumping on or near the site?
- Who uses the site now or used the site in the past for work, play, or other activity?
- Who else in the community should the site team contact to be sure nothing is overlooked?

Definition of Risk and Risk Assessment

Risk is the chance that chemicals from a Superfund site could cause health problems.

Risk is a complex term with different meanings for different people. Risk in the context of health and the environment may be described as the potential for a harmful event, such as cancer, that carries with it doubt about whether the harmful event will occur. Risk also may be described as the probability of harm from exposure to a hazard.

Risk assessment answers the following main questions:

Risk assessment is a way of finding out what the health risks are now and in the future.

- Is it toxic? (Hazard Identification)
- How toxic is it? (Toxicity Assessment)
- Who is exposed to it, to how much, how often, and for how long? (Exposure Assessment)
- What does the risk assessment tell us? (Risk Characterization)

Risk assessments are used to decide what needs to be cleaned up, where, and to what level.

The primary purpose of the baseline human health risk assessment* is to provide risk managers and the community with an understanding of the potential human health risks posed by the site in the absence of any cleanup or removal action. The NCP states that the baseline risk assessment should "characterize the current and potential threats to human health and the environment that may be posed by contaminants migrating to ground water or surface water, releasing to air, leaching through soil, remaining in the soil, and bioaccumulating in the food chain." (See §300.430(d)(4) in NCP).**

Risk Comparisons

Risk communication experts caution against comparing health risks from Superfund site exposures with risks from other harmful events, such as dying in an auto accident or lifestyle choices, such as diet. Such comparisons are often perceived as minimizing or trivializing the risks from a Superfund site. Comparisons also tend to confuse voluntary risks, such as the decision to drive a car or smoke cigarettes, with involuntary risks, such as living near a Superfund site.

It is better to compare similar risks, e.g., comparing risks for different standards, and comparing risks before and after cleanup. (See Tab 3 Common Questions and Answers).

*The videotape does not use the term "baseline risk assessment" and instead uses more general language to convey the "baseline" concept. (See Glossary in Tab 4 of this manual).

**The complete citation is shown in the reference section of this document.

ATSDR Public Health Assessments and Health Studies and the EPA Superfund Risk Assessment

The Agency for Toxic Substances and Disease Registry (ATSDR) was established in 1983 as an independent agency within the Department of Health and Human Services. Section 104 of CERCLA requires ATSDR to conduct a health assessment for all sites listed or proposed for listing on the NPL. (See page 3 in EPA's ATSDR Guidance). ATSDR's overall role is to determine exposure and adverse human health effects and diminished quality of life associated with exposure to hazardous substances from waste sites, unplanned releases, and other sources of pollution present in the environment.

ATSDR's public health assessment is usually more qualitative than EPA's baseline risk assessment. The health assessment focuses on medical and public health concerns associated with a Superfund site and surrounding community. (See Section 2.1 in Health Assessment Guidance and page 2-9 in RAGS-A). The EPA baseline human health risk assessment uses site-specific data to quantitatively appraise health threats associated with the site under current and future land use conditions. ATSDR may study existing health effects and whether they are related to past exposures.

ATSDR uses the health assessment to identify (1) knowledge gaps concerning the toxicity of substances identified at the facility, (2) communities near facilities or releases where measurements of human exposure or medical investigations are needed, and (3) the need for additional health information. ATSDR may choose to initiate a variety of health studies, such as pilot health effects studies (disease- and symptom-prevalence studies, cluster investigations, exposure studies), epidemiologic studies, disease registries, and site-specific surveillance. (See Health Assessment Guidance).

The ATSDR assessment assists EPA in identifying health concerns, potentially exposed people and sensitive subpopulations. However, the risk assessment and other information from the Remedial Investigation are used to make cleanup decisions.

EPA Baseline Human Health Risk Assessment

- Uses site data to assess current and future risks
- Helps identify potential threats to people from past and future chemical releases
- Identifies what and how people may be at highest risk
- Predicts health effects, but does not replace epidemiological studies
- Evaluates risks for sensitive populations so that risk management decisions will be protective

A risk assessment can help identify potential health threats before people get sick.

An ATSDR health study investigates health problems after people get sick.

ATSDR determines the need for a health study during a site-specific public health assessment.

Data Collection and Evaluation --- 14 Minutes

During data collection, EPA finds out what happened at the site and what pollution may be left there.

The second major segment of the videotape describes the initial part of risk assessment, which is the data collection and evaluation phase. The most important messages EPA conveys in this segment of the videotape are summarized below. Questions risk assessors might ask community members, more information on some of the key messages, and other topics that are often misunderstood follow these messages.

KEY MESSAGES

- **The chemical analysis answers the questions:** Which chemicals and how much are present in the environment, such as soil, water, and air?

It's important to collect samples in the right places so that no chemicals are missed.

- **EPA must follow strict protocols to ensure the quality and integrity of environmental samples.** EPA takes samples for chemical analysis using proper containers and equipment to ensure that the measurements are accurate and part of the sample does not get lost or contaminated. EPA also searches historical records and interviews former site personnel.

- **This step identifies chemicals of <u>potential</u> concern (COPCs).** This information does <u>not</u> tell us whether someone is exposed or at risk, but helps identify the list of chemicals reported in samples at the site. This list may be long because of the standard list of chemicals included in every analysis. This raises a perception problem that the community is exposed to all of the reported chemicals. The rest of the risk assessment will determine which ones are the "chemicals of concern" (COCs) that need to be addressed. For simplicity, the videotape focused on two chemicals that posed the greatest health risks: mercury in Lavaca Bay and arsenic in North Dakota. Superfund sites have mixtures of chemicals, and there is rarely one chemical of concern. However, often one or several chemicals pose the greatest risks and become the focus of the cleanup action.

People in the community can tell EPA where pollution might be found.

- **Community input helps.** People can tell EPA places where they and others could contact the site, what they know about historical disposal practices, and help identify realistic future land uses. People should not try to collect their own samples for Agency use because strict procedures must be followed to ensure that samples are adequate for the risk assessment.

Computer models can predict if the pollution will travel from the site and how fast.

- **EPA also uses computer models.** These help predict chemical movement in the environment or in relation to nearby communities. For instance, the movement and speed of contaminated groundwater away from a site and toward public drinking water wells can be determined using computer models. An example of this is shown in the videotape to illustrate how arsenic moved from the soil surface (after crops were sprayed) to the groundwater that people used for drinking water.

Sample Questions for Community Members

Data Collection and Evaluation

- Do you know how the site was used in the past? If not, who would know?
- Are there specific chemicals you know were used at the site?
- Do you worry about any particular dangers from the site?
- Do you have any reason to suspect that there is pollution in the (*name the area*) where we plan to take samples for background levels of contaminants?
- How do you think the land will be used in the future, considering the past history of the site?

Strict sampling procedures are followed to ensure the quality of the data.

Importance of Scoping, Sampling, and Data Quality

The videotape emphasizes the importance of scoping, sampling, and data quality for several reasons. First, community members can have a role early, during the scoping process and may have knowledge about site history that could contribute to the sampling strategy plan. Second, people usually do not understand EPA's data quality requirements. They may come to EPA with a sample of their well water and expect EPA to use it in the risk assessment.

The Superfund Program routinely analyzes samples for about 150 chemicals. Not all of those are hazardous to people. Hazard depends not only on the presence of a chemical but also on its concentration, toxicity, and chance that someone will come into contact with it.

The videotape explains that prior to the risk assessment, EPA tries to learn enough about a site to formulate a plan of action for the risk assessment. This involves producing a sampling and analysis plan. Risk assessors use environmental samples to find the harmful chemicals at the site and determine the amounts that are there.

Environmental samples may be gathered by EPA contractors, states or federal agencies, contractors for state-lead sites, Department of Energy (DOE) contractors, Department of Defense (DoD) for military installations, and Potentially Responsible Parties (PRPs) at enforcement-lead sites. The sampling plan and unannounced EPA audits of PRPs' work ensures proper sample collection. In addition, EPA has strict procedures to ensure the accuracy of sampling data and site decisions. (See Data Quality Objectives).

EPA established the Contract Laboratory Program (CLP) over 17 years ago to analyze environmental samples for Fund-lead sites. All laboratories performing Superfund work must follow strict EPA procedures, and the lead for the site obtains independent validation of the results. (See CLP).

EPA evaluates all of the chemicals detected in the samples (these are the COPCs), but focuses the risk assessment on those chemicals that may cause a significant health problem. These are the COCs.

Chemicals of Potential Concern (COPCs) and Chemicals of Concern (COC)

Chemicals of potential concern (COPCs) are chemicals found in site samples that may be toxic and related to the site. The list of chemicals may be long because samples are analyzed for a long list of chemicals. **However, this does not mean that all of these chemicals pose a risk or that people are exposed.** Some chemicals may be natural, such as calcium in a limestone aquifer. Others may be present in places where no person would come into contact with them.

The risk assessor evaluates the COPCs using the exposure and toxicity information and determines which ones are chemicals of concern (COCs). The list of COCs is usually much shorter than the original list of COPCs reported in samples at a site. (See pages 5-20 – 5-24 in RAGS-A).

Some people may argue that when risk assessors eliminate less threatening chemicals from the risk assessment, the sum of the risks will be artificially low. However, the criteria for eliminating COPCs are strict and are designed to prevent the possibility of diminishing the risks by any amount that would be a health concern.

Reasonable Land Use

EPA strives to develop realistic assumptions about the likely future land uses at Superfund sites through community involvement, including early discussions with local land use planning authorities, local officials, and the public.

Different land uses may result in different exposure scenarios, but many aspects of exposure are very similar from one Superfund site to the next. That is why EPA uses categories of land use, such as agricultural, residential, recreational, and industrial.

Land Use—Current and Future

The baseline risk assessment is designed to help risk managers protect people now and in the future. The site team needs to consider how the site might be used in the future. In determining future land use, RAGS Part A recommends making the most cautious and protective choice, which is residential land use. However, RAGS also mentions that an assumption of future residential land use may not be justifiable if the probability that the site will support residential use in the future is exceedingly small. The NCP does not require the residential land use assumption in risk assessment. Talking with people who live in the community on or near a Superfund site can help EPA make sure that the exposure scenarios evaluated in the risk assessment reflect realistic activities and land uses at the site.

The community and local officials in Fort Valley, Georgia, which is the location of the old pesticide plant mentioned in the videotape, decided that a portion of the contaminated property will be used for a public library. This information helped EPA understand how people might be exposed to site chemicals in the future.

When discussing the risk assessment's future land use assumptions, it is important to be clear that EPA has no role in determining the future land uses at a site. The process for identifying anticipated future land uses for a site is discussed in detail in the 1995 EPA directive *Land Use in the CERCLA Remedy Selection Process*. (See Land Use).

Exposure Assessment --- 9 Minutes

The Exposure Assessment provides the most opportunity for community involvement because it considers how people live, work, and play. The key messages EPA tries to convey in the videotape are summarized below. The next few pages contain questions risk assessors might ask community members, more detailed information on some of the key messages, and other risk assessment topics that are commonly misunderstood.

KEY MESSAGES

- **Exposure assessment answers three key questions:** How are people exposed, who could be exposed, and how much of the chemicals are people exposed to? The risk assessor evaluates all chemicals, all routes, and all pathways.

- **Exposure occurs only if the chemical gets to the person and then gets inside the body.** Without exposure to a chemical, there is no risk from that chemical.

- **Dose depends on the concentration of chemical and how people are exposed.** Some people may not incur high doses because of their behavior (e.g., they only work indoors, do not garden, consume small amounts of fish).

- **The Reasonable Maximum Exposure (RME) dose is the highest exposure reasonably expected to occur.** Superfund considers this in determining health risks for a site and also in setting protective cleanup levels.

- **The exposure route is important.** Some chemicals are not toxic by ingestion but are by inhalation. Some are not absorbed through the skin and are not toxic on the skin.

- **Standard assumptions are used to provide consistency and protectiveness.** Drinking water intake is assumed to be about 2 liters/day (8 glasses) for adults. Community information about pathways are sometimes used to modify the assumptions when appropriate.

- **People can contribute in many ways.** Examples in the videotape include identifying pathways (e.g., eating fish) and places to sample (e.g., where people fish and which species and parts are eaten).

Community Input has Helped EPA Describe:

- Sources of contamination
- Who is exposed
- How people are exposed

How much chemical a person is exposed to is called dose.

The RME is the highest dose anyone is likely to receive from the site.

Sometimes exposures to site chemicals pose no health concerns.

Elements of an Exposure Pathway

Source
(Origin of a chemical on site: e.g., leaking waste pile, leaking drums, or soil under them)

↓

Transport and Transformation
(The chemical can be carried by moisture or wind from its source to other areas, such as groundwater, and can be changed into something else more or less toxic)

↓

Exposure Point
(Place where people can be exposed to the chemical, such as a well that supplies drinking water)

↓

Exposure Route
(Way the chemical enters the body: drinking, eating, breathing, skin contact)

↓

Receptor
(People potentially exposed to the chemical)

The exposure route matters; some chemicals are more dangerous if eaten than if touched.

Sample Questions for Community Members

Exposure Assessment

- Do people fish, hunt, garden, pick berries, play, swim, or hike on or near the site? If so, how often do they do these activities?
- What types of animals are hunted or fished?
- What types of foods are grown in the garden?

Exposure Pathways

Exposure assessment describes how people can come into contact with site chemicals, who might be exposed, and by how much. To describe how people could be exposed to a chemical, risk assessors identify any possible paths that the chemical might travel from its source to points where people may come into contact with it. Risk assessors look at existing pathways as well as pathways that could occur in the future depending on the likely future use of the property. (See Exposure Pathways and page 6-8 in RAGS-A).

Although the important exposure pathway at the Lavaca Bay site involved the discharge of mercury into the Bay and subsequent eating of Bay fish, another pathway involved swimming in the Bay and subsequent skin contact. In Fort Valley, several exposure pathways were identified in the previously flooded neighborhood. Also, some people touched and ate contaminated kaolin.

Risk assessors take into account all exposure pathways. They do this by summing chemical risk estimates for all pathways of exposure in the risk characterization. RAGS Part A provides guidance for identifying exposure pathway combinations and for summing risks across pathways. (See pages 6-47 and 8-15 in RAGS-A and 2.5.1 Chemical Interactions and Additivity Assumption in this manual). Combining risks is a form of cumulative risk, but the risks are limited to those associated with site contamination. (See 2.5.6 Cumulative Risk in this manual).

Risk assessors are particularly concerned about people who might be especially sensitive, such as children or pregnant women. They are also concerned about people who have uncommon exposures, such as people who practice subsistence fishing.

