How to Explain Radiation Risk

Professional Personnel

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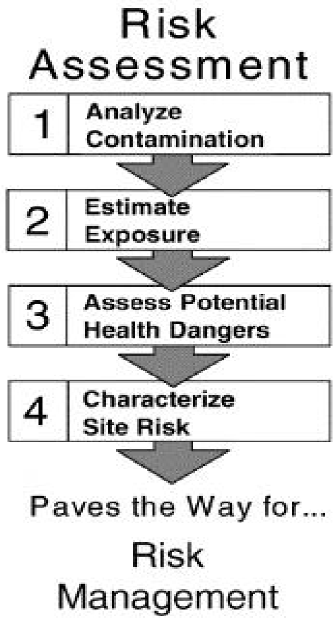
Environmental Health Programs
Division of Radiation Protection

Talking about radiation risk effectively is difficult at best. To explain radiation risk in crisis, or anytime, you must do these four things:

- Prepare yourself to speak earnestly and effectively in keeping with your position, comfort, and expertise.
- Know the difference and relationship between risk assessment and risk communication in conveying safety information (decisions, data, etc).
- Be clear about what you know and honest about what you don't know.
- To the extent possible, tell people THEY'RE SAFE and why this is true. If they're not totally safe, be as precise about the risks in general terms. Safety is everyone's first priority.

WHAT IS RISK?

Risk is defined as "some impact on health and safety", and is a technical measure of health impacts. Many ordinary activities, such as taking certain drugs, smoking, swimming, driving a car, etc. pose some degree of risk to our health and well-being. Every day, we decide for ourselves to take risks whether we are aware of the technical data or not.



Leaders also make decisions based on risks. Risk assessment experts provide technical analyses, which help in making these decisions. Communicating risks is as important as assessing them in the decision-making process and in disseminating health information. It isn't easy to make clear decisions about radiation risks for many reasons. Radiation, while well described and studied scientifically, is hard to quantify or familiarize in everyday life, and is dreaded and feared by the general public. Radiation science in the United States also has a legacy of secrecy and military applications, which is a difficult cultural obstacle to contend with, and makes being trusted or credible even more difficult.

For an accident situation, radionuclides could be released into the air. Some radioactive particulates could be deposited on the soil and surface water. Over time the radionuclides could move into the ground water. If we came into contact with these contaminated media, would we face a certain degree of risk? How much? Risk Assessment and Risk Communication are two equally important aspects of providing safety and health protection, which serve to help explain radiation risk.

WHAT IS RISK ASSESSMENT?

Risk assessment is a technical measure of health effects. Risk assessment methods vary depending on the purpose and scope of the available information (data) used in assessment. Some assessments look at impacts **after** an event, such as the discovery of toxic waste in an unwanted place. Other assessments, such as pesticide approval, look **ahead** to predict what the effects will be.

There are four phases in conducting risk assessments: identifying hazards, estimating exposure, assessing potential health dangers, and characterizing or describing the risk.

Identifying Hazards

When assessments are conducted after an event, scientists collect samples of soil, air, water, sediment, plants, fish and/or animals at and around the site of the event. They analyze these samples in laboratories. These analyses reveal the amount and types of radionuclides. Risk assessors consult past scientific studies on the effects these radionuclides have had on health.

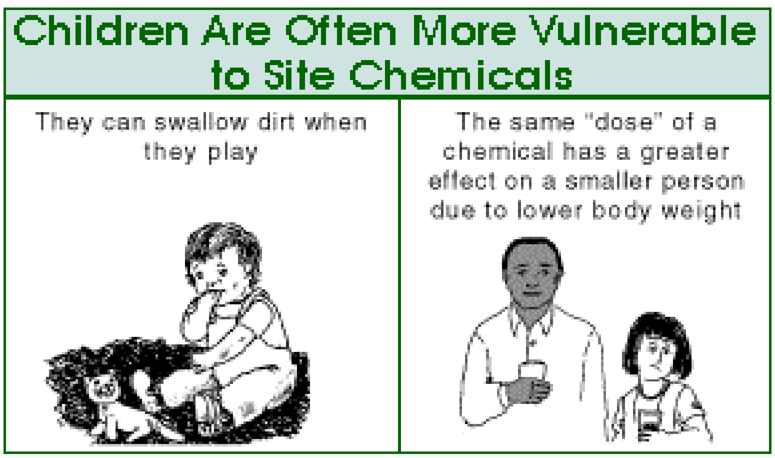
Where human health studies are unavailable, risk assessors look at animal studies. They compare the radionuclide levels at the site with those in the studies. This helps determine what radionuclides, if anything, are most likely to pose the greatest threat to human health. The rest of the risk assessment study focuses on these radionuclides.

