5 Communicating Risk

Overview

Understanding risk is an integral part of the risk management process. It is critical that risk information is communicated effectively to all concerned parties. This activity allows students to explore how timely and responsible communication among experts, the media, and lay people can lead to improved decisions about risk management.

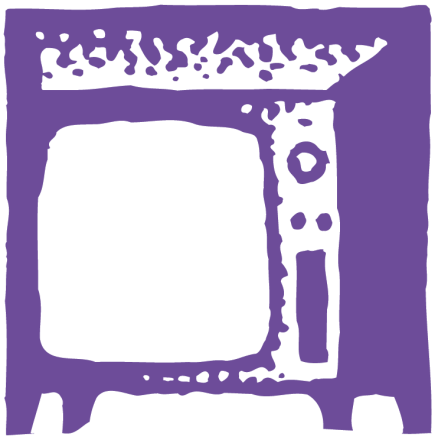
Background

Risk communication refers to the *exchange* of information regarding risk. It is used to inform the public, including decision makers, citizens, organizations, corporations, industry, the media, and other special interest groups, about sources of risk and possible solutions for reducing risk. Some current goals of risk communication include (1) improving understanding of risk issues; (2) informing stakeholders, as well as possible, given the available information; (3) influencing attitudes toward risk; and (4) reconciling differences in values over the acceptability of risks through conflict or dispute resolution.

In the past, communicating risk to the public often took place after assessments and management decisions were already made. Such practices, however, have been changing. Risk experts now realize that most lay people are very capable of understanding risk when given sufficient information. Experts have also realized that involving the general public in risk decisions, through timely communication, is important to the successful management of risk. At the same time, it is important to recognize that good risk communication does not *guarantee* successful risk decisions because other factors, such as values, politics, and economics, also influence the decision-making process (National Research Council 1989, A).

RISK PERCEPTION

An understanding of how people perceive risks is very important for effective risk communication. Accordingly, risk communication experts have done extensive studies on this topic and have found that a variety of factors affect the way in which people perceive risk. These factors help explain why people react to different risks differently. For example,



Subjects
Chemistry, Communications, Earth Sciences, Environmental Science, Health, Language Arts, Math, Social Studies, Visual Arts

Concepts
- Cultural and societal perspectives influence the attitudes, beliefs, and biases of people toward the use of resources and environmental protection. (6.3)
- In democratic societies, citizens have a voice in shaping resource and environmental management policies. They also share in the responsibility of conserving resources and behaving in an environmentally responsible manner. (9.2)
- Effective citizen involvement in the environmental decision-making process involves a careful study of all sides of the issues, along with the ability to differentiate between honest, factually accurate information and propaganda. (9.4)
- Increased public knowledge of the environment and the need for conservation of natural resources have resulted in lifestyle changes in many cultures. (15.5)

Skills
Analyzing, Comparing and Contrasting, Discussing, Evaluating, Interpreting, Synthesizing and Creating

Objectives
Students will (1) investigate the importance of communication in risk assessment and risk management, (2) identify guidelines for effective risk communication, (3) acquire a sense of scale using concentration analogies, and (4) communicate a local risk to their community.

Materials
Copies of the Student Pages "Sybron Chemicals Inc.: Background Information," "Risk Communication Options," "Sybron Chemicals Inc.: Risk Communication Response," "Radon Risk Chart–A," "Radon Risk Chart–B," "Radon Brochure–A," "Radon Brochure–B," "Risk Communication Guidelines," and "Concentration Analogies" on pages 78-82 and 84–87; and an overhead transparency of the Student Page "Radon Alert" on page 83. For Part D—a strip of colored paper, a ruler, and a pair of scissors for each student or 29 copies of the Student Page "One Part per Million."

Time Considerations
Preparation: 30 minutes
Activity:
Part A—one 50-minute period plus 30 minutes
Part B—one 50-minute period
Part C—one 50-minute period
Part D—30 minutes
Part E—one 50-minute period plus outside research

many people are more concerned about nuclear power than about radon gas in homes, even though radon is responsible for 21,000 lung cancer deaths per year (U.S. EPA 2005, E). A list of factors that influence how people perceive risks may be found on the Student Page "Risk Perception Factors" in Activity 2, "Things Aren't Always What They Seem."

THE COMPLEX NATURE OF RISK COMMUNICATION

Risk communication can be a complex and controversial undertaking for a number of reasons:

1. The hazards being described are often the center of controversy.

2. There is often enough uncertainty in the risk estimate that contradictory expert opinions are given to the public.

3. Communicating risk often involves the use of technical jargon that is unfamiliar to the general public.

4. It is unclear to what extent public officials should go beyond informing the public to advocating a certain position.

5. Risk messages are not always oriented to the target audience, making understanding the situation more difficult.

6. Risk communicators must be careful not to minimize the existence of uncertainty (National Research Council 1989, A).

In addition, one should be aware that risk messages may reflect the biases of the risk communicator. Looking for a complete story and checking sources can help interested parties develop a balanced view of the risk situation.