Risk assessors evaluate different exposure scenarios that reflect the various ways people may use land on and around the Superfund site. For example, people might live (residential scenario), play (recreational), or work (occupational or commercial) near or on the site. Although the Occupational Safety and Health Administration (OSHA) is generally responsible for promoting and enforcing compliance with workplace health and safety requirements, Superfund gets involved in the workplace when the source of the chemicals is from a Superfund site rather than from the workplace itself.

Exposure Concentrations and Calculating Dose

Risk assessors estimate intake dose to characterize risk. Intake dose estimates are based on five main factors (See page 6-19 in RAGS-A and Standard Defaults):

- Concentration of a chemical—at an exposure point, such as a drinking water well or contaminated fish fillet. (See page 1 in Calculating Concentration).

- Contact rate—amount of water, food, dust, or air that a person may take in over a specified time.
- Exposure frequency and duration—how often and for how long people could be exposed.
- Body weights for each age group that may be exposed.
- Exposure averaging time—is the time over which exposure is averaged in days. For a chemical that might cause cancer, EPA prorates the total exposure over a lifetime to determine a lifetime average daily dose. For a chemical that can cause non-cancer effects, averaging is over a year (365 days).

Risk assessors insert these five factors into the following equation to calculate an intake dose that results in a reasonable maximum exposure for that pathway:

$$\text{Intake Dose (mg/kg-day)} = \frac{(C)\ (CR)\ (EF)\ (ED)}{(BW)\ (AT)}$$

where: C = contaminant concentration
CR = contact rate (also called intake rate)
EF = exposure frequency
ED = exposure duration
BW = body weight
AT = averaging time

Reasonable Maximum Exposure (RME). Risk assessors choose a value for each factor so that the combination of all factors results in a RME dose. To do this, they use statistics as well as professional judgment. For instance, because of uncertainty associated with estimates of contaminant concentration, risk assessors usually use the 95 percent upper confidence limit on the arithmetic average, which is a higher concentration than the straight average. To protect the majority of individuals in a population, they choose "high end" values for contact rates and duration. However, to avoid unreasonable estimates they use the average value for body weight over the exposure period. This combination of "high end" contact rate and average body weight avoids the false assumption that a very small person would have the highest intake. (See page 6-19 in RAGS-A).

Exposure Assumptions: Standard versus Site Specific

When site exposure information is lacking, risk assessors use standard assumptions, also called default assumptions, in the exposure assessment. The standard assumptions help bridge the gap created by uncertainties. Their sole purpose is to protect the most vulnerable groups in the community, such as children, the elderly, pregnant women, and people who are sick. At the North Dakota site mentioned in the videotape, EPA used standard assumptions about water consumption to estimate how much arsenic people were drinking every day. However, community input can result in modification of the exposure assumptions, such as the fish consumption rate at the Lavaca Bay Superfund site also mentioned in the videotape.

Intake versus Absorbed Dose

Risk assessors most often calculate intake dose because they can estimate it more accurately than they can absorbed dose. Absorbed dose is the amount of chemical absorbed into the blood from the entry point in the body, such as the gut, lungs, or skin. Intake dose is the amount of chemical that enters the mouth, lungs, or contacts the skin.

The RME protects even the most vulnerable groups in the community.

EPA makes health-protective assumptions to be on the safe side.

Community input is sometimes used to change EPA's exposure assumptions.

Toxicity Assessment --- 7 Minutes

Information about how toxic a chemical is comes from research performed by universities, government, and others. Much of this information is available in databases, like IRIS.

The Toxicity Assessment provides less opportunity for community involvement than other phases of the risk assessment since EPA uses toxicity values that have been peer reviewed and derived from the scientific literature. However, the following key messages from the video are important for people to understand. Questions risk assessors might ask community members, more detailed information on some of the key messages, and other risk assessment topics that are commonly misunderstood follow on the next few pages.

KEY MESSAGES

- **Toxicity assessment** addresses potential health effects of the chemicals, and how much exposure causes adverse health effects.

- **"The dose makes the poison."** The harm caused by a chemical depends on how much of that chemical a person is exposed to.

A RME dose that is greater than the reference dose (a safe dose) may be harmful to people.

- **EPA uses toxicity data that are available to the public on the Integrated Risk Information System (IRIS).*** The data are derived from animal studies and occasionally from studies of people in the workplace. The toxicity data used in risk assessment are peer reviewed and represent "conservative" or protective estimates of toxicity in humans.

The likelihood that additional cases of cancer will occur from a site depends on the dose.

- **EPA evaluates cancer and non-cancer effects.** In general, non-cancer effects have some threshold below which no effects will occur (Reference Dose). **For cancer causing agents, we assume that even at very low doses, cancer may develop in a small percentage of exposed individuals. However, every chemical is different, and new science is showing that some chemicals do not follow these rules (some carcinogens may have thresholds and not pose a risk at low exposure levels).** To protect the public health, EPA uses large margins of safety when there is uncertainty in the data.

Science can't explain why some people get cancer while others who are equally exposed don't.

- **Some chemicals exhibit both cancer and non-cancer effects.** The risk assessment evaluates both.

* See Tab 4: Community Tools—Additional EPA Internet Resources.

Sample Questions for Community Members

Toxicity Assessment

- Have you or your neighbors had any health problems that you think could be related to the site?
- What do you want to know about the toxicity assessment process?

Elements of Toxicity

A substance is toxic if it is hazardous or poisonous to living things. Toxicity refers to the inherent potential of a substance to cause damage to living things. A person must be exposed to a toxic substance before a damaging effect can occur. The term hazardous is more broadly defined than toxicity. Hazardous refers to the capability of a substance to cause harm due to its toxicity, flammability, corrosiveness, explosiveness, or other harmful property. (See Region 5 Web Site).

Frequency and length of exposure help determine how much, if any, harm will occur. Chronic toxicity is usually studied in two different ways depending on whether or not cancer is a concern.

Acute toxicity can occur after a single large exposure or limited number of exposures within a short time, generally less than 24 hours. Damaging effects, such as breathing difficulties, vomiting, rashes, and even death, can occur immediately or within hours of an acute exposure. Occasionally, acute exposure can produce delayed toxicity. Chronic toxicity, the main concern at most Superfund sites, can occur after repeated exposures over a long time—usually years—and damaging effects are seen months or years after exposure began.

EPA often refers to large databases for toxicity information on chemicals at a site. The databases show the harm a chemical can have and at what dose to expect harm. This information comes from reseach performed by universities, government laboratories, and other organizations, and is peer reviewed. For instance, EPA would refer to such data to find out about the toxicity of the pesticides and arsenic at the Fort Valley site and to learn about mercury in Lavaca Bay.

The risk assessment predicts health risks based on toxicity and exposure information. An important point made in the videotape is that health effects do not need to be happening in a community for EPA to take some action.

"Safe" Dose

The term "safe" in reference to chemical exposure levels usually refers to amounts that are too small to be a human health concern even though some level of risk remains. This is true for cancer risks as well as non-cancer hazards and indicates that there are degrees of safety. (See Tab 3 Common Questions and Answers).

The Dose Makes the Poison

"All substances are poisons; there is none that is not a poison. The right dose differentiates a poison from a remedy."

Paracelsus (1493-1541)

When a chemical has a health effect on a laboratory animal, it often has the same effect on people.

Safety and Risk

An absolutely safe level with zero risk is unattainable for many chemicals in the environment. But to imply that an EPA risk level is not safe at all can lead the public to conclude that if it is not risk free, it must be unsafe.

Cancer and Non-Cancer Effects

Most chemicals cause cancer in different ways than they cause non-cancer effects, such as damage to the liver or kidneys.

Cancer and non-cancer effects are analyzed differently.

Very small amounts of some substances are capable of starting the growth of cancers. For these substances, there is theoretically no level of exposure that is risk free. For other substances, however, scientists have discovered that exposure has to occur above a certain amount, called a threshold dose, before risks to humans become a concern. Most chemicals that cause non-cancer effects as well as a few cancer-causing chemicals fall into the threshold category. (See IRIS and Chapter 3 in Reporting on Risk).

Because of these differences, risk assessors report risks differently for cancer and for non-cancer effects. When risk assessors estimate cancer risk, they try to predict a lifetime risk level for an exposed individual and how many additional cancer cases might occur in a population of exposed people. These are cancers that may or may not occur, but if they were to occur, they would be in addition to cancers from other causes, such as smoking tobacco. For non-cancer toxicity, risk assessors estimate a daily exposure level that is likely to be of little risk to people.

Risk Characterization --- 4 Minutes

The last part of risk assessment—Risk Characterization—brings the information from the previous parts together to describe the risks associated with the Superfund site. Risk characterization summarizes the risks and explores uncertainties in the risk estimates. The result should be a clear and understandable discussion of the site risks.

The most important key messages from the video are summarized below. Sample questions risk assessors may ask community members, more detailed information on some of the key messages, and other risk assessment topics that are commonly misunderstood follow on the next few pages. A complete description of risk characterization is provided in RAGS Part A (1989) Chapter 8, Risk Characterization (RAGS-A).

Community input during the risk assessment can help reduce uncertainty about exposure scenarios.

KEY MESSAGES

- **Risk characterization describes the risks.** Risks for individual chemicals are added. For instance, exposures to soil may include several chemicals and several routes. All of these are added to present a total risk.

- **Risks are presented as numbers.** Cancer risks are presented as probabilities. The cancer slope factor is used to estimate the probability that additional cases of cancer will occur at different doses. Non-cancer "risks" are described as a number called the hazard quotient, which is related to the Reference Dose.

- **Some uncertainties can be addressed.** There are many uncertainties related to the data sampling and collection process, exposure assumptions, and toxicity data. Communities can help reduce some sources of uncertainty in the exposure assessment and the data collection phase. EPA builds in margins of safety to prevent underestimating the potential risks.

Risk assessment uses the best available science and applies many margins of safety to protect people and the environment.

- **The risk assessment is used to develop cleanup goals.** EPA sets cleanup concentrations based on the information gathered in the risk assessment, such as location of chemical contamination, how people are exposed, and the concentrations that pose health risks. (See Tab 3 Common Questions and Answers).

Because uncertainties and incomplete information cannot be avoided, EPA uses safety factors that provide a margin of safety.

Sample Questions for Community Members

Risk Characterization

- Is the risk assessment understandable to you?
- Do you understand how the risk assessment is being used?

Conservatism in Risk Assessment

Safety factors tend to overestimate what EPA believes to be the actual risks. It is not possible to measure the actual risk.

EPA's risk assessment guidance for Superfund supports an approach that leads to protective or conservative risk estimates. Conservative risk estimates are made to prevent underestimating the health risks to the public. For instance, risk assessors add the risks posed by different chemicals at the site. Adding chemical risks is a protective approach risk assessors can take when data are lacking on how chemicals interact. In the exposure assessment, risk assessors use human dose levels that represent the reasonable maximum exposure (RME). This is the highest exposure level anyone is likely to receive from the site. Also, for the RME, risk assessors generally estimate the duration of exposure to site chemicals using the high-end value of 30 years for potential residential exposure, which is designed to protect most people who live on or near the site. By combining high-end estimates with average values for certain exposure estimates, EPA risk assessors ensure that the site risk estimates are conservative but possible, which translates into health-protective cleanup decisions.

In the absence of scientific data, EPA takes measures to err on the side of caution.

When assessing cancer toxicity, EPA guidelines recommend that risk assessors use the most conservative procedure possible for analyzing the relationship between the dose and response (i.e., a no threshold response) unless there is enough quality information to justify to EPA that a less conservative procedure is appropriate. And for non-cancer effects, EPA builds in a margin of safety to protect the public.

Chemical Interactions and Additivity Assumption

EPA Uses Additivity

EPA advises that in the absence of adequate toxicological data on a mixture, risk assessors should use data on a similar mixture if interaction information is known. In the absence of such data, EPA recommends summing the health risks of the individual chemicals.

When little or no information is available on the interaction of chemicals in a mixture, Superfund risk assessment guidance recommends adding risks. Risk assessors estimate total cancer risk by adding the estimated cancer risks for each chemical of concern. For non-cancer causing chemicals, risk assessors add the hazard quotients (HQs) from various exposure pathways provided that the chemicals produce the same toxic effect by the same mode of action and for the same exposure period. In the risk characterization, risks are summed across exposure pathways. (See page 8-16 in RAGS-A).

For instance, at Lavaca Bay, the risks of eating mercury-contaminated fish and touching mercury-contaminated water while swimming are summed. At Fort Valley, the risks are summed across even more exposure pathways that include ingestion, inhalation, and dermal routes of exposure.

Little is known about the effects chemicals may have when people are exposed to more than one chemical simultaneously. When people are exposed to more than one chemical, the combined health effect may be additive, synergistic, or antagonistic.

The risks of chemicals are additive when their magnitude in the presence of all chemicals is the same as summing the risks produced by each chemical alone (i.e., risk of

chemicals combined = risk of chemical 1 + risk of chemical 2 +...). Since little, if anything, is known about the actual interactions of chemicals, especially within the body, EPA considers additivity to be a reasonable assumption. However, some people view it as overly protective while other people believe it is not protective enough. (See page A-9 in Chemical Mixtures and Lang Article).

Synergism occurs when the damaging effect of both chemicals together is greater than would be expected if added together. In other words, they enhance each other's effects beyond what would be expected if they were not interacting with each other. For instance, polychlorinated biphenyls (PCBs) and vinylidene fluoride are each capable of altering enzyme activity in the liver. When an individual is exposed to both of these chemicals simultaneously, the effect on liver enzyme activity exceeds that expected when the effect of each chemical is added. Although EPA believes that synergism is a rare occurrence and that the additivity assumption is generally protective, EPA will use synergism in the risk assessment if specific data exist to support it.

Antagonism occurs when chemicals interfere with each other. In other words, the effect seen when a person is exposed to both chemicals together is less than would be expected if additivity had occurred.

Due to the lack of data on both synergism and antagonism, addition of chemical risks is our most protective approach. EPA's Risk Assessment Forum is revising the 1986 Guidelines for Health Risk Assessment of Chemical Mixtures, but changes are not expected in EPA's recommended use of additivity in the absence of data suggesting that another type of interaction occurs. (See Mixtures Guidelines).

Scientists must use large doses to determine if cancers will develop in laboratory animals. These doses are far larger than those people are exposed to in the environment.

Sources of Uncertainty

Uncertainty is part of all risk assessments simply because scientists lack sufficient information on actual exposure and on how some chemicals may harm people. Uncertainty can come from many sources, such as the following (See Exhibits 4 and 5 on pages 9 – 10 in Data Usability in RA):

- Inadequate sampling data.
- Incomplete information about how people might come in contact with site chemicals.
- No information on how a chemical might harm people.
- Having to use experimental animal studies to estimate human risks.
- Having to use small numbers of experimental animals at high doses to see an effect, especially since some effects can take years to develop in humans.