If the assessment is prior to an actual event, risk assessors and other experts prepare a "projection"; a determination of what radionuclides would be most probable if the event were to occur. These assessments often accompany emergency response plans.

Estimating Exposure

Radiation exposure is estimated based on the amount of contamination and the interaction it might have with human health. People could inhale contaminated air, ingest contaminated foods and water, or be directly exposed. For each of these "pathways", risk assessors calculate quantities of a given radionuclide that could reach a person's lungs, digestive system, or skin. Calculations include answers to questions like:

- Do people live or work on or near the site? For how long?
- Do children play on or near the site? How frequently?
- Do people drink or shower with site-contaminated water? How frequently?
- Do people eat fish from, or swim in, site-contaminated lakes or streams? How often?



Assessing Potential Health Dangers

While probable exposure to the community is being calculated, risk assessors determine the toxicity, or harmfulness, of each radionuclide identified. Potential health problems and their severity vary, depending on the radiations emitted and the amount of exposure. Risk assessors compare existing studies and information on health effects to "doses" that could be encountered by people. For example, a likely "dose" could come from consuming, every day for 30 years, a certain amount of contaminants in polluted drinking water.

Risk assessors use two methods to evaluate the human health effects arising from exposure to site contaminants. One approach calculates the chance of *cancer* occurring as a result of exposure. The other compares what is known about the *non-cancer* health effects of radionuclides to the concentration of radionuclides at the site.

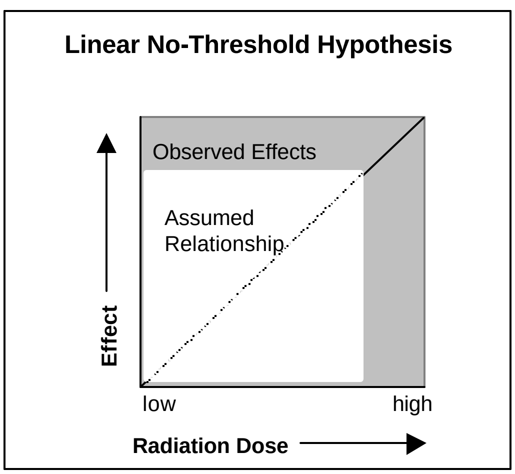
The likelihood of any kind of cancer resulting from a site is expressed as a probability; for example, a "1 in 10,000 chance." In other words, for every 10,000 people that could be exposed, one extra cancer case *is expected to* occur as a result of exposure to site contaminants. An extra cancer case means that one more person could get cancer than would normally be expected from all other causes. The American Cancer Society reports that between 33-50% of Americans are expected to be diagnosed with cancer over their lifetime “normally” (without specific known cause). In this example, 3,300-5,000 cancers would be expected in a population of 10,000 who didn’t get the exposure, and 3,301-5,501 in a population that did.

Example	Population	“Expected Cancers”
Not subjected to the risk (“normal”)	10,000	3,300-5,000
Subjected to the risk	10,000	3,301-5,001

NOTE! Be sure to understand that this is only statistical probability – there is no way to directly determine how cancers are caused in most cases, including carcinogens such as radiation exposure.

Non-cancer health effects can range from rashes, eye irritation, and breathing difficulties to organ damage, birth defects, and death. Risk assessors calculate a "hazard index" for non-cancer health effects. The key concept here is that a "threshold level" (measured usually as a hazard index of less than 1) exists below which non-cancer health effects are no longer predicted. Risk assessors determine the amount of a chemical that can cause a noticeable non-cancer health effect. Then they use these data to figure out how dangerous the site contaminants are.

Low-Level Radiation Risks



In the last 20 years a lot of research has been undertaken on understanding the health effects of low-level radiation exposure. Many studies have questioned the linear no-threshold hypothesis, the basis of public health radiation protection. This model assumes that any level of exposure can cause cancer, and that the probability of contracting cancer is proportional to the amount of radiation dose. Extensive research has neither supported nor disproved the linear hypothesis for low-level radiation exposure. Some evidence suggests that there may be a threshold below which no harmful effects of radiation occur. However, this is not yet accepted as proven by national or international radiation protection bodies.