RISK COMPARISONS AND CONCENTRATION ANALOGIES

In an effort to overcome some of these difficulties, risk communicators may use ***risk comparisons*** and ***concentration analogies*** to facilitate understanding and help put risks into perspective (Covello, Sandman, and Slovic 1991, A). Risk comparisons should be used to convey the nature and magnitude of a risk estimate. (See the box and the Student Page "Radon Risk Chart–A" for an example of a risk comparison table.)

An important part of communicating risk, particularly with respect to environmental and health pollutants, is the use of concentrations. However, understanding chemical concentrations (parts per million (ppm), ***parts per billion (ppb)***, and so forth) can be difficult. So it is helpful to use analogies (1 ppm = 1 drop of gas in a car's gas tank) that appeal to the imagination and that help people to understand the magnitude of a concentration. (See the Student Page "Concentration Analogies.")

Examples of Ways to Compare Risks

- Comparisons of chemically related agents: The risk of one organophosphate pesticide compared with the risk of another.
- Comparisons of risks and benefits: The risk to human health of using chlorine to disinfect drinking water vs. chlorine's role in protecting human life from infectious diseases.
- Comparisons of alternatives: The risk of incinerating waste vs. landfilling it. (Which has less of an impact on the environment?)
- Comparisons of the same agent with different sources of exposure: The risk of carbon monoxide poisoning from automobile exhaust vs. from the burning of fuel in a wood-burning stove.
- Comparisons with a regulatory standard: The amount of arsenic in a city's drinking water compared with the standard set by the Environmental Protection Agency.
- Comparisons of different agents with the same exposure route: Foods with either natural or synthetic carcinogenic components.
- Comparisons of different agents with similar effects: The risk of lung cancer from secondhand smoke vs. from exposure to radon particles.

Sources: Kamrin, Katz, and Walter, 1995, A; Presidential/Congressional Commission on Risk Assessment and Risk Management 1998b, E; Covello, Sandman, and Slovic 1991, A.

However, there are significant limits to the value of risk comparisons and concentration analogies, which often makes their use more controversial than helpful:

- Certain risk comparisons may be inappropriate, such as comparing an involuntary risk with a voluntary risk (for example, exposure to low-level radiation versus alcohol consumption).
- Other factors besides the level of the risk (such as trust, ethics, fairness, and alternatives) also influence the public's understanding and acceptance of the risk.
- Because risk comparisons are based on probabilistic estimates of the risks, a certain degree of uncertainty exists. It is difficult to say for sure whether one risk is better than another because not all variables are known.
- Many times, the use of risk comparisons and concentration analogies can be viewed as trivializing the risk, which can misrepresent the potential for harm, thereby causing anger or mistrust.
- Risk comparisons and concentration analogies are limited by the reality that even when people understand a risk, it does not necessarily mean that they will be more accepting of it, nor does it mean that they will take action to reduce the risk.
- Concentration analogies, by themselves, can be misleading because chemicals vary in their potency. For example, one part per million of one substance may be lethal to a human, while one part per million of a different substance may be harmless.

Risk comparisons and concentration analogies may be useful as communication aids; however, it is important that the audience be critical consumers of the information provided. Likewise, it is important for the risk communicators to choose comparisons and analogies carefully.

Part A

COMMUNICATING RISKS: THE CASE OF SYBRON CHEMICALS

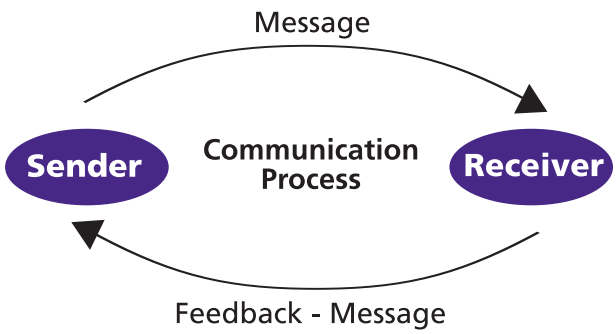
This lesson provides students with an opportunity to explore how one company implemented a risk communication strategy. The case study demonstrates the benefits of risk communication even before a risk occurs.

It is important for students to understand that the process of risk communication is multidirectional (with all parties acting as both sender and receiver) and that the process is successful only when the risk message is understood. Figure 9 presents a simplified illustration of the communication process. You may want to put it on an overhead or on the chalkboard while you teach the activity.

GETTING READY

Make a copy of the Student Pages "Sybron Chemicals Inc.: Background Information" and "Risk Communication Options" for each group. Make a copy of the Student Page "Sybron Chemicals Inc.: Risk Communication Response" for each member of the class.

Figure 9. Communication Process



DOING THE ACTIVITY

1. Ask students how they would find out information about a risk. If they wanted more information, where would they go? What kind of information would they be interested in?

2. Divide the class into cooperative learning groups of 4–5 students. Give each group a copy of the Student Pages "Sybron Chemicals Inc.: Background Information" and "Risk Communication Options." Have students read both Student Pages in their groups. Then have them discuss the alternative philosophies and choose the strategy that they *think* will be most appropriate for this situation.