The Community's Role

The community can provide information to help overcome some uncertainties. For instance, community members can tell EPA:

- How they use the site
- How much fish, if any, people eat from nearby streams
- Whether people grow and eat their own garden vegetables
- Where children play
- Past activities they have observed at the site

Uncertainty and Margins of Safety

Any description of uncertainty should emphasize that EPA takes a cautious and protective approach in response to it. EPA builds margins of safety into the exposure assessment, toxicity assessment, and risk characterization to prevent underestimating the potential risk. EPA also seeks information from the community to minimize uncertainties. (See also Chapter 8 in CI-Toolkit).

EPA builds in many margins of safety to prevent underestimating risk.

To ensure an adequate margin of safety for the public, EPA uses protective assumptions in the risk assessment. (See page 28 in Hazardous Substances). For instance—

- In the exposure assessment, risk assessors use the human dose representing the reasonable maximum exposure because it is the highest exposure anyone is likely to receive from the site. For example, when risk assessors look at a person's possible exposure to contaminated drinking water, they typically assume that people drink 8 glasses of water a day. So people that drink less than 8 glasses of water a day are protected. Also, risk assessors typically use the upper-bound value of 30 years to estimate exposure duration in residential settings. This practice may overstate the years of exposure for some residents, but is designed to protect most people. These and other margins of safety help EPA make sure it protects people's health.

Mathematical dose-response models are used to find out the likelihood that cases of cancer may occur at the low doses typical of Superfund sites.

- When assessing the toxicity of a chemical, EPA also wants to be protective. When data about the mechanism of carcinogenic action are limited, EPA guidelines recommend using a linear multistage model to estimate the relationship between dose and response to the chemical at the low concentration levels found in the environment. (This relationship is referred to as the slope factor in the videotape.) Risk assessors may apply a less conservative model than the linear multistage model when there are enough data to convince the Agency it is appropriate to do so.
- For non-cancer effects, EPA builds a margin of safety into the toxicity criteria for noncarcinogens. An "uncertainty factor" ranging up to 10,000 might be applied to compensate for limits in the data available on a particular chemical. For instance, these factors can account for unknown differences between laboratory animals and humans, potential differences in response to chemicals among people, and other uncertainties in the data. This means that the reference dose (RfD), which is considered safe for humans, can be up to 10,000 times less than the smallest dose that can cause a health problem in laboratory animals.
- In risk characterization, risk assessors sum the risks for individual chemicals across exposure pathways to present a total risk estimate.

The risk assessment results in numbers that indicate how great the risk is.

Risk Estimates are Presented as Numbers

For each chemical of concern that may cause non-cancer effects, a Hazard Quotient (HQ) is reported. The HQ is a ratio of the reasonable maximum exposure (i.e., the chronic daily dose averaged for a lifetime) divided by the reference dose (RfD):

$$HQ = \frac{\text{Chronic Daily Dose}}{\text{RfD}}$$

Non-cancer risks are described as a number that compares the RME to a safe dose, called the reference dose.

If the chronic daily dose is less than the RfD (i.e., if the ratio of HQ is less than 1.0), people are not likely to be harmed because of the many safety features built into the RfD. However, if the HQ is above 1.0, there is a potential for concern.

When more than one chemical is involved, EPA adds their respective HQs. This rule is in keeping with the assumption that the effects of different chemicals over an exposure period are additive unless specific data indicate otherwise. The sum of HQs is called a Hazard Index (HI). (See standard tables in RAGS-D and page 8-12 in RAGS-A).

Cancer risk in Superfund risk characterizations is expressed as an upper-bound estimate of excess lifetime cancer risk for an exposed individual. These cancer risks are called "excess" or "additional" cancer risks because they are risks only from the Superfund site. People have cancer risks from other sources related to their family medical histories and lifestyle choices. Cancer risk is the probability that additional cases of cancer might occur in the future. Cancer risk is calculated by multiplying the reasonable maximum exposure (i.e., chronic daily intake averaged over a lifetime) with the cancer slope factor derived from the dose-response relationship:

Individual Excess Lifetime Risk = Chronic Daily Intake x Cancer Slope Factor

See standard tables in RAGS-D and Exhibit 8-2 on page 8-7 in RAGS-A for examples of how cancer risk estimates are usually reported in table format.

Cancer risks are reported as a statistical probability. For instance, a risk of 3×10^{-2} indicates that 3 additional cancer cases in a population of 100 are likely to occur, and 3×10^{-4} indicates that 3 additional cancer cases in a population of 10,000 could occur. This means only that the possibility exists that these cancer cases will occur, not that they will or will not occur. An excess lifetime cancer risk of 10^{-6} after cleanup could be expressed this way: among one million people drinking 2 liters (8 glasses) of water per day over their whole lives, one case of cancer might result from exposure to contaminants in the water.

Numbers such as $1x10^{-4}$ (one in ten thousand) are terms that scientists use to describe the extra cancer risk above the baseline level of cancer from other causes.

Acceptable Risk and Risk Range

The term "acceptable risk" may be misleading because it suggests a value judgment (See Tab 3 Questions 8 and 9).

EPA generally considers an upper-bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6} as a safe range. A risk of 10^{-4} represents a probability that there may be one extra cancer case in a population of 10,000. A 10^{-6} risk is the probability that there may be one extra cancer case in a population of one million people over a lifetime of exposure to a chemical at the RME dose. This also means that at most, there is one chance in a million of getting cancer from exposure to a specific level of a chemical, under the conditions defined in the risk assessment, over a lifetime (See page 8-27 in RAGS-A).

An upper-bound cancer risk estimate ensures that the actual chance of getting cancer will most likely be below EPA's risk estimate. To get an upper-bound risk estimate, EPA chooses the most conservative mathematical model to analyze the data. Also, in the exposure assessment, EPA chooses reasonable maximum exposure. As a result, the cancer risk range that EPA views as acceptable for soil, air, and water is likely to overstate the actual human cancer risks.

The NCP Says

"For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper-bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6} using information on the relationship between dose and response. The 10^{-6} risk level shall be used as the point of departure for determining remediation goals for alternatives when ARARs are not available or are not sufficiently protective." (NCP)

Cumulative Risk

In 1997, EPA's Administrator issued the *Cumulative Risk Assessment Guidance—Phase I Planning and Scoping*. The guidance defines cumulative risk assessment as

Superfund risk assessments address all site sources of pollution but do not include off-site sources of pollution.

the aggregate ecological or human health risk caused by the accumulation of risk from multiple stressors and pathways. (See Cumulative Risk Guidance). EPA's definition of cumulative risk is evolving.

It is important that people understand that Superfund risk assessments address only site-related sources of pollution. Because of limits set in the Superfund law, they do not yet incorporate potential off-site sources of pollution, such as nearby highways, permitted factories, or farms. Superfund's policy of adding risks from several exposure pathways in the risk assessment is a form of cumulative risk, but EPA has defined cumulative risk more broadly. (See Chapter 1 in Considering Cumulative Effects).

Questions about cumulative risk are often raised by communities with environmental justice concerns. For information about environmental justice, please refer to the following guidances: the 1997 *Cumulative Risk Assessment Guidance*, 1997 *OFA-NEPA Environmental Justice Guidance*, 1998 *CEQ-NEPA Environmental Justice Guidance*, and 1998 *Interim Guidance for Investigating Title VI Administrative Complaints Challenging Permits*. A history of environmental justice at EPA and other related documents are in the EJ Action Agenda.

Videotape Closing Remarks --- 1 Minute

In the closing of the videotape, EPA briefly mentions that the risk assessment results are used to help risk managers determine how to clean up the site to protect public health. A brief discussion of risk management may be needed at the end of the videotape, and the following information will help you prepare for that discussion.

Risk Management

Risk management addresses the question: what is going to be done about the risks? Risk management decisions center around selecting ways to block exposure pathways and remove contamination risks. These decisions involve the site team and the community.

EPA established a national goal and a series of criteria for EPA staff to use in choosing site cleanup methods, often called remedial alternatives. The national goal of the remedy selection process is to select cleanup methods that are protective of human health and the environment, maintain protection over time, and minimize untreated wastes. The goal and expectations are set out in the NCP. (See pages 1-9 in Rules of Thumb).

EPA's nine criteria for evaluating site cleanup methods ensure that the site team considers all important factors in deciding on a remedy:

- Overall protection of human health and the environment;
- Compliance with ARARs (applicable or relevant and appropriate requirements);
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume of contamination through treatment;
- Short-term effectiveness;
- Implementability;
- Cost;
- State acceptance; and
- Community acceptance.

At a minimum, the chosen cleanup option must meet the first two criteria (protection of human health and the environment, and compliance with ARARs). No remedy will be permitted if it does not satisfy these requirements.

Risk assessment information applies to several of the nine criteria EPA uses for selecting cleanup methods during the Feasibility Study phase of the Superfund process:

- Overall protection of human health and the environment is a risk-based threshold criterion that the selected cleanup method must satisfy.
- Risk assessment is used to evaluate possible short-term health concerns that could occur during the cleanup process if contamination is released creating new exposure pathways.

Thus, risk estimates are used to identify the chemicals that need to be cleaned up, target the chemical concentrations that the cleanup methods must attain in each medium (soil, water, air) during and following treatment, and identify risks that will remain after the cleanup goals are met.

Risk Estimates Are Used To

- Identify chemicals that need to be cleaned up
- Target chemical concentrations that the cleanup methods must attain in each medium (soil, water, air) during and following treatment
- Identify risks that will remain after the cleanup goals are met

When the risk is unsafe, EPA takes action to clean up the site.

There are no simple solutions for cleaning up most Superfund sites.

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PUBLIC MEETINGs

TYPICAL QUESTIONS & SAMPLE RESPONSESs

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The following list contains sample questions which are often asked by the public. The list is taken from USEPA, Region 9's Risk & Decision Making and Public Involvement Workshops. Some typical answers or responses to these questions are given as examples. The examples show how a good understanding of the question and careful preparation of a response using USEPA's Seven Cardinal Rules of Risk Communication are needed to provide helpful answers. Whether or not answers are perceived to be helpful depends on the credibility of the Agency and the trust that citizens give to the people representing the Agency. This important point is the subject of USEPA Region 9's Public Involvement Workshop.

The authors welcome your comments and suggestions for additional questions. Based on your feedback, the list may be expanded or revised. All comments may be directed to the authors at (415) 744-1133 or 744-1018.

If you are interested in learning more about how to work productively with the public and how to answer similar questions, you may want to attend EPA Region 9's Workshop on Public Involvement. This popular and informative workshop provides the framework and experiences one would need to fully understand some of the questions and answers in this section. If you are interested, please call Alvin Chun or Arnold Den at (415) 744-1133 or (415) 744-1018, or e-mail: chun.alvin@epa.gov or den.arnold@epa.gov.

A CAUTION TO THE READER — People are astute. Thus, the sample answers given are intended only to be used as ideas from which to develop one's own genuine responses. They are not intended to be memorized and used verbatim since then it may not sound genuine and be perceived as hollow "P.R." As a general rule, responses should be open, honest, and frank; address the specific needs of your audience; and be acceptable to both you and your organization. This usually requires spending additional time, getting policy input from management as well as technical input from credible sources. Such preparation is required in order to be an effective Agency representative and communicator. (CR 2) *

* Cardinal Rule #2 from USEPA's Seven Cardinal Rules of Risk Communication (See next page).

USEPA' Seven Cardinal Rules of Risk Communication*s

.... For Many Organizations These May Be New Policies Requiring New Leadership, Processes, Resources and Skills

CR 1 - Accept and involve the public as a legitimate partner early and often in the process for environmental decisions.

CR 2 - Plan carefully and evaluate your performance. Ask others who do not have a direct stake in your work for their frank evaluations and suggestions.

CR 3 - Listen and be responsive to people's feelings.**

CR 4 - Be honest, open, frank, kind and respectful.

CR 5 - Coordinate and collaborate with other credible sources.

CR 6 - Meet the needs of the media.

CR 7 - Speak clearly using plain conversational English and with compassion.

* Updated by USEPA, Region 9

** Examples of "active listening" are underlined in responses to the questions which follow

1.s Q. Why can't I ask my question now?s

Underlying Public Need: The public is saying they would like their concerns and questions addressed now instead of later. Apparently, the Agency's proposed agenda isn't meeting the needs of the public. Sometimes the Agency incorrectly assumes that the public needs to be educated before they should be allowed to ask questions. One should seriously consider involving the public in resetting the agenda to better meet their needs. The public is more likely to listen to the Agency if their concerns and needs are addressed first. This example of involvement is a way that the Agency can show its interest in listening and treating the public as a legitimate partner. This action helps to reduce fear and begin to establish trust and credibility with the public.

Reminder Note: The underlined sentences are examples of "active listening," an important skill used in facilitating discussions. Active listening is the subject of management, supervisory and interpersonal skill training.

A. **<u>It sounds like you have a lot of questions that need to be answered now</u>. Maybe we should do that first and save the rest of the agenda for later? Is that OK?** (Principles: Listen; provide feedback on what you heard; and accept the public as a legitimate partner by getting their participation in deciding on the agenda.) **(CR 1, 3)**

A. **<u>I know you all have a lot of questions that you want answered</u>. Would it be alright if we proceed with the 10 minute presentation, which I believe will answer many of your questions, and then leave the bulk of the remaining time to address the rest of your questions?** (Principles: Listen; provide feedback to the public with a recommendation on how to proceed with the meeting; and accept the public as a legitimate partner in deciding on a final agenda.) **(CR 1, 3)**

A. Poor Response: We share your concerns. If you will please allow us to finish I'm sure your questions will be answered. (Caution: The overused statement, "We share your concerns" is vague and may be perceived to be patronizing. The previous two answers are less vague because they provide more specific definitions of what is understood. People are astute and they can usually tell when an Agency response is not genuine or sounds too much like a "P.R." spin. As a general rule good responses usually requires hard work, an investment in time and policy input.)

A. Poor Response: Please let me finish my talk! There will be lots of time after my talk to answer your questions. (It can be difficult to hear what the audience is trying to say especially if you are nervous about your talk and had invested a great deal of time preparing for it. This problem may be avoided if you can get a sense of the community's concerns (i.e., know your audience) before the meeting, and prepare accordingly. It may also be helpful to involve a neutral meeting facilitator† who can assist you by listening for subtle messages being expressed by the audience. Not being able to hear the audience's urgent need for answers to their questions may be interpreted as an indication that the Agency doesn't care and that it knows better than the community. This may create perceptions that we are disrespectful and not genuinely interested in helping.)

A. Poor Response: Please (With your hand raised and pushing at audience), all questions will be taken after our presentation! We need to follow the (Agency's) agenda. Let us give our presentation, and then we'll take your questions. (The push-back hand gesture may send out a subtle but strong

message that you and your Agency don't want to listen to people's concerns and that people don't have anything important or useful to say. Remember that for a meeting to be useful it must have an agenda that meets most of everyone's needs; otherwise a meeting may not be useful and some other medium needs to be used. To help insure that an agenda is useful, a trained Agency meeting facilitator or a neutral outside facilitator† should be designated to develop an agenda using input from both the Agency and the audience or community.)

