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Risk Communication in Action

THE TOOLS OF MESSAGE MAPPING

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Risk Communication in Action:

The Tools of Message Mapping

By

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Foreword

The U.S. Environmental Protection Agency (EPA) is charged by Congress with protecting the Nation's land, air, and water resources. Under a mandate of national environmental laws, the Agency strives to formulate and implement actions leading to a compatible balance between human activities and the ability of natural systems to support and nurture life. To meet this mandate, EPA's research program is providing data and technical support for solving environmental problems today and building a science knowledge base necessary to manage our ecological resources wisely, understand how pollutants affect our health, and prevent or reduce environmental risks in the future.

The National Risk Management Research Laboratory (NRMRL) is the Agency's center for investigation of technological and management approaches for preventing and reducing risks from pollution that threaten human health and the environment. The focus of the Laboratory's research program is on methods and their cost-effectiveness for prevention and control of pollution to air, land, water, and subsurface resources; protection of water quality in public water systems; remediation of contaminated sites, sediments and ground water; prevention and control of indoor air pollution; and restoration of ecosystems. NRMRL collaborates with both public and private sector partners to foster technologies that reduce the cost of compliance and to anticipate emerging problems. NRMRL's research provides solutions to environmental problems by: developing and promoting technologies that protect and improve the environment; advancing scientific and engineering information to support regulatory and policy decisions; and providing the technical support and information transfer to ensure implementation of environmental regulations and strategies at the national, state, and community levels.

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Sally Gutierrez, Director
National Risk Management Research Laboratory

How to Use this Workbook

Section 1.0 introduces the topics of risk communication and message mapping.

Section 2.0 provides a background on risk communication. Since a message map is a tool used in risk communication, this chapter will discuss the history of risk communication and outline some general principles of effective risk communication.

Section 3.0 provides information for preparing risk communication messages. Risk perception, risk communication theories and guidelines will be discussed. The role of the media in risk communication will also be discussed.

Section 4.0 discusses the structure of a message map, and includes a blank message map template as well as an example of a working message map.

Section 5.0 will provide step-by-step directions about how to create a message map.

Section 6.0 provides examples of how to create a message map in the event of a public health crisis. Examples chosen are: the West Nile virus epidemic of 2002 in the United States, the anthrax scare of 2001 and the Cryptosporidiosis drinking water outbreak in Milwaukee, Wisconsin, 1993.

Section 7.0 is a short conclusion.

Section 8.0 is a glossary of important terms.

Section 9.0 is a list of the most frequently asked questions during a crisis.

Section 10.0 is a template for risk communication.

Section 11.0 is a list of references that were cited throughout the paper.

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1. Introduction

In 1976, a 19-year old U.S. Army private named David Lewis came down with flu-like symptoms, and died within 24 hours. Two weeks after the private's death, health officials disclosed to the American public that something called "swine flu" had killed Lewis and hospitalized four of his fellow soldiers at the Army base in Burlington County, New Jersey. Healthcare officials feared a repeat of the 1918 flu epidemic, which killed 20 million people around the world. The Centers for Disease Control and Prevention (CDC)'s recommendation was to vaccinate all Americans. The National Influenza Immunization Program (NIIP) officially started in October of 1976. The number of vaccinations given each week increased rapidly from less than one million in early October to more than four million in the later weeks of the month, and reached a peak of more than six million doses a week by the middle of November 1976.[1] Overall 40 million people were vaccinated, although it was later discovered that the vaccines were technically flawed and contained only one of the antigens necessary for an effective inoculation.

Moreover, on December 16, 1976 the NIIP was suspended following reports from more than ten states of a rare degenerative disease, Guillain-Barré syndrome (GBS), in vaccinated people. By January of 1977, more than 500 cases of GBS had been reported, with 25 deaths. Based on the weekly numbers of vaccinations, a comparison of observed cases with expected cases showed that the relative risk of acquiring GBS during the six weeks after vaccination was about ten times the endemic expectation.[2] Meanwhile, the expected mass epidemic of swine flu never occurred. However, the regular seasonal flu did break out, and the only flu vaccines available were mixed with swine flu vaccine.[3]

The swine flu incident illustrates the difficulties of risk communication. The fear of a swine flu epidemic was so great that a mass inoculation program was implemented without proper thought and planning. In this case, the vaccine caused more harm than good. Currently, there is much concern in the news about the avian flu, which to date has killed 70 people in Asian countries.[4] But how can organizations prepare for a threat that is so unpredictable? Communicating risk is a task with unique difficulties. Law enforcement officials, public health officials, and government agencies all face the same challenge: in a high-stress, high-concern, or emotionally charged situation; how does the organization quantify and convey risk in an appropriate, effective and factual manner? What are the proper actions to recommend (or discourage)? How will the public react? Will the message change behavior?