3. Each group should have a representative explain to the rest of the class why the group chose that particular strategy.

4. Distribute a copy of the Student Page "Sybron Chemicals Inc.: Risk Communication Response" to each member of the class to read for homework. During the next class period, discuss the questions at the bottom of the Student Page.

5. To conclude this part of the activity, share and discuss Biography 4, in Appendix 6, with your students.

Part B

COMMUNICATING THE RISK ASSOCIATED WITH RADON

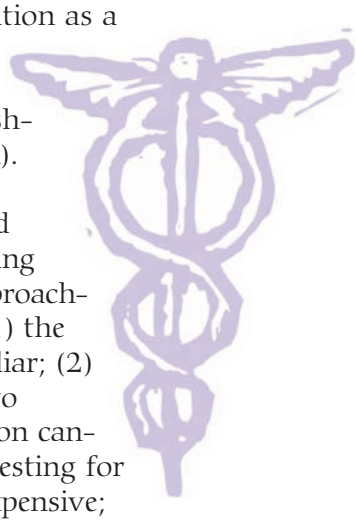
Psychologists maintain that people often reject information that does not agree with their preconceptions. People use a variety of filters to interpret information in light of their particular attitudes and beliefs. For example, smokers sometimes refuse to heed accounts about the health risks of smoking, and new car owners may reject negative reports about their recent purchase (Johnson, Fisher, Smith, et al. 1990, A).

For risks such as radon exposure, the U.S. Environmental Protection Agency (EPA) has set up voluntary risk reduction programs. The main vehicle for these programs is risk communication through public education. The basis for such initiatives is the assumption that education programs will motivate people to voluntarily reduce risks. Evidence on the effectiveness of risk information programs to stimulate individual actions and behavior changes has been split. For example, the results from the radon education program (initiated in 1993) have so far been positive, with an overall increase in both public awareness and home radon testing between 1993 and 1994 (U.S. EPA 1998a, E). As another example, despite the use of warning labels on cigarette packages, current statistics indicate that only 30 percent of women who smoke stop after they find out that they are pregnant (American Lung Association 2005, E).

WHAT IS RADON?

Radon is a colorless, odorless gas that occurs naturally in soil and rock. It moves from the soil or rock into the foundations of buildings and sometimes becomes trapped in the buildings. The EPA estimates that radon causes more cancer deaths per year, 7,000–30,000, than any other pollutant under the EPA's jurisdiction (U.S. EPA 2005, E). Specifically radon is responsible for about 21,000 deaths from lung cancer each year in the United States. A report from the National Research Council indicated that smokers exposed to radon are at the greatest risk: 90 percent of the radon-related cancers occur in current or former smokers (Suplee 1998, B). Because exposure occurs primarily in people's homes,

conventional regulatory approaches are not appropriate. This situation has led the EPA to turn to risk communication as a way of encouraging voluntary reductions in radon risk (Johnson, Fisher, Smith, et al. 1990, A).



Radon provides a good opportunity for evaluating risk communication approaches for several reasons: (1) the risk is relatively unfamiliar; (2) there is usually no one to blame; (3) although radon cannot be seen or smelled, testing for radon is simple and inexpensive; and (4) homeowners' mitigation choices can provide an objective measure of the impacts of a communication effort.

In Steps 2 and 3 of this part of the activity, students will learn why radon is a risk as they compare and contrast two radon information charts. In Step 4, students will compare and contrast two brochures intended to educate people about reducing the risk of radon exposure.

GETTING READY

Duplicate sufficient copies of the Student Pages "Radon Risk Chart-A," "Radon Risk Chart-B," "Radon Brochure-A," and "Radon Brochure-B" for each member of your class. (If you plan on conducting this activity using cooperative learning groups, you will need just one copy of each Student Page per group.) Prepare an overhead of the Student Page "Radon Alert."

DOING THE ACTIVITY

1. Ask students if they have heard of radon and have them share what they know.

2. Distribute copies of the Student Pages "Radon Risk Chart-A" and "Radon Risk Chart-B." Allow students time to review the data presented in the charts. Make sure that they understand the charts by asking one or more students to explain what each column means. Make sure students understand that the higher the number of ***picocuries*** (pCi), the greater the amount of radiation. Picocuries refers to a unit that expresses the rate of radioactive decay.

3. Ask the students to compare Chart A with Chart B. After allowing them a few minutes, discuss the following questions:

   ? Which of the two charts do they prefer? Why?

   ? Does the additional information presented in Chart A help them understand the risks associated with radon exposure better than the information presented in Chart B? Why or why not?

   ? If they were going to design a brochure to educate the public about radon, which elements from the charts would they use and why? Is there anything they would add?

4. Distribute copies of the Student Page "Radon Brochure-A," and "Radon Brochure-B" and put up an overhead of the Student Page "Radon Alert." Present the following scenario to your students:

   "The results from your radon test have just arrived. The report indicates that your home radon level is 3.8 pCi/L (yellow). Enclosed with the test results were two brochures that provide information on reducing risk from radon exposure."