† COMMENT: An experienced meeting facilitator with mediation skills would be helpful; an inexperienced facilitator may hurt the trust and credibility of your Agency.

2.s Q.s Why won't you answer my question?s

(This is usually a follow-up question to Question #1 after the Agency insists that questions will only be answered following their presentation.)

Underlying Public Need: This person is anxious to vent or express his feelings and would like the Agency to listen attentively and acknowledge their concern before responding. By providing an opportunity for this person to express his concerns, he may feel that we have a better understanding of his concern and that we will therefore take appropriate action. The public is usually more interested in direct answers to their questions, and may not have patience for "slick" presentations that don't address their specific concerns. (Most Agency staff tend to be well versed in giving detailed presentations to their peers who are more interested in details. In contrast, the public is usually more interested in our conclusions. Details may become important later or not at all. A useful presentation for the public generally includes responses to their needs and concerns.)

A. It sounds like you have a pressing question that we need to address immediately? Let me answer (briefly) then: .....
(Principles: Listen and respond.) **(CR 1, 3)**

A. I apologize if we have not answered your question, and I have written down your question here (on the board or a flip chart pad of paper)**, and I have saved this part of the agenda** (also, shown on another flip chart) **to answer them. After having heard some of your questions, I believe that many of them will be answered in the 10 minute presentation that we have prepared. I also believe that hearing the brief presentation first may save you and everyone here some time. If that sounds like a useful way to proceed, can we proceed? And if that's not acceptable, then we'll have to think of something else.**

(Principles: Listen; provide feedback and helpful suggestions; and involve the public in deciding how to proceed.) **(CR 1, 3)**

A. (When you feel that an apology is not needed.) **Let me try again. I feel it's important that we answer your question and everyone else's. I'll write your question here on the flip chart to make sure that we fully understand it, and then give you an answer. Let me restate your question so that everyone can hear it: "_____." Did I correctly understand your question? If not, please help me out by restating it. (CR 1, 3)**

A. **I understand that your question is very important to you, and maybe we haven't been listening too well. How many of you also have questions and would like them answered now?** (From the show of hands) **I see there are many questions. Let me offer two suggestions on how we might proceed, and with a show of hands let me know if one sounds good:**

One suggestion is to answer your questions until they are all answered, and then if you are still interested, we can give you our 10-minute presentation. Also, you are welcome to pick up a fact sheet which summarizes the presentation if you can't stay.

A second suggestion is to let us give the 10-minute presentation so that everyone will have some common understanding of the situation. The 10-minute presentation may answer many of your questions. It may also raise other questions which you may want addressed. After the presentation, we can spend the rest of the evening making sure that all your questions are answered. Because there seems to be a lot of questions, we are prepared to stay late until all your questions have been answered.

Now let's have a show of hands to decide how we should proceed. How many would like to hear the presentation first? How many would like to get at the questions first? It looks like most of you would like to _____. Would those of you who voted for the other choice mind if we proceeded this way and give it a try? (Principles: Listen; provide feedback with helpful suggestions; and involve the public in deciding how to proceed.) **(CR 1, 3)**

A. Poor Response: Because they will be answered after you hear our presentation. Please let us finish and you will see. (This will not be effective if there is low trust between the Agency and the public.)

A. Poor Response: Sir (using a frustrated or irritated tone of voice), if you would just let me finish, I'll get to your question at the end, and we will answer all your questions. (It is sometimes very difficult for Agency personnel to share control of the meeting with the public. As a consequence, it may appear to the public that the Agency is more concerned about sticking to its agenda and maintaining "control" (thus, reinforcing public perceptions that government is inflexible and not receptive) of the meeting rather listening and including agenda items raised by the public. In other words, the Agency's message to the public is that they and their problems are not important. In an attempt to maintain control, one will likely lose trust, credibility and control. An important point to consider: If your goal is to give your presentation at any cost, you may want to consider just sending out a fact sheet and not have a meeting. However, if you do have a meeting people will also expect your attention, and we should take time to listen, and try to meet the needs of the community, and/or to include their input in solving an environmental problem. When a community is insisting to be heard, we should try to accommodate them, or present them with alternatives that meet both their needs and the Agency's. Giving people more control and input to the meeting agenda beforehand will help build trust and promote two-way communications.)

A. Poor Response: If you will be patient like everyone else here, I'm sure we'll get to your question along with everyone else's. You may even learn something. (Insults and arrogance will tend to anger everyone especially when the Agency is not respected. Insults and arrogance is not acceptable nor a substitute for respect which people deserve and expect.)

3. Q. What are you doing about it? Why is it taking so long?

Underlying Public Need: The public would like to see action, and to know that we are correcting the problem. Ultimately, they will be evaluating our sincerity in protecting their health.

A. Unfortunately, there are no simple solutions for cleaning up hazardous waste sites. It is a complicated and time consuming process. You are concerned about what we're doing, and why it's taking so long. Like you, we would like to clean this up as quickly as possible. Here's what we have done and what we will be doing: _____. Our goal is to protect public health, and we are proceeding as fast as we can. (Principles: Listen; provide feedback.) **(CR 3, 4, 7)**

A. You know, you're right. It is taking long and I have not been clear on why. Unfortunately, there is no quick and easy solutions for cleaning

up hazardous wastes site so that your health is protected. What I can do is tell you what we have done, what we plan to do and keep you updated with progress that we are making.
(Principles: Listen; provide feedback.) **(CR 3, 4, 7)**

A. Poor Response: Ah, Ah, Ah ... Don't you know we're doing our best! Cleaning up this site and issuing the permit is very complicated. It takes time. If you will just read our Fact Sheet you will understand. (This Agency person was not well prepared and did not have answers to some basic questions. He became defensive and sarcastic. This tends to increase public fears which may ultimately delay any Agency decision on cleanup options or solutions. Some lessons learned here are: that you should be knowledgeable about your site, state that a primary Agency goal is to protect public health and the environment, anticipate that people will be concerned, have responses that address those concerns, and remember that we serve the public.)

A. Poor Response: I have five other sites that I'm working on and I'm working hard on all of them. (The public is usually not interested in the status of other sites or our excuses. They want to know specifically what we are doing to clean up their site and to protect them.)

4. Q. Why haven't you Closed the Plant or Given us Bottled Water Yet? How many more People Need to Get cancer or be Hurt Before You will act?

Underlying Public Need: The public is fearful about getting cancer from exposure to DNC, and is concerned that we have not closed the plant. From the public's perspective, closing the plant and giving bottled water seem to be obvious and logical solutions.

A. The plant does not pose an immediate health threat. You can drink the water and your air is O.K. for now. However, we are concerned that if we do not take action, the water will get contaminated and breathing the contaminated air for many years might cause harm. We are taking action so that you can continue to drink the water and breathe the air for many years to come without health problems.
(Principles: Give a direct answer that demonstrates our concern for protecting people's health and welfare, and state our actions.) **(CR 3, 4, 7)**

A. We are not closing the plant because there is no immediate health threat. The problem is a long term one where if nothing is done about it in the next few years, it will become a health problem. In other words,

constant long term exposures to DNC is the problem which may cause cancer, and that is the problem we are aggressively solving. We are taking action to eliminate the long term exposure to you and your family. Here's what we are proposing, and we believe this will correct the problem and protect your health: _____. Your health is not in danger.

(Principles: Give a direct answer that demonstrates our concern for protecting people's health and welfare, and state our actions.) **(CR 3, 4, 7)**

A. Poor Response: We've been working with the plant, and we don't think that it's necessary! (While this may be true, it does not tell the whole story. This response may suggest that we are more concerned about the plant than the community. It may also give the community the impression that their concerns and ideas are not important, and that only the Agency knows what is best for them.)

A. Poor Response: (Even though the water is safe to drink and not contaminated, several Agency staff at the meeting are seen drinking bottled water. This can alarm and mislead people to conclude that the water is highly contaminated because the Agency's "actions" give the impression that the water is not safe to drink.)

A. Poor Response: We are studying the problem and we'll let you know if we find something. (Does not provide a definite positive, negative or uncertain answer. This can suggest that the water may be unsafe to drink and that we just don't care, causing more unnecessary alarm.)

When this question is asked after you have begun your presentation:

A. Poor Response: Let me finish my presentation! (Even though one may have spent hours preparing the presentation, one must remain open and be prepared to change. The problem may be that one is not prepared to change or that one has not been given permission by one's supervisor nor requested it ahead of time in order to be able to make adjustments during the meeting. Planning for these situations, and designating a neutral meeting facilitator† (see "COMMENT" at end of Question #1) who will have responsibility for making changes are important contingencies to consider.)

5. Q. Is it Safe? Are my Kids Safe?

Underlying Public Need: The public wants to know if there is any danger to their family. They want direct and understandable answers to their question, e.g., yes, no, or I don't know and why. They do not want

answers that come from an Agency who is not trustworthy nor credible, e.g., "This hazard represents only a 10^{-5} risk to your community." This example suggests that one is hiding something because the response is indirect and uses mysterious technical language; thus, one may perceive that "it isn't safe" even though the intent is to suggest otherwise. Answering this common question is easier when one has developed trust with the public and is confident about his answer. One can respond more confidently when there is general agreement within the Agency.

A. Yes, you and your family are safe. Let me explain what I mean by safe. <u>Your concern for safety is our concern also</u>. We are here to protect your health and the health of your family. We consider any amount of a cancer causing agent to be potentially dangerous and we take it seriously. (This is the non-threshold dose response policy that EPA uses in cancer risk assessments.) **DNC is such a substance. Based on our knowledge of the amount of DNC that people are being exposed to, we feel it is safe for all residents east of the Acme Plastics Plant because DNC isn't in the air or drinking water. For the residents of Coyote Knolls, DNC is only present in the air, but in such small quantities that exposure may be a health concern if it is not reduced in the next several years. In other words, it is safe now and by taking action in the next years it will continue to be safe. (CR 3, 4)** (In this case there will be a finite but small concentration of DNC that will remain in the ground water and air, but it will be below the RfD or RfC or within a 10^{-4} to 10^{-6} risk range which the Agency considers "safe" in its various air and water standards. You should anticipate that this may not be acceptable to some people and possibly some Agency people, especially if they believe that any contamination is unacceptable. These issues must be discussed and resolved internally so that everyone in the Agency has a common understanding. In addition such issues must be fully heard and discussed with concerned citizens in order to reach some common understanding.)

A. <u>We are also very concerned about your safety and the safety of your loved ones</u>. We believe it is safe for you and your kids to drink the water and breathe the air. There is no DNC in the drinking water, but we feel there will be in the future if the leak from Acme's underground tank is not controlled. There is some DNC contamination in the air and this will become a health concern if steps are not taken to control it, and if people continue to be exposed to it for many years. We are taking steps to insure that the contamination will be controlled so that it will continue to be safe. (CR 3, 4)

A. Poor Response: The lifetime risk of getting cancer based on the current level of DNC in the air is 10^{-4}. Based on that estimate, we feel that we should

reduce the risk to a level of 10^{-5}. (It may be second nature and more comfortable for Agency people to use scientific language, but it is not usually helpful to speak in terms that are unfamiliar to the public. Addressing the community by using unfamiliar scientific language may be taken very offensively because it can suggest an unwillingness to communicate. Because this response does not directly or indirectly say if it is safe, the community may interpret it as being very unsafe!)

6. Q. Are there any safe levels for a carcinogen? (A Class A, or B, or C carcinogen, or known or likely carcinogens are descriptors that the Agency is revising in its cancer guideline.)

A. <u>Your question is about carcinogens and whether there are safe levels</u>. EPA has categorized some chemicals as "known" or "A" carcinogens, "likely" or "B" carcinogens, and "possible" or "C" carcinogens. These classifications are based primarily on actual data from humans for "A" carcinogens, and animal studies for "B" and "C" carcinogens. If EPA believes that a chemical is a carcinogen, we assume that all levels of exposure will have some level of cancer risk. The smaller the exposure, the smaller the risk. We generally describe these risks in terms of probability or the specific chance of getting cancer. If in asking your question, you want to know if there are levels of exposure that are free from risk, the answer is no. If, on the other hand, you are asking whether certain levels of chemical exposure are too small to be of a health concern, then the answer is yes. Our goal is to reduce the level of exposure to a safe level where it will be safe to drink the water and breathe the air. (From EPA's experience and the experiences of many health agencies, risks greater than 10^{-4} are almost always unacceptable or unsafe and need to be controlled. Risks that are between 10^{-5} to 10^{-4} have been controlled on a case-by-case basis, and risk less than 10^{-6} are usually not controlled and thus deemed safe. Remember that a safe level does not necessarily mean zero risk. (There is an actual EPA court decision on this. See Bork 1989 decision on the Clean Air Act NESHAP on Vinyl Chloride.) For example, 10^{-4} or 10^{-5} risks are safe levels. There are many reasons why zero risk may not be feasible, but one must also remember that 10^{-4} or 10^{-5} are upperbound estimates or maximum risks. This means that the actual probability or risk may be much lower or even be zero given all the health protective assumptions that are used.) **(CR 3, 4)**

A. Poor Response: No. Any level is dangerous, and can cause cancer. (This answer paraphrases EPA's use of its non-threshold dose response assumption

for carcinogens. This assumption is a default policy that EPA uses when there is no documented evidence for how a particular chemical causes cancer. EPA's default policy assumes that there is some finite risk or probability associated with any exposure to a carcinogen, i.e., theoretically one molecule of DNC can start the cancer process. Too often the public as well as some Agency personnel misinterpret this policy to mean that any exposure to a carcinogen will definitely cause cancer. Contrary to this notion, the policy uses a probability concept, and asserts that when the exposure to a carcinogen is very small, the probability of getting cancer is also very small; so small that it is not a health concern and is safe. This is an important concept to understand since we routinely set cancer risks levels above zero (i.e., 10^{-4} to 10^{-6}) as safe levels. While we may want to eliminate any exposure to a carcinogen as an overall Agency goal, the reality of taking into account technology limits, budgetary limits, analytical limits, social benefits, etc., often requires management decisions that will reduce risks to levels that are greater than zero, but so small as to not be a health concern.)

7. Q. Would you drink our water? Would you breathe our air?

Underlying Public Need: Again, the public wants to know how this affects their family and if we are sincerely concerned about protecting their health.