Bottom Line: Low-level radiation risks are indeterminate and uncertain (lack definitive scientific proof and acceptance) and are conservatively estimated so as to err on the side of safety, rather than the side of the unknown. We assume that what we don't know "might" hurt us.

Characterizing (Describing) Risk

The results of the three previous steps are combined, evaluated, and summarized to show the overall risk. Risk assessors add up potential risks from the individual radionuclides and pathways and calculate a total risk, expressed as a number. They also consider the amount of uncertainty in the risk estimates. Risk managers plan strategies to reduce or prevent risk by limiting or stopping exposure to contaminants.

MAKING RISK MANAGEMENT DECISIONS

When risk managers make decisions about radiation risks, they consider not only the risk assessment results, but also social, economic, political, and legal issues. They may use the risk assessment results as part of a cost-benefit analysis, and try to translate risk into monetary values. All through, they must consider and incorporate public opinion and political demands into their decisions.

WHAT IS RISK COMMUNICATION?

Risk Communication is the art or practice of talking about scientific information and principles to a non-expert audience. The goal is to convey accurate and trustworthy information about *safety* to decision-makers, the public, or anyone else with an interest in the safety of the public or themselves.

Risk assessment measures health risk, which is one of many considerations in addressing the ULTIMATE QUESTION: **AM I SAFE?**

Risk communication is a descriptively applied discipline, which means that there are no hard and fast rules which will lead directly to achieving understanding or consensus. While guidelines and some preparation can help, it is most important to be:

- Flexible
- Open
- Responsive

There are no "magic" words that will engender trust and complicity in all cases. As a person speaking of radiation risk, you MUST develop your own:

- Natural style of talking about the facts
- Beliefs about those facts, based on your expertise

Research shows that these are crucial elements in building and maintaining trust with your audience.

THE APPROACH

As stated above, people will always want to know if they are safe, and they want to hear it from a trusted expert source. Your challenge is to prepare to fulfill that role, using these guidelines, the facts, and your own personally developed relationship to the audience.

About Public Perception

In a crisis environment, the perception of the threat is as important as the risk assessment.

- VOLUNTARY = LESS RISKY

  Voluntary risks that people choose to take (i.e. skiing) are accepted more readily than those that are imposed (pushed down a mountain strapped to wood sticks).

- PERSONAL CONTROL = LESS RISKY

  Risks under individual control (where you dock a boat) are accepted more readily that those under government control (we're building a levy whether you like it or not).

- FAIR RISKS = LESS RISKY

  Risks that seem fair are more acceptable than those that seem unfair.

- MORE TRUST = LESS CREDIBLE RISK

  Risk information that comes from trustworthy sources is more readily believed than information from untrustworthy sources

- GREED-BASED RISK = MORE DREAD

  Risks that seem ethically objectionable will seem more risky than those that don't

- MAN-MADE = GREATER RISK

  Natural risks seem more acceptable than artificial risks

- FAMILIAR ITEMS, CONCEPTS = LESS RISKY

  Exotic risks seem more risky than familiar risks

Seven Cardinal Rules of Risk Communication

- Accept and involve the public as a legitimate partner
- Plan carefully and evaluate your efforts
- Listen to your audience
- Be honest, frank and open
- Coordinate and collaborate with other credible sources
- Meet the needs of the media
- Speak clearly and with compassion

Other Guidelines

- Show **Empathy**
- State the **Conclusion** in a sound bite
- Give two **Supporting Statements** – concrete facts to support conclusions
- Repeat the **Conclusion** in the same words
- State one **Future Action**

Some Pitfalls and Guidance

Pitfall	**Comment**	**Tip/ Guidance**
Jargon	Technical bureaucratic language, including risk comparisons and quantitative health risk numbers	-Use plain language -Stop talking when you've answered
Use of Humor	Making light of a serious situation, being flippant	-Skillful self-deprecating humor can work; otherwise avoid it
Retaliation	You and your integrity or your technical prowess may be attacked to deny credibility; perhaps you have a fit of rage or lose your temper	-Return to the issues -Breathe; remain calm -Show your passion, but only about safety, not about your provocateur
Shifting/ Identifying Blame	It is tempting to say who is wrong or at fault	-Focus on responsibilities, rather than "choosing sides"
Using the Department as a Shroud	A comfort to us all, but is often an obstacle in establishing a personal trust with the audience	-Focus on your personal expertise, as afforded by your position, experience, and knowledge

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