   Allow the students several minutes to thoroughly read each of the sample brochures. Then take a poll to determine which one the class preferred. Ask a representative number of students why they liked the brochure they selected. Did they find it more likely to motivate action? Was it more informative or easier to understand? Did the brochure they chose address their concerns, if they had any, regarding radon exposure?

   List on the chalkboard all the positive factors that the students suggest about each brochure.

5.  Next, have students develop a list of guidelines that they think

would be useful for developing an effective brochure to inform the public about a particular risk. The guidelines should also encourage action to reduce the risk.

Write the guidelines on the chalkboard or on a transparency using an overhead projector (this information can then be duplicated for the class to use with Part C). Here are a few guidelines you may want to be sure students include in their list—the brochure should be easy to read and easy to understand, should have useful comparisons, and should make sure the risk is clearly defined.

6. To debrief this part of the activity, ask students how developing a set of guidelines helps to create effective risk communication.

Part C

EVALUATING THE PROFESSIONALS

GETTING READY

Option 1: Bring in sample risk communication pieces for your class. Option 2: For homework, assign your students the task of bringing to class some sample pieces showing risk communication. Examples might include brochures from various public and government agencies, newspaper articles, and magazine articles from the popular press.

DOING THE ACTIVITY

1. Review with the class the guidelines developed in Part B of this activity.

2. Distribute copies of the Student Page "Risk Communication Guidelines." Review the guidelines with class members to ensure that they understand what each guideline means and why each one is important.

3. In cooperative learning groups of 4–5 students, have students compare the list of guidelines generated by the class with the list from the Student Page. Have students add any items to their lists that they think would be useful for evaluating the effectiveness of various risk communication pieces that are available to the public.

4. Using the combined guidelines, have students evaluate the effectiveness of the sample pieces that you have provided (or that they have brought in). Have students think about whether their sample meets the standards indicated in the combined guidelines. For example, is the information unbiased? Do they find the presentation of the material ethically acceptable? Is the information effective and accurate? Is it easy to understand?

5. Have students share their critiques and samples with the class either informally or as a formal presentation.

6. To debrief this exercise, discuss with students the role that risk communication plays in the big picture of risk. How does it interact with risk assessment and risk management? It may be helpful to review Figure 1 in the Background Information for Educators section.

Extension

Have students analyze evening news stories that involve risks. Ask them to report back on whether they feel the risk was reported fairly and accurately or whether it was portrayed to generate particular reactions and emotions.

Part D

NUMBERS, BIG AND SMALL—WHAT DO THEY REALLY MEAN?

GETTING READY

Duplicate sufficient copies of Student Pages "Concentration Analogies" for each member of the class. Option: Duplicate 29 copies of the Student Page "One Part Per Million," and on one of the pages white-out seven dots (this change results in one million dots), or have available a strip of colored paper, a ruler, and a pair of scissors for each student. You may also want to bring to class copies of articles that use terms such as one part per million (ppm).

DOING THE ACTIVITY

1. Ask your students if they can think of anything they have read or heard that uses terms such as one part per million or one part per billion. Ask if they can visualize what this figure means. If you have copies of articles with these terms, you can share some examples with class members to give them an idea how these terms are used in scientific studies. To help them acquire a sense of scale, distribute copies of the Student Page "Concentration Analogies." Then review the list with the class.

2. Organize the class into several cooperative learning groups. Using the Student Page as a guide, ask the class to try to develop analogies similar to the ones given to represent the following scales: one part per million, one part per billion, one part per trillion, and one part per quadrillion.

3. Choose option a or b below to visually represent one ppm.

a. Pass out to each student a strip of colored paper and a ruler. Have each student cut a piece of paper that is 1/3 of an inch wide. Explain that if students had 100 football fields lined up end to end, the width of the strip of paper would be approximately equal to one ppm of that distance. If they could cut that piece of paper in half, and then cut that piece in half, and keep doing that six times, then the "sliver" of paper they would end up with would be equal to one ppm of one football field. (After three cuts, students will find that it is extremely difficult to keep cutting the paper in half.)

b. Here is another way to illustrate one ppm:

- Have students form a circle, facing in.
- Hand out 29 copies of the Student Page "One Part per Million." (If you have fewer than 29 students, hand out multiple copies until you have distributed 29 pages. If you have more than 29 students, hand out only 29 pages. Then have some students share.)
- Ask students to hold up their page in front of them (dots facing in so everyone can see them) and to look around the circle. Explain that each page (except the one with the seven dots whited-out) has 34,483 dots and that collectively the pages now show one million dots.
- Have one student circle one dot on his or her page, and again have the students look around the circle. That dot now represents one ppm. (You may want to mention that while one dot among one million dots may seem insignificant, the potency of that "dot" is also an important factor and can influence the significance of the concentration.)
- Finally, ask students about how many pages they would need to visually represent one part per billion? (29,000) One part per trillion? (29,000,000)

4. Debrief this exercise by asking students (1) why they think it is important for the public to understand what these numbers really mean, and (2) depending on how these numbers are used, if such analogies could be helpful or misleading.