A. Yes, I would drink the water because it is not contaminated with DNC, and I am here breathing the air because it is such an extremely low risk that I am not concerned about it harming my health. I understand that some of you may still feel that any concentration of DNC in the air is unsafe. But let me say again that we feel there is no immediate hazard or concern, and that we can clean up the contamination so that there will be no long-term health concern. (If there was an immediate health hazard, an emergency response action would have been ordered, and bottled water may have been offered or recommended if the drinking water was contaminated.) **(CR 3, 4, 7)**

A. Poor Response: That's a personal choice whether to drink the water or not. (While this is true, it sounds evasive and doesn't answer the question. As a result, even though we know that the water isn't contaminated with DNC, the response gives the impression that the water isn't safe to drink.)

A. Poor Response: (Hesitates and doesn't answer. Similarly, this may also give the impression that the uncontaminated water isn't safe to drink.)

8. Q. How can you say it's acceptable? My uncle has cancer! Just look at our neighborhood and all the illnesses and people with cancer!

Underlying Public Need: The public wants to have some control over determining what is acceptable, and to make it as safe as possible. They may just want some expression of acknowledgment, compassion and concern for the people stricken with cancer. (The phrase "acceptable risk" should not be used by the Agency because it is a value judgment. An Agency can decide what it considers "safe" and the public has every right to say that it isn't acceptable. The Agency's goal in risk communication is not to impose our value judgments on people. Rather our goal is to engage people in a dialogue so that we can understand their perspective and so that they can have a better understanding of the situation, the Agency, and it's intentions. With this information, people can make a more informed judgment.)

A. I'm sorry (genuinely) about your uncle's cancer. (Pause and wait for any reaction.) (CR 1, 3, 4, 7)

A. I'm sorry (genuinely) to hear about your uncle. I'm also hearing that you're not satisfied with our cleanup proposal, and that you're very concerned about cancer which DNC can cause. (CR 1, 3, 4, 7)

A. I'm troubled to hear that there is so much sickness. I want you to know that our goal is to make it safe for you and your family. (An Aside - It is not necessary to say this now, but we do not believe that DNC is responsible for the cancers because cancer usually takes many years of exposure to develop and DNC has only been in the environment for a few years.) **I believe the DNC leaking from ACME Plastics can be eliminated so that your health is protected. If you would like, we can discuss this further after the meeting, during the break, or I would be happy to call you at your convenience. (CR 3, 4, 7)**

A. Poor Response: I'm sorry (insincerely) about your uncle's cancer.

A. Poor Response: I'm sorry (memorized from this document and not genuine) to hear about your uncle. I'm also hearing that you're not satisfied with our cleanup proposal, and that you're very concerned about cancer which DNC can cause.

A. Poor Response: I'm sorry to hear about your uncle, however, we are going to clean up the situation to our acceptable risk range of 10^{-6}. (One's feeling of sorrow for the uncle is eliminated with the word "however" and the

words following. Sorrow should be genuine and could have been more clearly expressed by just saying, "I'm sorry to hear about your uncle." Usually nothing more needs to be said unless one is asked again.)

A. Poor Response: It's acceptable because the risk is 10^{-6}. Based on that risk level, those cancers couldn't have been caused by DNC. (While the numbers and conclusion may be correct, the response doesn't acknowledge the tragedy of the situation and address the person's concern to have some personal control in this situation. The Agency's response about acceptability may be perceived as callous; we appear to be more concerned with numbers than with people.)

A. Poor Response: We don't know what caused those cancers. However, you should know that one out three of you will get cancer in your lifetime just from everyday activities and exposures that don't include DNC. For example, you're more likely to get cancer from eating peanut butter or charcoal broiled steaks than from exposure to DNC. (Whether this is true or not is irrelevant when people are upset. People may just want acknowledgment of their feelings, or to just be allowed to vent their concerns. They may not expect an answer. If this is the case, people would probably appreciate some expressions of acknowledgment or empathy from the Agency. People, especially when they are upset, do not want to be told why they shouldn't be concerned or that their concerns are exaggerated. In this case, any explanation may be perceived as patronizing.)

9. Q. What does 1 x 10^{-4} or 1 x 10^{-6} mean? What is risk? What's a risk assessment?

Underlying Public Need: The public needs direct answers. They also need to know us, and if we are trust worthy, e.g., Are we trying to "snow them" with our jargon and are we're looking after their best interest. First understanding and discussing how the situation affects people personally, and directly answering the "Is it safe?" question will address most of people's needs. Usually only after that has been adequately demonstrated will people be more receptive to a technical discussion about risk calculations. Often, if the Agency has done a good job addressing the "Is it safe?" question with honesty and compassion, it will have earned some degree of trust and credibility. As a result of addressing their underlying concerns, the public may not require more explanation of the technical jargon or specific 10^{-6} terminology.

Problems occur when Agencies focus on the 10^{-6} term or issue with the public too soon, because they assume that it is the primary question on people's minds. Some of the primary questions on people's minds that deserve attention are: Does the Agency understand my concerns? Is the Agency interested

in my concerns? Is the Agency open and upfront with me? Do they know what they're doing? Can I trust them? These are the questions that must be first worked on to establish rapport necessary to answer other questions.

Focusing too soon on 10^{-6} issues may generate more public concern and confusion. When this happens, Agency staff may sometimes misinterpret this to mean that they did a poor job of explaining the technical terms; and that if 10^{-6} could have been more clearly explained, then the public wouldn't have overreacted. This line of reasoning usually leads to more frustration for everyone.

Answering this question can get quite involved because it is technically complex, and not easy to do in conversational English. This often times requires an extensive dialogue with the community which should be offered. Be prepared to spend sufficient time explaining the technical aspects when people want it. It is also usually helpful to use easy-to-understand graphics to help explain your points in the discussion.

Assuming that this question is being asked at a non-technical public meeting, some answers could be:

A. Explaining risk and risk assessments cannot be easily done in our short meeting, but I will try to give you a short answer which I hope will be helpful. If you're interested in a more thorough discussion, I would invite you to meet with me in the future or we can arrange for a separate meeting with all of you who would be interested. If that is not convenient, I also have a short video tape which gets into what risk assessments are, and you may find looking at this helpful. Of course, I would be available afterwards to discuss it with you.

1×10^{-6} is an expression which scientists often use to express one chance in a million that something may occur. In a risk assessment, this means <u>at most</u> one chance in a million of getting cancer if one is constantly exposed to a specific level of a chemical under the conditions stated in the risk assessment (e.g., 24 hours/day of exposure) **over one's 70-75 year lifetime. In our risk assessments, we tend to overestimate the risk when there is insufficient information; that way, we insure that public health is protected.**

If that still isn't a good enough explanation, let me explain it another way and hopefully, it will be more helpful: DNC is a dangerous chemical because we have reasons to believe that it may cause cancer. Currently, there is no danger to you if you drink the water because it

isn't contaminated. The air is contaminated with DNC, but in such small levels that it is safe in the short-term. However, we must reduce the contamination to a lower level for it to be safe in the long-term. I'm sorry if this sounded confusing because on the one hand we're saying it's safe in the short-term, but on the other hand we're proposing to clean it up to make it safe in the long-term. (CR 1, 7)

As in any response, this one may not be satisfying to everyone, and you may need to be prepared to offer other examples, or get people to tell you where it isn't clear so that you can elaborate. For example:

A. <u>It looks like that answer wasn't too helpful for everyone</u>. Maybe some of you now have some more specific questions for me which may help me explain this better, or maybe I could meet with those of you who would like to discuss it further after this meeting. If you would like, I can try to find another example. We also have a short video tape that you may want to view. The tape introduces risk assessment and tries to explain it but even it may need to be supplemented with some discussion.

Other examples: **A 10^{-6} risk level is equal to the risk level associated with EPA's drinking water standard for trichloroethylene, a degreasing solvent and classified by EPA as a probable human carcinogen; alternatively, this level is 100 times more stringent than EPA's drinking water standard for vinyl chloride, another cancer causing chemical. (CR 1, 3, 7)**

Assuming that this question is being asked at a technical meeting where the question can be taken literally, some answers could be:

A. Explaining risk and risk assessments cannot be easily done in our short meeting, but I will try to give you a short answer which I hope will be helpful. I would invite you to hear a more thorough discussion on this rather complex question when you like.

In this situation, we are talking about cancer risk. Cancer risk is the likelihood or chance of getting cancer from exposure to that chemical. When we write, "1 x 10^{-6}" or say "one times ten to the minus sixth," we are using scientific shorthand to express "one-in-a-million." By saying that there is a one-in-a-million *excess* cancer risk from a given level of exposure to a chemical, we mean that for each person exposed to a specific cancer causing chemical at some definite level

during his/her entire lifetime of 70 years, he/she has at most a one-in-a-million chance of getting cancer from that chemical. This is similar to saying that due to exposure to a chemical over a specific time frame, we would expect to see no more than one additional cancer case in a population of one million people. We specifically refer to "excess cancer risk" and "additional cancer case" because historically or statistically we know that there will be about 300,000 cancer cases over a 70-year period in a population of one million people due to ordinary exposures from daily activities, family history, genetics, etc. So the additional cancer cases are those above the statistically expected cases from ordinary everyday activities.

I should also point out, however, that there is a great deal of uncertainty built into our risk estimates to ensure safety. This is because science has not yet progressed far enough to explain exactly how cancers are caused. In addition, we can never be absolutely sure of the exact levels of a chemical that are present in the environment. To account for these uncertainties and to acknowledge gaps in science, we build in safety factors in the risk estimates which tend to overestimate what we believe to be the actual risk. Where there is uncertainty or where our information is incomplete, we make assumptions that tend to overestimate the risk as a way to insure that public health is protected. For example if we are not sure about the amount of time you may be exposed to a chemical, we overestimate your exposure by saying your exposure is 24 hrs/day for a lifetime. As a result, when we estimate that there is a one-in-a-million (excess) **risk, the actual excess risk is probably much less and may even be zero.**

Where the audience is technically oriented and has a greater interest for technical details, a more expanded explanation may sound like this:

A. Explaining risk and risk assessments cannot be easily done in our short meeting, but I will try and give you a summary which I hope will be helpful. I would invite you to hear a more thorough discussion on this rather complex question when you like.

As a summary, risk defined by EPA is the probability or chance of getting cancer from being exposed to a specific carcinogen such as DNC or a group of carcinogens under conditions described in the risk assessment. We should remember, of course, that the general risk of getting cancer in our lifetime without any presence of DNC is about 30% i.e., 300,000 people in a population of 1 million will develop cancer in a lifetime. That is, from looking at hospital records, 30% of us will be afflicted with some form of cancer in our lifetime just from

our routine lifestyles, medical history, etc. Thus, the risks that EPA estimates are risks that are in addition to the 30% level found in the general population.

The conditions defined in the risk assessment are used to help predict the risk. They depend on the site, and may, for example, state that people in a community are being exposed to DNC for 24 hours each day, everyday for the next 9 years. In estimating the risk, two sets of conditions are often used; one to reflect a typical exposure level and a second to reflect a higher exposure level.

Numbers such as 1×10^{-4} and 1×10^{-6} are terms used by scientists to describe the extra cancer risks above the 30% baseline cancer level in the United States. 1×10^{-4} means that if you were exposed to DNC at the levels and conditions set forth in the risk assessment, that there may be a one-in-10,000 chance of getting cancer from DNC. In other words, if 10,000 people were exposed to DNC over a long period of time, there may be one person who might get cancer in addition to the 3,000 people who will get cancer from lifestyle exposures and other factors which do not include DNC. Unfortunately, there is no certainty to our risk estimates because neither doctors nor scientists know enough yet about the cancer process, i.e., a one-in-10,000 chance or risk estimate does not mean that one person out of a 10,000 people exposed to DNC will actually get cancer. It means that they might.

In order to estimate the chances of getting cancer from exposure to chemicals, such as DNC, over a long period of time, EPA must make a number of health protective assumptions also referred to as scientific policies. Because of our lack of understanding about cancer, our assumptions or policies tend to overestimate risk rather than underestimate it. (All of the probabilities or risk numbers that are calculated are based on these assumptions.) **This is done to insure that public health will still be protected should some of our assumptions or policies later be proven to be wrong, based on further scientific research. An example of a health protective assumption that EPA makes is that when animals get cancer from very large doses of a chemical given in laboratory experiments, EPA assumes that people will also get cancer from that chemical even at much lower levels typically found in our environment. In making this assumption, we are erring to protect public safety. If science should prove in the future that our assumption was too health protective, and that people do not get cancer from exposures to DNC, then we would have erred on the side of safety. So when a risk assessment states, for example, a one-in-a-million risk or 10^{-6} risk, it means a probability or prediction that there may be up to one extra cancer case in a population of one million people over a long**

period of exposure to a chemical. This one possible extra cancer case is one in addition to the 300,000 cases in a population of one million that would occur over a lifetime due to lifestyle, family medical history, etc. Again, if any of our assumptions are later proven wrong, then the actual risk or danger from exposure to DNC may be lower (or had been overestimated) and could even be zero. (Remember in the absence of conclusive scientific data, EPA uses health protective assumptions in its risk assessments.) **This means that the calculated risks may be a lot lower should one or more of our assumptions prove to be overprotective. EPA takes these precautions to ensure that the public's health and safety are protected. (CR 3, 4)**

A. Poor Response: It's almost like getting a four-of-a-kind hand in a poker game. (If people are expressing doubt or confusion about the terms, and you continue to explain using more unfamiliar or technical terms, it may not help and may increase people's fears.)

10.sQ. Am I going to be the one-in-a-million?s Why isn't it zero?s

Underlying Public Need: The public is concerned about how they will be affected personally, and whether they should trust the Agency's judgement. The questions may also indicate that the public wants to be more involved in deciding on an acceptable cleanup level.

A. I would say no because the odds are so great against it. (When there is high trust in the Agency, this is a sufficient answer. To earn trust, usually requires early involvement and clear communication with the public through the sincere use of the Seven Cardinal Rules.)

A. Your concerns about what the risk numbers means to you personally is a very valid one. Because we are talking "probability" or "chance" when we talk about risk, there is unfortunately no definite answer to your questions. But based on the safety factors we've used to develop these risk numbers, we sincerely doubt if you will get cancer from DNC. Let me explain why. In estimating the risk, we've made numerous health protective assumptions and assumed several worst case exposure situations to be on the safe side. The assumed exposure situations over estimate your exposures and are thus very unlikely, but because of the uncertainties about cancer, we wanted to use this case to be as protective as possible. As a consequence, the actions we will take to reduce your risk based on these assumptions will be more

substantial or health protective than if we had assumed more typical exposure situations. For example, we assumed a maximum exposure to DNC of 24 hours/day, 365 days/year for the next 30 (or 70) **years. If this describes your current situation, you may have at most one-in-a-million chance of getting cancer from DNC. If you are exposed to DNC for less than 24 hours/day which is more likely then your risk is even less. Conversely, under those extreme exposure situations you may have at least a 999,999-in-a-million chance of not getting cancer from DNC, and an even much less chance if your exposure is less than the maximum exposure situation we assumed. In your case, I would guess that you will not be constantly exposed to DNC for all of your life, and thus your chance of getting cancer from DNC is much less than one-in-a-million, and for all practical purposes is zero, especially when one considers all the other health protective assumptions that are used. (CR 3, 4, 7)**

A. Poor Response: Chances are you will not be the one-in-a-million to get cancer from being exposed to DNC. You're more likely to get cancer from eating peanut butter or charcoal broiled steaks which also contain carcinogens. (It may seem logical and even fair, but it isn't, to show how insignificant the risk from DNC is by comparing it to everyday risks. Such comparisons are unfair because they compare an involuntary exposure to DNC with other voluntary exposures. It's like comparing apples with oranges. As you can imagine such comparisons generate anger because it sounds like you are belittling people's real concerns.)