In spite of the challenges, risk communicators have many resources that can help them create informative, balanced, and well-considered risk messages. Risk Communication is a fairly new science developed mainly by Vincent Covello and Peter Sandman. This workbook, *Risk Communication in Action: The Tools of Message Mapping* will describe one robust and effective tool of risk communication, **message mapping**.

Figure 1-1. The swine flu incident was an example of a risk communication disaster. Massive stockpiles of swine flu vaccine were prepared and administered for an epidemic that never became widespread. The vaccine itself, however, did cause 500 cases of Guillain-Barré syndrome and 25 deaths.

1.1   What Is a Message Map?

A message map is a detailed description of hierarchically organized answers to anticipated questions and concerns from stakeholders (e.g., the public, the media, and special interest groups) in the event of a disaster, crisis, or alarming situation. A well-constructed message map should bring focus and clarity to a potentially high-stress, high-concern, or emotionally charged situation.

The three key goals of a message map are:
- to educate and inform the public (stakeholders)
- to build and maintain trust and credibility between the general public and decision makers during a crisis
- to create informed dialogue and decision making among the public and figures of authority.

A message map is a template, containing three tiers of information. The first tier identifies the audience for the message map (called the **stakeholder**) as well as the questions or concerns that the message map is intended to address. The second tier of the message map contains **three key messages** pertaining to the situation. These key messages can serve as themes for a public presentation and sound-bites for the mass media. The third tier of the message map contains supporting information for the three key messages. The supporting information is blocked in groups of three under the key messages. Supporting information amplifies the key messages and provides additional facts and details.

1.2   What Are the Benefits of Using a Message Map?

A message map is a useful organizational tool by providing guidance and clarity to both the authorities and the stakeholders in a high-stress situation. A well-designed message map helps multiple partners (e.g., the firemen, the police, the health-care workers and other authorities) speak with one voice, in a clear, concise manner. It minimizes the chances of speaker's regret at an inappropriate comment, omission of pertinent following information, or disinformation that can confuse stakeholders. The three key messages and hierarchically organized supporting information provide talking points that a speaker can check off in order of importance.

In addition to providing guidance during a crisis, message maps are useful planning tools in anticipation of potential threats and crises. Organizations can develop these messages and test them through focus groups and surveys.

A message map as a public health tool was developed by risk communication expert Vincent Covello in the early 1990s and was first widely adopted in the aftermath of the anthrax attacks of the fall of 2001.

2. Background of Risk Communication

2.1 Introduction to Risk Communication

The National Research Council of the United States gave the following definition of risk communication: *"Risk communication is an interactive process of exchange of information and opinions among individuals, groups, and institutions. It often involves multiple messages about the nature of the risk or expressing concerns, opinions, or reactions to risk messages or to the legal and institutional arrangements for risk management."*[5]

Thus, risk communication involves messages about the nature of the risk as well as messages that express concerns, opinions, and/or reactions to risk messages. An ideal risk communication tool would put a risk in context, make comparisons with other risks, and encourage a dialogue between the sender and the receiver of the message.

Complexities are inherent in any risk situation. Although it is tempting and sometimes advantageous to use basic, unspecific terms, risk communicators must also explain the complexity of the situation. There may be 20 appointed experts with many different assessments whereby opinions and risk regulators must understand multiple conflicting objectives. For instance, even though data overwhelmingly prove that smoking is a carcinogen, risk communicators must acknowledge the rights of the tobacco industry, as well as those of smokers.

There are also degrees of risk. Risk communication expert Peter Sandman also makes the distinction between *hazard* and *outrage*; hazard is the experts' assessment of risk and outrage is the public perception of risk.[6] Some situations may have a very low hazard factor but a great outrage factor, while other situations will have very high hazard but very low outrage. One example is malaria and tuberculosis, two diseases that are still top killers in the developing countries and are increasingly resistant to treatment but still receive little coverage in the press. It is also possible to have a situation with both great hazard and great outrage – i.e. the Chernobyl nuclear reactor incident. The swine flu incident was an example of a situation that aroused great outrage but had very little actual hazard. Instead, the real hazard became the treatment of the swine flu, which caused 500 Guillain-Barré cases and 25 deaths.