Part E

TAKING ACTION: COMMUNICATING A LOCAL RISK TO YOUR COMMUNITY

GETTING READY

Prepare an overhead of the guidelines generated in Part C, Step 3. Before you begin this part of the activity, you may want to get the support of the school administration to avoid any potential conflicts.

DOING THE ACTIVITY

1. As a class, make a list of the risks that are present in your school or community. These may vary from structural hazards (a loose step) to health hazards (poor air circulation) to ecological hazards (habitat destruction). (Once you've completed this part of the activity, save the list for Activity 8, "Taking Action: Reducing Risk in Your School or Community.")

2. Divide the class into cooperative learning groups of 4–5 students.

- Option 1: As a class, choose one risk from the class list that all groups would like to research and write about. (This option will allow students to compare different risk communication approaches for the same issue.)

- Option 2: Have each group choose one risk from the class list to research and write about. (This option allows students to compare different risk communication approaches for different types of risks.)

3. Allow time for students to conduct research on the risk selected and to compile and share the information in their groups. They should focus on obtaining information about what the risk is and if anything is being done to reduce it. If so, what? If not, why not?

4. Using the combined list of guidelines from Part C, have students (in groups) develop an effective flier to communicate to the public about the local risk they researched. Their flier could be used to help educate their local community about the concern.

5. Make enough copies of each flier for the groups to review or display them around the room. Have students, in their groups, use the guidelines to critique a flier developed by another group. Provide additional suggestions on how the flier could be improved (for example, layout, color, etc.), if necessary.

Option: Students could either publish their flier or write an editorial about the risk for the school or local newspaper. If available, a computer program and color printer could be used to print a colorful flier for distribution.

6. Debrief this activity with a discussion about the different styles that the groups used to communicate risk. Which fliers do they think would be more effective at increasing public *awareness* of the risk? Which ones do they think would be more effective at motivating *action* to reduce risk?

Extension

Have students take home copies of the various fliers for their family or friends to review. They should ask those people which flier is the most informative and why. They should also ask for suggestions on how to improve the presentation. Time permitting, you could review the recommendations provided by family members and friends in a follow-up class discussion. Students could incorporate these new suggestions in a revised final flier.

Enrichment

Risk Communication on the Internet

Use this enrichment if students have access to the World Wide Web. Students can complete this Internet assignment in cooperative learning groups or individually. Before students begin this Enrichment, please review with them Appendix 4, "Suggestions for Using the Internet as a Resource."

Ask students to run a keyword search for the words "radon risk." Have them access at least four Web sites and review the information presented. As they look through the sites, give them the following questions to think about:

- Do the Web pages provide enough information for the public to understand the potential of risk from radon exposure?
- Is the information provided appropriate for informing the public about potential risks of radon?
- Is there conflicting information between different sites?
- How does the Internet compare to other forms of media, such as the brochures the class critiqued?
- Do you find the information presented on the Web sites credible? Why or why not?

After they complete the assignment, have the students discuss the questions.

If students need help with their search, the following Internet addresses provide a starting point (American Forest Foundation and Project Learning Tree do not endorse or promote any of the Web sites listed):

DoItYourself.com. "The Radon FAQ" <http://www.doityourself.com/home-safety/radon.htm>, accessed April 12, 2005.

U.S. Environmental Protection Agency. "Radon-Specific Publications and Resources" <http://www.epa.gov/radon/pubs/index.html>, accessed April 12, 2005

The Alexander Law Firm. "Radon: A National Health Problem" <http://consumerlawpage.com/article/radon5.shtml>, accessed April 12, 2005.

U.S. Environmental Protection Agency. "Sources of Information on Indoor Air Quality-Common Indoor Air Pollutants: Radon (Rn)" <http://www.epa.gov/iaq/radon>, accessed April 12, 2005.

Assessment Opportunity

1. During a week, have students look for newspaper and magazine articles (or listen to the news reports on TV or radio) that deal with a risk. Ask them to critique one article or report, on the basis of its effectiveness in communicating about risks. (Was it understandable? Was it believable? Was there technical jargon? Was it objective?)
2. Use the flier created in Part E to evaluate the students' understanding of what constitutes effective risk communication.

Student Page

Sybron Chemicals Inc.: Background Information

In the fall of 1988, Sybron Chemicals, a small chemical speciality manufacturer with headquarters and a plant in Birmingham, New Jersey, released 40 pounds of ethyl acrylate, a gas with an overwhelmingly acrid odor, to the surrounding community*. About one hour later, citizens began calling local officials with complaints of the stench. Seven went to the hospital for treatment of eye irritation. Without clear information about the seriousness of the situation, the local fire company roused more than 60 nearby residents from their beds and evacuated them to the local fire hall until the next morning. Several months later, the company suffered an unrelated, small chemical flash fire that severely burned two workers. As a result of these incidents, there were calls from the surrounding neighborhood for a shutdown of the plant.