11.sQ.s What does 1 ppb mean; 1 µg/l; 1 µg/m³?s

(The context of this question is that we've been using 1 ppm in all our previous discussions and now we've introduced 1 ppb. This is a technical question requiring a technical answer which should be given in terms that are familiar to the audience. The second response provided below can also be used to clarify "ppb" when it is introduced in a public discussion.

For example,

A. 1 ppb is a term used for expressing concentration. 1 ppb is similar to one drop of water in an Olympic size swimming pool, 1 second in 32 years, or 1 item out of a billion of those items. I hope these examples are helpful. Does that clear it up better? (CR 1, 3, 4, 7)

A. I'm sorry if we've confused things by switching from 1 ppm to 1 ppb concentration. (or, "Oops, I think I may have confused things. Let

me try it again.") Here's some other ways to explain it that may be more helpful:

1 ppm is 1,000 ppb, or 1 ppb is a 1,000 times smaller than 1 ppm.

Another way to visualize 1 ppm is that is it is 1/1,000,000, and 1 ppb is 1/1,000,000,000. (Writing these two numbers on a flip chart will help to illustrate your points.) **Even though these may be small numbers or small concentrations, a small concentration of a certain toxic chemical may still hurt you. Whether it will hurt you depends on the chemical, its toxicity, and the length of exposure. (CR 7)**

A. Poor Response: (Answering with technical terms or jargon similar to the previous response when the question was actually a non-technical question is a poor response because it isn't helpful to the audience.)

12. Q. What does RCRA mean?

A. See Answers to Question #11. (Avoid jargon and explain terms early in your presentation. **Referring to "RCRA" as the Resource Conservation and Recovery Act, the "law," or the "regulations**" may also be sufficient and won't sound so "jargony" once people are familiar with your term.) **(CR 7)**

13. Q. How can you trust the company?

Underlying Public Need: The public wants to know if our primary concern is for their health and well being. They would also like to know if and how we go about verifying the company's data.

A. You're concerned about the credibility of the company's data. Even though we have very limited resources to do our own sampling and must often rely on company supplied data, let me assure you that we don't take their data on face value. We critically review the data and the process by which it was derived to ensure its credibility. If we had any doubts, we would request additional and more reliable data. Our goal is to protect your health by ensuring that we have the most reliable data from which to base our decisions. We would be more than happy to share their monitoring data with you, and discuss how we looked at it to insure it's accuracy. (CR 3, 4)

A. Poor Response: Why do you think we trust the company? (This is defensive, and does not answer the question. It gives the impression that we are

not subject to question and that we should be trusted. That we "should" be trusted usually creates suspicion and distrust.)

14.sQ. Why did the company have to tell you?s Why didn't you spot the problem and wh did it take so long?s

Underlying Public Need: The public probably needs to vent their frustration about the situation, and to feel reassured that we are doing everything that we can. They may need an honest apology from the Agency for any delays which we may have caused, and to be kept more regularly informed about any progress that is being made.

A. Unfortunately, we do have to rely on the good faith reporting by the company. To provide strong incentives that they do a good job, we heavily penalize company's that don't and make sure everyone knows we are serious. Now that we know, we are taking actions to solve the problem, and here's what we are doing to protect your health: _____. (Some examples of limitations: "We didn't have any authority in this matter until recently when the regulations came into affect," or "Nobody knew that DNC was a carcinogen until recently when the cancer data was published." **(CR 3, 4, 7)**

A. Poor Response: We're doing the best we can, and I would appreciate it if you could be patient and try to understand that we are doing our best. (While this is a true statement, it does not answer the question. If we are open with people, then maybe they can be more understanding and patient with us.)

15.sQ. What does 0.07 cancers mean? How cans you have a partial cancer?s

Underlying Public Need: The public is confused by the information and would like clarification so that they can better understand it. (A suggestion here is to revise the presentation and increase the population size even if it is larger than the real population to make 0.07 be a whole number. For example, saying seven out of 100 million may be clearer.)

A. I apologize for our poor example. (or "Let me try again since I seem to be confusing you with our jargon.") Another way that may help to explain what we mean is to say that out of a population of 100 million people who might be exposed to this chemical over a lifetime, there may be no more than seven extra cancer cases. (The seven cases

attributed to DNC are those projected above other cancer cases attributed to everyday activities and lifestyle choice.) **So for a population of 100,000, it would be highly unlikely that there would be any extra cancer cases attributed to DNC. Does that explain it better? (CR 1, 3, 4, 7)**

A. Poor Response: I'm not sure. (Even though this may be an honest response, it is not satisfactory. The public expects an Agency representative to have an answer to this question, i.e., they expect you to understand your own data and how you arrived at it. It is embarrassing that such a basic question could not have been answered; this hurts your credibility and the Agency's.)

A. Poor Response: Of the 1,000,000 people that would be exposed to DNC, a maximum of 0.07 cancer cases may result. (This response uses more unhelpful technical jargon, and does not answer the question.)

16.sQ.s What do you mean you don't know?s

Underlying Public Need: The public probably needs to vent their frustration and concerns, and may also need a genuine apology from Agency officials. IMPORTANT RULE: If you don't know, you should be open, honest, and frank, and say so. You may have to repeat this many times and this may be uncomfortable for you, but never guess or try making up an answer just because you feel pressured; this is a sure way to lose any established trust and credibility. People know when you are making up an answer and when they do, trust and credibility fall below zero and is not easy to regain.

A. I should know the answer but I don't. I'm sorry. I would like to get back to you with the answer tomorrow. (CR 3, 4, 7)

A. Your question deserves a good answer. I'm sorry I don't have the answer because it is not my area of expertise. May I called you next week after I've done some checking to see if I can get the answer for you? I'd like to follow up with you after this meeting. My phone number is (415) 744-1133 if you need to reach me in the meantime. (CR 3, 4, 7)

A. <u>You sound very disappointed</u>, but we just don't know. Science sometimes just doesn't have all of the answers for us. I can tell you what we do know and what we don't. If you're bothered by this, we can talk some more after this meeting to see if there's more that we can do. (CR 3, 4, 7)

A. <u>You sound very disappointed</u>. I'm sorry, but we just do not have an answer. If you'd like, we can talk some more after the meeting.

A. Poor Response: We don't know, and you can't expect me to know everything. (A rational response in this case fuels more anger when all that people probably needed was an opportunity to vent their frustrations; any sarcasm added to a rational response just makes a situation worse.)

17.sQ. One of our very close friends who liveds near the hazardous waste site just dieds from cancer. (Person breaks down in tears.) How long are you bureaucrats going tos take before we see some action? How man more people must die? We're taxpayers and we pay your salaries! I'm totall frustrated and angered by the amount ofs pres ure we need to put on your offices before we can get any action. What do yous have to say for yourself? I want somes answers! (Person breaks out into tears.)

<u>Underlying Individual Need</u>: The individual is very upset about the loss of a dear friend, and is probably needing, most of all, some place to vent their emotions, and perhaps to get some compassionate response.

A. (One listens and allows the individual to vent emotions, and empathetically responds:)

I'm sorry (genuinely) to hear about the loss of your friend. If you would like, I would be glad to discuss this with you after our meeting. (Principle: Listen and respond with compassion.) **(CR 1, 3, 4, 7)**

A. (One listens and allows the individual to vent emotions before empathetically responding:)

<u>This is an especially sad and difficult time for you</u>. I'm so sorry for your loss. (CR 3, 4, 7)

A. ***Silence***. (No response is needed or expected. Your facial expression (genuine, not faked) will convey your thoughts. One can satisfy the person's need for compassion by genuinely listening with empathy until the person is ready to stop. While listening, you may conclude that people

may really want to be periodically informed about progress and future actions. Providing frequent updates may give people some assurance that cleanup is proceeding. Without feedback, people can get the impression that nothing or very little is being done.) (Principle: Listen with compassion.) **(CR 3)**

A. ***Silence.*** (One is speechless because you may have been surprised by the emotional outburst, and may not know what to say, being quiet is the next best thing to do, given that no response was expected. Being quiet may also be hard to do because one may feel that a response was expected. Most of the time, all a grieving person wants is just a chance to vent their emotions and to share their grief.) **(CR 3)**

A. Poor Response: (Interrupts the individual and gets somewhat defensive.) We're doing the best we can. Why, last week we finished the proposed _____ (e.g., permit, report, or RI/FS). And by next month we should be making a decision. Please be patient with us.

A. Poor Response: I'm sorry your friend died, but all of you should know that one out of three of you will get cancer in your lifetime anyway from normal daily activities. Specifically, for the DNC contamination, the added lifetime risk of getting cancer is only one in 10,000. Since there are 5,900 people in this community, we would not statistically expect to see any excess cancers in such a small population. (While this may be technically correct, the person is looking for some display of empathy rather than an explanation. A technical explanation may be interpreted as one of not caring.)

A. Poor Response: I'm sorry your friend died, but it probably wasn't caused by the DNC contamination because the site has only been there for five years, and it normally takes 15 years or longer for someone to develop cancer. We are doing everything we can.

A. Poor Response: Your friend's death is unfortunate, but you shouldn't be blaming us or the DNC contamination because we had nothing to do with it.

18.sQ.s I've been working here at Acme Plastics for 15 years and I'm fine. How can yous ay there's a problem?s

Underlying Public Need: The public needs to know how credible we and our science are. (This person's question may also represent some initial denial of the risk at hand, or a concern about their job, or something else.)

A. **<u>Sir, I'm very relieved that you and most everyone else are fine</u>. We have to be concerned about those who may be less fortunate and more prone to being affected by DNC to make sure they are also protected.**

In saying that DNC is a probable human carcinogen and that it has contaminated the air, we are not trying to create more of a problem. Unfortunately, science doesn't have all the answers that you and I would like. It can't explain why some people will get cancer while others equally affected won't, but we have to deal with that. In dealing with this, we use many health protective assumptions to make up for the uncertainties that remain in science. In our evaluation of the health effects information related to DNC, we believe that it is a carcinogen which should be treated seriously. We do this to ensure that you, your family and others do not suffer from any future or long-term health problems. Because of the uncertainty in science about the causes of cancer and the wide range of variability, some people are more susceptible than others. So your statement of good health is not surprising. Unfortunately, I cannot say with your degree of confidence that DNC will not harm others; the health data say that we should treat the DNC contamination with caution. Our goal is to ensure that you, your family and everyone else in your community can say with your degree of confidence that the DNC exposure is so small that it doesn't pose a danger. (CR 3, 4, 7)

A. Poor Response: Your case is an exception. Our animal studies combined with our use of health protective assumptions in the risk assessment indicate that there is a cancer risk which may not be seen for another 20-30 years. (Even though you understand risk assessment, being argumentative and not acknowledging that people's concerns are valid can create obstacles in future communications. In this case, it creates unnecessary or false concerns.)

19.sQ. If we can't get action from EPA ons maintaining the value of our property, whos can we go to?s

<u>Underlying Public Concern</u>: The public is now less angry and fearful, and more willing to consider solutions to the problem. They also realize that EPA can't do all they had initially expected.

A. <u>Your concerns about the value of your property are serious</u>. We are trying to protect your health and in doing so, we may have to consider some remedies that may not completely resolve your concern about

property values, but they will protect your health. Our goal is to find a remedy that will protect your health and not affect your property values; but our primary concern is with safeguarding your health. Your ideas and input will help us make the best decision. I encourage you to comment on the options that we will be considering, and I hope that in doing so we can correct this problem to your satisfaction. (CR 3, 4, 7)

A. <u>I know you are concerned about the future value of your property</u>. Even though we can't do anything directly about your property values, here are some suggestions: _____ which may be helpful. Are there other ideas that someone else would care to offer? (CR 1, 3, 4, 7)

A. Poor Response: We have been working hard to solve the hazardous waste problems. Right now I'm working on five other NPL sites and your site is getting most of my attention. We don't have legal authority to address your property value concerns. (We're not listening to people's needs, reacting naturally, and inappropriately being defensive; this tends to create a negative perception that we're unwilling to consider or consult with other credible sources when it is needed.)

20.sQ. You don't have to live in our neighbor-s hood! You don't have to deal withs the stiqma as ociated with this hazardous waste site! I've got my life savings tied ups in my home! Would you buy my home?s

<u>Underlying Individual Need</u>: Even though the Agency may be only concerned with protecting health and the environment, this person is very concerned about another legitimate risk: the risk of declining property values due to the contamination. People want to know if we understand their concern and if our actions will help maintain their property values.

A. <u>Sir, it sounds like you would like to know if I would buy a home here, but I think your real question or concern is about the type of cleanup we will be doing to ensure that your property values are not affected, and that are we doing everything we possibly can</u>. Would answering that question be more helpful? (CR 1, 3, 4, 7)

Option 1. If so, here's what we are doing: _____. I would like to stress that our goal is to ensure that your environment is safe to live

in. In other words, to ensure that the air you breath, the soil that your children play in, and the water that you drink are safe. We wouldn't like your property values to decline. Returning your environment to a healthful state or preventing it from being unsafe is our responsibility, and this is what we can offer to help protect your property values. As you know, there are other factors which also affect property values such as public perception that unfortunately neither you nor we have any control over.

Option 2. If not, I don't know if I can really answer your question about whether I would buy a house here because like other major investments there are many things to consider, such as schools, commuting distance, transportation, employment, environment, etc., before I could make such a decision. I know that if I were living here or if I had to buy a home here, I would at a minimum want the environment to be safe, and that is the goal of our Agency: to ensure that your environment is safe.

A. <u>This whole situation has not been an easy or pleasant one for you, and we're also very concerned</u>. As to whether I would live or buy a home here, that's usually a very complex question for most situations. But if my only considerations for making a decision were whether the air was safe to breath or the water safe to drink, I would say yes because our Agency's goal is to ensure that it is. As you know, there are other important and personal considerations such as cost, neighborhood, quality of schools, mortgage rates, etc., which most of us take into account before deciding on the purchase of a home. (CR 1, 3, 4, 7)

A. Poor Response: Personally, I wouldn't live here. That's off the record, of course. (Everything that you say should be considered on the record representing your Agency's position. This response implies that the cleanup will not result in a safe environment.)