* Ethyl acrylate is known primarily as an eye and skin irritant that can be smelled at very low concentrations. It poses a low degree of hazard if there is intermittent exposure at low concentrations likely in the ambient environment. It is listed by the National Toxicology Program as an oral carcinogen (based on animal studies), but there are insufficient data to determine whether inhalation or dermal contact is potentially carcinogenic.

Problem:

You and the members of your group are employees of Sybron Chemical Inc. The company's president has presented your work group with the task of developing a risk communication strategy. A new risk communication approach is needed because the community is very upset about the two accidents that have recently occurred at Sybron. You have been given a copy of options for communicating information about company risks. Please consider the options and decide which would be most appropriate for creating an effective risk communication plan for this situation.

Helpful Definitions:

ambient—surrounding
carcinogen—any substance capable of producing or inducing cancer
dermal—of the skin

Source: Excerpted with permission from Chess, Caron; Alex Saville; Michal Tamuz; et al., "The Organizational Links Between Risk Communication and Risk Management: The Case of Sybron Chemicals Inc." *Risk Analysis* 12, no. 3 (1992): 432–33. © 1992 by Society for Risk Analysis.

Student Page

Risk Communication Options[1]

- **Option 1:**
  Scientific assessments of risk provide the most objective answers to risk problems. Our company is dedicated to developing accurate evaluations of the costs and benefits involved in risk-related decisions. After thoroughly analyzing all relevant data, we will present the numerical results to members of the community so that they can make rational decisions for their town.

- **Option 2:**
  Scientific assessments of risk provide objective answers to risk problems. Our company is dedicated to developing accurate evaluations of the costs and benefits involved in risk-related decisions. The results of our analyses are often very complex. It is our responsibility to put the data that we collect into a form that the community can easily understand. If community members understand the significance of such data, they will be able to make rational decisions about how to manage risk.

- **Option 3:**
  Lay people do not regularly use scientific assessments to make decisions about risks. It is our responsibility to help the community make better decisions about how to manage risks. We can accomplish this goal by showing how the community has accepted similar risks in the past. Once the community members realize this earlier acceptance, they will understand that the risk that our company may impose on the community is very small.

- **Option 4:**
  It is our responsibility to help the community make better decisions about how to manage risks. We can accomplish this goal by showing our audience that any risk our company may impose on the community is small compared to the benefits that our company provides. The risk posed by our company is almost negligible, whereas our company provides many jobs and large tax revenues to the town. In addition, we can offer community members compensation for the risks that they accept. If we are sincere in the offer that we make to the public, community members will see that it is in their interest to keep our company in their town.

- **Option 5:**
  We will have a difficult time convincing the town to support our company because the community does not trust our company to manage risks. To survive in this town, we will need to show that we are dedicated to protecting the community from the risks our company may impose on it. We can accomplish this goal by taking responsibility for our actions, illustrating how we're managing risks to the community, and engaging members of the community in a dialogue about what their concerns are. In short, we will have to make the community a partner in our company's risk management activities.

[1]Not listed in any particular order

Source: Fischhoff, Baruch. "Risk Perception and Communication Unplugged: Twenty Years of Process," *Risk Analysis* 15, no. 2(1995):137–45.

Student Page

Sybron Chemicals Inc.: Risk Communication Response

The company embarked on a crash course in environmental self-improvement and community relations.

The company decided that its survival depended on changing from "keeping things at arm's length" to being an actively involved, "caring neighbor," according to the vice president of human relations. Since the release, the company has spent more than $500,000 on community relations activities (not including staff time) and, in addition, nearly $250,000 per year on environmental improvements, according to its own estimates.

Becoming a caring neighbor has included installing a sophisticated telecommunications system, the Prompt Inquiry and Notification System (PINS),[1] which can automatically dial Sybron neighbors in the event of an emergency. In the inquiry mode PINS works like a sophisticated answering machine and plays recorded messages about the plant's status to those who call into the plant. Callers can also leave messages requesting further information. Thus, if people in the community smell fumes, they can call PINS instead of the police, the fire department, or regulatory agencies.

In addition, the company has conducted two surveys that solicited the community's perception of the company; developed a Neighborhood Involvement Committee that meets monthly; instituted a quarterly newsletter for the community; and concluded a plant tour and open house. Sybron also has developed a variety of informal ties with reporters, local officials, and state representatives. The plant's most innovative effort is a program to train volunteers from the surrounding community to identify specific odors from the plant so they can report them more accurately to the company.

Although the plant has never had an event considered sufficiently threatening to activate the PINS notification system, it has had accidental releases that have tested the usefulness of the inquiry system. For example, in the fall of 1990, under weather conditions similar to the night of the ethyl acrylate release, a plant worker violated SOPs [standard operating procedures], resulting in a styrene release. However, this time there were no evacuations, TV cameras, or calls for a shutdown. Plant managers credited the PINS system, which allowed the plant to provide information and respond to concerns quickly.

Discussion Questions

a. How did Sybron Chemicals react when the community began to call for a shutdown of the company?

b. What was good about the way that Sybron reacted? Why?

c. What was bad about the way that Sybron reacted? Why?

d. Make a list of some important factors that you think communicators should take into account when they devise risk communication plans.

[1]PINS is the trademark name for the Prompt Inquiry and Notification System. All rights reserved by the Environmental Affairs Institute Inc.

Source: Excerpted with permission from Chess, Caron; Alex Saville; Michal Tamuz; et al., "The Organizational Links Between Risk Communication and Risk Management: The Case of Sybron Chemicals Inc." *Risk Analysis* 12, no. 3 (1992): 432–33. © 1992 by Society for Risk Analysis.

Student Page

Radon Risk Chart–A

Lifetime Exposure to Radon (picocuries per liter)	Lifetime Risk of Dying from Radon (out of 1,000 people exposed)	Comparable Risks of Fatal Lung Cancer (lifetime or entire work life)
75	214–554	working with asbestos
40	120–380	
20	60–210	
10	30–120	smoking 1 pack of cigarettes per day
4	13–50	
2	7–30	having 200 chest X-rays per year
1	3–13	
0.2	1–3	

Lifetime risks assume that you spend about 18 hours a day in your home. Because every household is different, you may want to consider your typical risk to fit your circumstances. For example, if you have a reading of 10 picocuries per liter but spend only 9 hours inside your home on a typical day, you would multiply your risk from the risk chart by one-half, or 0.50. In this case, the risk would now range from as low as 15 out of 1,000 to as high as 60 out of 1,000.

Source: Covello, Vincent T.; Peter M. Sandman; and Paul Slovic. *Risk Communication, Risk Statistics, and Risk Comparisons: A Manual for Plant Managers.* Washington, DC: Chemical Manufacturers Association, 1988.

Radon Risk Chart–B

Lifetime Exposure to Radon (picocuries per liter)	Comparable Risks of Fatal Lung Cancer (lifetime or entire work life)
75	working with asbestos
40	
20	
10	smoking 1 pack of cigarettes per day
4	
2	having 200 chest X-rays per year
1	
0.2	

Source: Covello, Vincent T.; Peter M. Sandman; and Paul Slovic. *Risk Communication, Risk Statistics, and Risk Comparisons: A Manual for Plant Managers.* Washington, DC: Chemical Manufacturers Association, 1988.

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Radon Alert

Radon Alert
Radon Gas Detectors
1234 Hardrock Way
Springfield, USA 00000

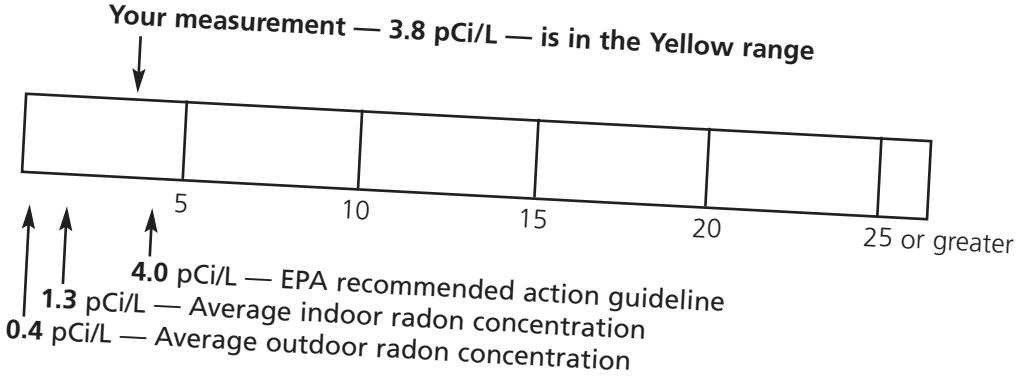
RADON TEST REPORT

Dear Consumer:

You have taken an important step to find the radon level in your home. Here are your radon test results:

Lab ID#	Radon Level	Test Location	Test Length	Test Type
178845	3.8 pCi/L[1]	basement	short-term	activated charcoal
Kit ID#		**Start/Stop Dates**		
C00053208		01/16/98–01/18/98		

Use the chart below to compare your results with the EPA guideline.



[1]pCi/L = picocuries of radon per liter of air.

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Radon Brochure–A

Action Guidelines

RED: These levels are very high risks. You should act to reduce these levels, preferably within several months.

ORANGE: Living in these levels for many years presents a high risk. You should act within the next few years to reduce these levels.

YELLOW: Living in these levels for many years still has some risk. You should see if it is feasible to reduce these levels.

GREEN: These are low levels and have lower risk. The average outdoor level is about 0.4 picocuries per liter. The average indoor level is about 1.3 picocuries per liter.

Because radon risk is cumulative, it usually is given as lifetime risk. This risk is based on two factors:

- How long you are exposed to your radon level: Lifetime risk calculations assume an average "lifetime" of 74 years in a house with a particular radon level.
- Hours at home each day: Lifetime risk calculations usually assume you spend about three-quarters of your time, or 18 hours, at home each day.

These assumptions will not fit you exactly, but you should use lifetime risk as a benchmark in making any decisions.