A. Poor Response: (You appear to be caught off guard and seem to be searching for an answer but can't give one, or are afraid to. This may give the community the impression that you wouldn't ever buy a home here because the cleanup will not be effective.)

A. Poor Response: Property values are beyond our control and not our responsibility. I'm sorry we cannot help you. (This may be partially true, but the response fails to mention how the cleanup will likely improve the situation and help to minimize losses in property value.)

21. Q. I am considering buying some property here. Given all that has happened, would you buy or recommend buying property here now or in the future?

Underlying Individual Need: This person is concerned about investing his money here, and would like to know if that would be a wise thing to do.

A. <u>Property investments are important transactions requiring careful consideration. I can appreciate your concern about buying property here</u>. Property investments are also very personal choices. Where I may be willing to invest my money may be very different from where you or someone else might be willing to invest their's. For me to tell you how you should spend your money would probably not be very helpful because I'm not very knowledgeable in that area, nor do I know what criteria you consider important. What I think would be more helpful would be to give you all the information about the hazardous waste problem that we have so that you or another potential buyer or seller can make the most informed choice possible. (CR 1, 3, 4, 7)

A. Poor Response: Sorry, we don't make those types of recommendations. (Even though this may be true, it does not address the individual's underlying need, and may give the impression that you wouldn't recommend buying property here. In the preceding answer, the response was not only honest but also provided helpful information.)

TAB 4. HANDOUTS FOR COMMUNITIES

This section contains the following:

- Glossary of Technical Terms in EPA's Superfund Risk Assessment Video
- Community Tools
- Diagram of Superfund NPL Remedial Response Process
- Fact Sheets

Glossary of Technical Terms in EPA's Superfund Risk Assessment Video

Arsenic — A natural element common at low levels in the environment. At higher concentrations, arsenic can damage the skin and increase cancer risk. It is an important commercial ingredient in pesticides and wood preservatives.

Assumption — Facts or relationships that are taken for granted.

Benzene — A toxic liquid, often found in gasoline, that can cause cancer and anemia.

Baseline Risk Assessment — An analysis of the potential adverse health effects (current or future) caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these releases (under the asssumption of no action). The results of the baseline risk assessment are used to:

- help determine whether additional response action is needed;
- modify preliminary cleanup goals; and
- document the magnitude of risk at a site and the primary causes of risk.

Cancer Slope Factor — A high-end estimate of the likelihood that an individual will develop cancer as a result of a lifetime of exposure to a particular chemical.

Carcinogen — Any substance that can cause or promote cancer.

Chemicals of Concern — Substances related to the site that cause the most serious health risks.

Chemicals of Potential — Substances related to the site that may be toxic.

Concern Cleanup Plan — A program developed to deal with a release or threat of release of a substance that could affect humans or the environment. The term "cleanup" is sometimes used interchangeably with remedial action, removal action, response action, or corrective action.

Contaminants — Chemicals that have the potential of causing harm. Same as pollutants.

Data Collection and Evaluation	Gathering of information about the chemicals, history, and human activities for a site and the surrounding area.
Dermal Exposure	Contact between a chemical and the skin.
Dermal Toxicity	The ability of a chemical to harm people through skin contact.
Dose	The amount of chemical a person is exposed to.
Exposure	Contact with a chemical or physical agent.
Exposure Pathway	The steps a chemical takes from its source to a receptor, such as a person. A complete pathway includes the source, chemical transport and transformation, contact point, exposure route, and receptor.
Exposure Assessment	An estimate of how chemicals can contact people who may be exposed, and by how much.
Exposure Route	The way a chemical enters the body, such as by breathing (inhalation), eating or drinking (ingestion), or by skin contact (dermal).
Geographic Information System (GIS)	A computer system designed for storing and displaying information in a geographic context. For instance, a GIS could show where people live and work in relation to a site.
Groundwater	Water below the surface of the ground.
Hazardous Waste	Waste defined by the Resource Conservation and Recovery Act (RCRA) that may cause or significantly contribute to illness or death, or that may substantially threaten human health or the environment when not properly controlled.
Health Assessment	A description that focuses on potential medical and public health risks posed by a Superfund site.
Ingestion	The process of eating or drinking.
Inhalation	The process of breathing.
Kaolin	A fine white clay that is used in medicine as an adsorbent in the treatment of diarrhea.
Lead	A natural element common at low concentrations in the environment. At higher concentrations, lead can delay mental and physical development in young children. Lead was commonly used in paint and gasoline.

Margin of Safety	A measure of protection.
Mercury	A natural element. Exposure to mercury can lead to serious nervous system problems in humans.
Model	A series of mathematical equations used to simulate the behavior, concentration, or occurrence of chemicals or other features of interest. Models can conserve time and easily allow "what if" predictions. Models are usually run on computers.
Reasonable Maximum Exposure	The maximum exposure reasonably expected to occur in a population, or in different groups within a population (for example, the elderly or children).
Reference Dose	An estimate with some uncertainty of the daily exposure to people (including sensitive subpopulations) that is not likely to cause damaging health effects during a lifetime.
Risk	The mathematical chance that chemicals from a Superfund site will cause health problems.
Risk Assessment (for human health)	A procedure for estimating the kind and degree of hazard posed to all people who come in contact with site chemicals now and in the future if no action were taken to remove the hazard. A full risk assessment involves data collection and evaluation, exposure assessment, toxicity assessment, and risk characterization.
Risk Assessor	One who conducts a risk assessment.
Risk Characterization	The last phase of the risk assessment process that describes the potential health risks to people from exposure to site chemicals and the uncertainties involved.
Risk Manager	An individual or group who serves as the primary decision maker for a site. Generally, the decisions involve the regional Superfund management in consultation with members of the site team and technical staff.
Sampling	A method of taking small portions of the soil, water, air, plants, and animals from a site to determine which chemicals are present and at what concentrations.
Sensitive Subpopulations	Groups, such as children, the elderly, and pregnant women, who may be more likely to be harmed by chemicals at a site than the general population.

Standard Assumption	The use of statistical data on drinking water consumption, soil ingestion, inhalation rates, and other factors to help fill in gaps created by uncertainties.
Subpopulation	An identifiable part of a population. A smaller group within a larger population.
Superfund	This is the common term for the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, which is the federal law that can require the cleanup of uncontrolled hazardous waste sites.
Toluene	A toxic liquid that resembles benzene, but is less volatile, flammable, and toxic. It is produced commercially for heavy-duty cleaning. Toluene can cause nervous system problems, such as confusion and weakness.
Toxicity	The degree to which a substance or mixture of substances can harm humans or animals.
Toxicity Assessment	An evaluation of what health effects can be caused by specific chemicals and how much of each chemical can cause harm.

Community Tools Available on Internet

Several Superfund publications for communities are available on EPA Web sites. The following is a sample of current documents at *www.epa.gov/superfund/tools/index.htm*.

Risk Assessment Guidance for Superfund (RAGS) Part A Community Involvement in Superfund Risk Assessment

Common Chemicals Found at Superfund Sites

Ground Water Cleanup at Superfund Sites

Mercury - Emergency Spill & Release Fact Sheet

NPL Information Documents

Rules of Thumb for Superfund Remedy Selection

Superfund at Work

Superfund Information Brochure

Superfund Today:
- Focus on Revisions to Superfund Risk Assessment
- Focus on Property Issues
- 400th Construction Completion Information
- Focus on Community Advisory Group Program
- Focus on Cleanup Costs
- Focus on Risk Assessment
- Community Resources
- This is Superfund

Community Advisory Groups (CAGs) documents: (See below for description)

Technical Assistance Grant (TAG) documents: (See below for description)

Technical Outreach Services to Communities (TOSC) Program documents: (See below for description)

Community Based Environmental Protection

Superfund Job Training Initiative

Kids & School Projects

Terms of Environment

Technical Publications

A Citizen's Guide to EPA's Superfund Program. U.S. Environmental Protection Agency, Region 3, Hazardous Site Cleanup Division. *www.epa.gov/reg3hwmd/super/sfguide.htm*.

General EPA Superfund Information. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response. *www.epa.gov/superfund*.

Many EPA publications are available free of charge from the National Service Center for Environmental Publications. To order publications, call NSCEP toll free at 1-800-490-9198.

Superfund Hotline telephone number: 1-800-424-9346.

Community Risk Assessment Tools Across the Agency. U.S. Environmental Protection Agency, Office of Research and Development. *www.epa.gov/nceawww1/communit.htm*.

Superfund Today—EPA Moves Ahead on Risk Assessment Reforms. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response. *www.epa.gov/superfund/tools/today/sft_rags.htm*.

Introduction to RCRA, Superfund, and Emergency Planning and Right-to-Know Act Hotlines. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. *www.epa.gov/epaoswer/hotline/hotintro.htm*.

Community Advisory Groups (CAGs)

A Community Advisory Group is a committee or task force of residents affected by a hazardous waste site. EPA encourages communities to create a CAG, especially around sites with diverse perspectives and major environmental justice concerns. They are intended to help empower communities and provide a public forum where representatives of diverse community interests can discuss their concerns and participate in the cleanup process.

Other government agencies support similar groups. The U.S. Department of Defense (DoD) urges communities around military installations and FUDS (Formerly Used Defense Sites) to form Restoration Advisory Boards (RABs). Information on the RAB program may be obtained on the Internet at *www.attic.mil/envirodod/rab*. The U.S. Department of Energy (DOE) involves stakeholders in Site-Specific Advisory Boards (SSABs) at DOE sites. Information on the SSAB program may be obtained on the Internet at *www.em.doe.gov/em22/ssabpg.html*. The Agency for Toxic Substances and Disease Registry encourages people living and working near NPL sites to participate in Community Assistance Panels. These panels provide citizen input into ATSDR's public health assessments.

CAG documents are available on EPA's Internet site at *www.epa.gov/superfund/tools/index.htm#communityadvisorygroups*. The following indicates the type of information available:

U.S. EPA. 1995. "Guidance for Community Advisory Groups at Superfund Sites." Office of Emergency and Remedial Response. Washington, DC. EPA 540-K-96-001. Directive 9230.0-28. PB94-963293.

> This document advises community groups on opportunities for the public to participate early, directly, and meaningfully in site cleanup decisions.

U.S. EPA. 1996. "Community Advisory Groups: Partners in Decisions at Hazardous Waste Sites." EPA 540-R-96-043.

> In this report, EPA describes how community groups can form CAGs to participate in cleanup decisions This report includes case studies of CAGs at five sites. The introductory sections of the document are available on the Internet in both English and Spanish.

U.S. EPA. 1998. "About the Community Advisory Group (CAG) Toolkit: A Summary of the Tools." U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Washington, DC. EPA 540-K-97-007.

This booklet briefly describes the information, tips, and tools in the Community Advisory Group Toolkit. It can help communities understand what a CAG is and decide if their community needs one. If a CAG already exists in a community, this booklet can help citizens become involved.

Technical Assistance for Communities

EPA awards Technical Assistance Grants (TAGs) of $50,000 to eligible citizens' groups representing communities affected by a Superfund site that is listed, or proposed for listing, on the NPL. The citizen's group must use the funds to hire an independent technical advisor. The advisor is someone who can explain and comment on site information as well as describe the community's concerns. Citizens' groups must be non-profit and incorporated to apply for a grant. Since awarding the first TAG in 1988, EPA has provided grants, totaling over $12.5 million, to almost 200 local citizens' groups.

TAG documents are available on EPA's TAG Web site at *www.epa.gov/superfund/tools/tag/*. Each EPA region has a TAG coordinator. The following indicates the type of information available:

U.S. EPA. 1993. "Superfund Technical Assistance Grant (TAG) Handbook: Applying For Your Grant." U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Washington, DC. EPA 540-K-93-003. Directive 9230.1-09A. PB93-963352.

This booklet explains the basic program requirements that the citizen's group must meet to be eligible for a TAG and to complete a grant application.

U.S. EPA. 1993 "Superfund Technical Assistance Grant (TAG) Handbook: The Application Forms with Instructions." U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Washington, DC. EPA 540-K-93-004. Directive 9230.1-09B. PB93-963353.

This booklet contains detailed instructions to assist citizens in completing the TAG application forms. It also contains sample completed forms and blank forms.

U.S. EPA. 1994. "Superfund Technical Assistance Grant (TAG) Handbook: Procurement—Using TAG Funds." U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Washington, DC. EPA 540-K-93-005. Directive 9230.1-09C. PB93-963354.

This handbook describes certain procedures that must be followed when spending TAG funds.

U.S. EPA. 1994. "Superfund Technical Assistance Grant (TAG) Handbook: Managing Your Grant." U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Washington, DC. EPA 540-K-93-006. Directive 9230.1-09D. PB93-963355.

Because TAGs are subject to the same regulations as federal grants awarded to non-profit organizations and universities, there are some standard federal reporting requirements. This handbook explains what is expected.

U.S. EPA. 1997. "Technical Assistance Grants (TAG): How to Find, Choose and Hire a Technical Advisor." U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Washington, DC. EPA 540-F-97-001. Directive 9200.5-222FS. NTIS: PB97-963205.

Other Technical Assistance

Technical assistance is also available to communities through the university-based Technical Outreach Services for Communities (TOSC) program, the U.S. Department of Defense's Technical Assistance for Public Participation (TAPP) program, and recently the U.S. Department of Energy's Citizen Monitoring and Technical Assistance (CMTA) Fund. The few sites participating in Project XL are eligible for technical assistance funds administered for EPA by the Institute for Conservation Leadership.

The following are the Internet sites for each of these programs:

TOSC: *www.hsrc.org/hsrc/html/tosc*

DoD's TAPP program: *www.dtic.mil/envirodod/rab/2tappfact.html*

DOE's CMTA Fund: *www.em.doe.gov/settlement/funding.html*

Project XL: *www.epa.gov/projectxl*

TOSC provides independent technical assistance to communities that do not qualify for a TAG or other federal assistance. TOSC services are provided through a national network of university staff and students coordinated by five regional Hazardous Substance Research Centers. The five centers involve 29 leading universities. TOSC gives communities an independent understanding of hazardous substance contamination issues to improve their participation in site decisions. TOSC is not available in all communities.

DoD's TAPP program provides funds to members of DoD Restoration Advisory Boards and Technical Review Committees to obtain independent technical analysis on topics of local concern, including the potential health implications of the site.

DOE's CMTA Fund provides money to non-profit, non-governmental, and tribal government organizations at DOE sites to obtain technical assistance on activities.

Project XL provides funds to some community-based, small local governments, and worker groups participating directly in XL projects. The funds help them build their capacity to make independent and informed decisions about the project. Project XL (eXcellence and Leadership) is a national pilot program that tests new ways of achieving better and more cost-effective public health and environmental protection. As of April 2000, 21 XL projects were underway and 20 more projects were under development. The project is committed to a total of 50 projects.

Additional EPA Internet Resources

EPA home page: *www.epa.gov*

EPA Risk Assessment Web site: *www.epa.gov/superfund/programs/risk*

EPA RCRA, Superfund & EPCRA Hotline: *www.epa.gov/epaoswer/hotline*

Superfund for Kids: *www.epa.gov/superfund/kids*

Recycle City: *www.epa.gov/recyclecity*

Integrated Risk Information System (IRIS): *www.epa.gov/iris/*

Ordering Government Documents

General sources of EPA documents:

The National Center for Environmental Publications, is a central repository for all EPA documents. Over 5,000 titles in paper and electronic format are available for distribution (usually at no cost to the public). Individuals can browse and search EPA's National Publications Catalog, and order EPA publications online or by telephone. The EPA publication number (*e.g.*, EPA 999-F-99-999) is used to identify the resource.

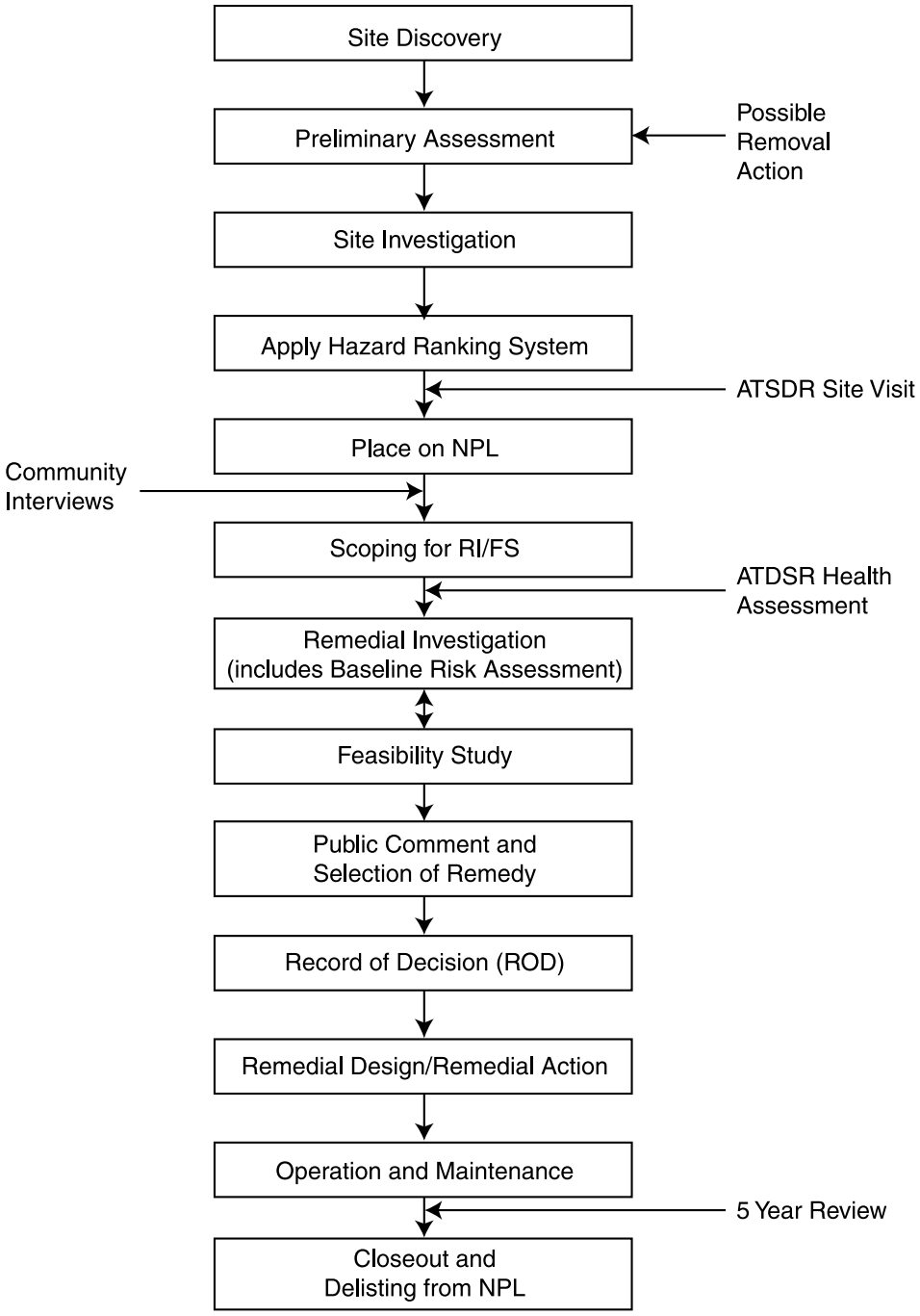
NSCEP
National Service Center for Environmental Publications
P.O. Box 42419
Cincinnati, OH 45242-2419
Phone: 800-490-9198
Fax: 513-489-8695
Internet: *www.epa.gov/ncepihom*

Documents not available free of charge through NSCEP can be obtained through the National Technical Information Service (NTIS).

NTIS is a central resource for government-sponsored U.S. and international scientific, technical, engineering, and business-related information. As a self-supporting agency of the U.S. Department of Commerce, NTIS covers its business and operating expenses with the sale of its products and services. NTIS indexes EPA publications by their EPA publication number, complete title, and an NTIS product number (*e.g.*, PB99-999999). NTIS accepts Visa and MasterCard.

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22151
Phone: 800-553-6847 or 703-605-6000
Fax: 703-321-8547
E-mail: orders@ntis.fedworld.gov
Internet: *http://www.ntis.gov*

Superfund NPL Remedial Response Process



Risk Characterization

Risk Characterization, the final step of the process, sums it all up. It reveals which chemicals are posing the risks and what the health risks are. It also says how sure we are about the results. Since some uncertainty about risk estimates is unavoidable, we build in a large margin of safety to prevent underestimation of the risks. These safeguards are intended to protect the exposed public.

We now can use the risk assessment to develop a cleanup plan that will make the site safe for current and future uses.

Here's how to get more information

- Call the toll-free Superfund/RCRA Hotline at 1-800-424-9346 or the Community Involvement Coordinator in the EPA regional office for your state.
- Information is available on the Superfund home page (www.epa.gov/superfund) under the Community Tools and Technical Resources subheadings.

United States Environmental Protection Agency
EPA 540-K-99-003
OSWER 9285.7-30
December 1999
www.epa.gov/Superfund

Superfund Risk Assessment—

What it's all about And how you can help

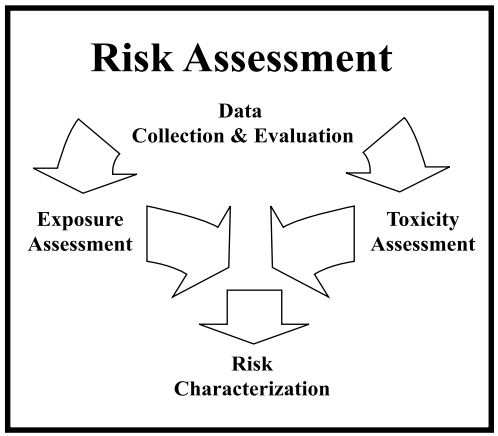
We at EPA would like you to help us learn about the health risks of the Superfund site in your community. That's why we want to tell you about risk assessment, a tool we use in deciding how to clean up sites.

We hope that the more you know about risk assessment, the more you can help us. And the more you know, the more you'll understand the risks the site may pose to you and your family. You'll also see that your interest in the site can improve cleanup.

Here's a brief review of Superfund risk assessment

We study health risks based on what people do and are likely to do on the site. Our goal is to protect everyone who could come in contact with chemicals from the site especially children, women of childbearing age, the elderly, and others who may be at greatest risk.

We use a four-part process to estimate the chance that contact with chemicals from a site will harm people now or in the future. This process gives us numbers that show how great (or small) the risks may be. It also points to who is at risk, what is causing the risk, and how sure we are about the numbers.



Data Collection and Evaluation

The first step of the process is Data Collection and Evaluation. We find out what has happened at and around the site and where chemicals may have been left. We collect samples of the soil, water, air, fish, garden vegetables, and other things that might contain chemicals from the site. From these samples, we try to find out what chemicals are there and how much. You can help us find out where chemicals might be and how they got there. For instance, you may have seen someone dumping something or know about the history of the site. This information helps us get better samples.

You can help us find out—

- Where chemicals are located
- What people do on or near the site

Exposure Assessment

People must come in contact with chemicals from the site to be at risk

In the next step—Exposure Assessment—we use the data collected in the first step to find out how much of each chemical people may be exposed to. People must come in contact with the chemicals to be at risk. The amount of exposure depends a lot on how much of each chemical is there, who might be exposed, and how they are exposed. For instance, children might play in a polluted stream. People might drink polluted well water or eat polluted fish. You can tell us about these activities, which helps us identify everyone who could be exposed. Your assistance helps us estimate the highest exposure anyone is likely to receive from the site.

Toxicity Assessment

"The dose makes the poison" (Paracelsus, 1567) which means as dose rises, the risk of harm rises

Toxicity Assessment is how we learn about which illnesses or other health effects may be caused by exposure to chemicals. It also says at what dose harmful health effects will occur. This is the same as saying how much of each chemical it takes to cause harm. The higher the dose, the more likely a chemical will cause harm.

químicos. También nos dice la cantidad de la dosis que tendrá efectos peligrosos para la salud. Eso es lo mismo que decir cuál es la cantidad necesaria para que el producto químico cause daño. Mientras más alta sea la dosis, mayor es la probabilidad de que el producto químico causará daño.

Caracterización de los riesgos

La caracterización de los riesgos, el último paso del proceso, lo resume todo. Revela cuáles son los productos químicos que presentan riesgos y cuáles son esos riesgos para la salud. También indica la seguridad que tenemos en la exactitud de los resultados. Puesto que no es posible evitar cierta incertidumbre acerca de los cálculos de los riesgos, nos damos un gran margen de seguridad para prevenir que calculemos esos riesgos por debajo de la realidad. Esas salvaguardas tienen como fin proteger al público expuesto.

Ahora podemos utilizar la evaluación de los riesgos para elaborar un plan de limpieza que convertirá el sitio en un lugar sin peligro para los usos presentes y futuros.

Cómo obtener mayor información

- Comuníquese con la línea especial de información (Superfund/RCRA Hotline) sin cargo alguno: 1-800-424-9346, o con el Coordinador de Participación Comunitaria en la oficina regional de la EPA de su Estado.
- También puede encontrar información en la página electrónica del Superfund *(www.epa.gov/superfund)* debajo de los subtítulos "*Community Tools*" (Instrumentos comunitarios) y "*Technical Resources*" (Recursos Técnicos).

La Agencia de los Estados Unidos para la Protección del Medio Ambiente

EPA 540-K-00-001
OSWER 9285.7-35
Diciembre 1999
www.epa.gov/Superfund

EVALUACIÓN DE LOS RIESGOS DEL SUPERFUND –

De qué se trata la evaluación de los riesgos y cómo nos puede ayudar

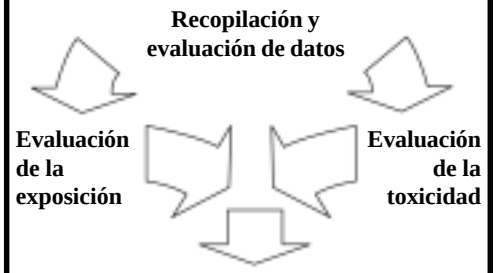
En la EPA deseamos que nos ayude a conocer los riesgos para la salud que presenta el sitio del Superfund en su comunidad. Por eso es que deseamos hablarle de la evaluación de los riesgos, que es el método que utilizamos para decidir cómo limpiar cada sitio.

Esperamos que mientras más sepa acerca de la evaluación de los riesgos, más podrá ayudarnos. Y mientras más sepa, mejor podrá comprender los riesgos que puede presentar el sitio para Ud. y su familia. También observará que su interés en el sitio puede mejorar la limpieza del mismo.

He aquí una reseña breve de la evaluación de los riesgos del Superfund

Estudiamos los riesgos para la salud de acuerdo con lo que la gente hace y puede hacer en el sitio. Nuestro objetivo consiste en proteger a todos los que pudieran entrar en contacto con los productos químicos del sitio, particularmente los niños, las mujeres en edad de procrear, los ancianos y otras personas especialmente las más vulnerables.

Evaluación de los riesgos



Empleamos un proceso dividido en cuatro partes para calcular las probabilidades de que el contacto con los productos químicos de un sitio perjudique a las personas ahora o en el futuro. Ese proceso nos proporciona cifras que indican la magnitud del peligro. También indica quiénes son vulnerables, qué es lo que causa los riesgos y la fiabilidad de las cifras.

Recopilación y evaluación de los datos

El primer paso del proceso es la recopilación y evaluación de datos. Nos enteramos de lo que ha pasado en el sitio y sus alrededores, y donde es posible que hayan quedado productos químicos. Recogemos muestras del suelo, agua, aire, peces, plantas y otros objetos que pudieran contener productos químicos del sitio. Con esas muestras tratamos de hallar cuáles son los productos químicos que hay allí y su cantidad. Ud. nos puede ayudar a encontrar donde puede haber productos químicos y cómo llegaron a ese lugar. Por ejemplo, puede haber visto a alguien desechar objetos o conocer la historia del lugar. Esta información nos ayuda a tomar mejores muestras.

Usted puede ayudarnos a descubrir

- Donde se encuentra los químicos
- Qué la gente hace en o acerca al sitio

Evaluación de la exposición

Las personas tienen que entrar en contacto con los productos químicos del lugar para correr peligro

En el siguiente paso, Evaluación de la exposición, utilizamos los datos recopilados en el primer paso para averiguar el nivel de exposición de las personas a cada uno de los productos químicos. Para correr peligro, es necesario que las personas entren en contacto con los productos químicos. El nivel de exposición depende en gran medida de la cantidad del producto químico, quiénes pueden estar expuestos y cómo están expuestos. Por ejemplo, el arroyo donde juegan los niños, el agua que se bebe de los pozos o los pescados que se comen pueden estar contaminados. Ud. nos puede informar acerca de esas actividades, lo que nos ayuda a identificar a todos los que podrían estar expuestos. Su asistencia nos ayuda a calcular el nivel más elevado de exposición que puede recibir cualquier persona en ese lugar.

Evaluación de la toxicidad

"La dosis hace el veneno" (Paracelso, 1567). Eso significa que a medida que aumenta la dosis, aumenta el peligro.

La evaluación de la toxicidad nos permite aprender cuáles son las enfermedades u otros efectos sobre la salud que pueden ser causados por la exposición a los productos