Smokers and former smokers exposed to radon are at especially high risk for lung cancer.

Should I have additional radon tests?

If your risks are in the red or orange areas of the colored chart, you should have more than one test to verify the results.

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Radon Brochure–B

Are There Any Guidelines for Radon Levels?

Several government agencies and scientific groups have recommended that actions be taken at various levels to reduce exposure to radon.

Agency or Organization	Radon Level (picocuries/liter)	Action Guidelines
U.S. Environmental Protection Agency	20	Remedial action, preferably within several months
	4	Remedial action within next few years
National Council on Radiation Protection	8	Remedial Action
Canadian Government	30	Prompt Action
	4	Remedial Action

What Is Lifetime Risk?

Because radon risk is cumulative, it usually is given as a lifetime risk. This risk is based on two factors:

- How long you are exposed to your radon level: Lifetime risk calculations assume an average "lifetime" of 74 years in a house with a particular radon level.
- Hours at home each day: Lifetime risk calculations usually assume you spend about three-quarters of your time, or 18 hours, at home each day.

Smokers and former smokers exposed to radon are at especially high risk for lung cancer.

Should I have additional radon tests?

You will get a reading for your basement, where radon levels are likely to be highest. It is a good idea to check the accuracy of a single test by having more tests done.

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Risk Communication Guidelines

Ultimately, people judge how dangerous a risk is and decide whether they will take action to reduce it. Therefore, people must get information that will help them evaluate the risk and determine what should be done about the risk.

To effectively communicate risk to the public, you must consider the following principles:[1]

- Involve the community early in the decision-making process.
- Do not assume what people know or do not know about the risk.
- Coordinate communication efforts with other credible sources.
- Use simple, nontechnical language.
- Use risk comparisons carefully.

To help people evaluate risk, you must address the following questions:[2]

- How much of the substance are they being exposed to?
- What is the likelihood of accidental exposure? What safety or backup measures are in place?
- What is the legal standard for the substance? Is the standard controversial or widely accepted as sound?
- What health or environmental problems is the standard based on? Are there other problems that should be considered?
- Is the source of the risk information reputable? Who funded the work? What do other sources say?
- Were the studies done on a population similar to the group it is being compared to?
- What are the benefits of the substance or facility? What are the tradeoffs?
- How does the risk compare with other risks that are of concern to the same audience?

To encourage constructive action, you must provide the following information:[2]

- Describe what individuals can do to reduce their exposure.
- Describe what industry and government are or are not doing to reduce the risk.
- Describe the benefits, as well as the risks, to the specific audience (not just society in general) of the substance or process of concern.
- Describe the alternatives and their risks.
- Describe what people can do to get involved in the decision-making process.
- Provide information that will help the audience to evaluate the risk.

[1]Covello, Vincent T.; Peter M. Sandman; and Paul Slovic. "Guidelines for Communicating Information About Chemical Risks Effectively and Responsibly." In *Acceptable Evidence: Science and Values in Risk Management*, edited by Deborah Mayo and Rachelle Hollander. New York: Oxford University Press 1991.

[2]Kamrin, Michael; Dolores J. Katz; and Martha L. Walter. *Reporting on Risk*: *A Journalist's Handbook on Environmental Risk Assessment*. Ann Arbor, MI: Michigan Sea Grant Program and the Foundation for American Communications, 1995, 89–90.

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Concentration Analogies[1]

1 Part Per Million

- 1 automobile in bumper-to-bumper traffic from Cleveland to San Francisco
- 1 pancake in a stack 4 miles high
- 1 inch in 16 miles
- 1 minute in 2 years
- 1 cent in $10,000
- 1 bogey of 3,500 golf tournaments
- 1 lob in 1,200 tennis matches

1 Part Per Billion

- 1 4-inch hamburger in a chain of hamburgers circling the Earth at the equator $2^1/_2$ times
- 1 silver dollar in a roll of silver dollars stretching from Detroit to Salt Lake City
- 1 kernel of corn in a 45-foot-high, 16-foot-diameter silo
- 1 sheet in a roll of toilet paper stretching from New York to London
- 1 second in 32 years
- 1 cent in $10,000,000
- 1 pinch of salt on 10 tons of potato chips
- 1 bad apple in 2,000 barrels of apples

1 Part Per Trillion

- 1 drop of detergent in enough dishwater to fill a string of railroad tank cars 10 miles long
- 1 square inch in 250 square miles
- 1 mile on a 2-month journey at the speed of light
- 1 6-inch leap on a journey to the sun

1 Part Per Quadrillion

- 1 postage stamp on a letter the size of California and Oregon
- 1 human hair out of all the hair on all the heads of all the people in the world
- 1 mile in a journey of 170 light years

[1]Kamrin, Michael; Dolores J. Katz; and Martha L. Walter. *Reporting on Risk: A Journalist's Handbook on Environmental Risk Assessment.* Ann Arbor, MI: Michigan Sea Grant Program and the Foundation for American Communications, 1995, 96.

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One Part Per Million