2.2 Goals of Risk Communication

Risk analysis experts Ralph Keeney and Detlof von Winterfeldt, of the Institute of Safety and Systems Management at the University of Southern California[7], conducted extensive discussions with regulatory officials, after which they listed the objectives of risk communication[7]:

- **To educate the public about risks, risk analysis, and risk management**
  Risks should be put in perspective. The public should grasp the complexity of the problem and also understand the rationale of risk assessment and risk management. The public should understand that there is no "zero risk" solution. In any risk situation, tradeoffs are necessary, and uncertainty cannot be avoided.
- **To inform the public about specific risks and actions taken to alleviate them**
  Risk managers should speak in user-friendly words as opposed to technical jargon. Accessible graphics/visual aids are helpful in achieving this goal.
- **To encourage personal risk reduction measures**
  This is perhaps the most important goal. Ideally, risk communication should also change individual behavior. If the presentation is about the dangers of carbon monoxide poisoning, one goal would be to persuade some of the audience to indicate that they plan to install a carbon monoxide detector in their homes.
- **To improve understanding of public values and concerns**
  To do this, risk communicators must consider the difference (if any) between hazard and outrage about a risk, and the factors that influence risk perception (see Section 3.0). This understanding will allow the risk communicators to address the issue in an appropriate manner.
- **To increase mutual trust and credibility between the authorities and the public**
  For organizations to exude credibility and engender public trust, the manner of communicating risk is critical. Some general guidelines: communication must be honest, must not evade or exaggerate, and must not second-guess the audience. This will engender the audience's trust and build up your credibility.

- **To resolve conflicts and controversies**
  Many risk problems become a matter of heated debate and controversy because they affect people directly, because the authorities and decision makers disagree, and because of lost trust and credibility. Risk communicators should attempt to resolve these conflicts. Their tone should be caring and empathetic.

2.3   History of Risk Communication

Risk communication is a relatively new science. Vincent Covello and Peter Sandman have traced the evolution of risk communication from the 1980s to the present. They specify four distinct stages[8]:

Stage 1: Ignore the public
This was the pre-risk communication stage prevalent in the United States until about 1985. The assumption was that there was no point communicating risk to the general public, as they would not heed the warnings or understand the risks. It was thought that the public was largely content to let authorities shape environmental policy.

Stage 2: Explain the risk data
From the mid-to-late 1980s, the public reasserted its claim over environmental policy. Many organizations attempted to better explain risk data. Explaining risk data to the public is still a challenging task for many institutions, however. For instance, if an EPA spokesperson said, "The maximum allowable arsenic in drinking water is 10 parts per billion," only a small segment of the population would understand what that actually means, and how to follow those guidelines. This is exacerbated by the fact that many times there is no easy remedy for a risk.

Stage 3: Dialogue with the community
For some risk problems, such as radon, where the hazard is large but the controversy is minimal, doing a better job explaining risk data is important. However, when the hazard is not great but public outrage is very high, simply explaining data does little to ameliorate a tense situation. An example of this occurred in the late 1980s. Medical waste began showing up on the shore of the Atlantic coastline. In New Jersey, the Department of Environmental Protection reported that the waste was not dangerous, but this only increased public outrage. In Rhode Island, the Commissioner of Health agreed with the public that the waste was an outrage and unacceptable, and promised to use any means possible to clean the waste up. This in turn diffused public outrage and also forced the public to consider the costs of a thorough cleanup.

Stage 4: Involve the public as a cooperating partner
This is a very difficult stage to achieve, mostly because it is very difficult for individuals and organizations to adopt new decision-making approaches. There is also a mindset within organizations that they are the experts and that the public is in general not informed enough to be a fully cooperating partner.

2.4   Cardinal Rules of Risk Communication

Before making a message map it is useful to consider Vincent Covello and Frederick Allen's **Seven Cardinal Rules of Risk Communication**[9]:

Rule 1: Accept and involve the public as a legitimate partner
Demonstrate respect by involving the community early, before important decisions are made. People and communities have a right to participate in decisions that affect their lives and livelihoods. The goal of risk communication is not to diffuse public concern, but to create an informed public. A scientific experiment that tested public support for space exploration policies showed that public participation during decision-making about risks can lead to more acceptance of risk policies.[10]

Another example of a successful public involvement effort was a public committee that debated and resolved several highly controversial water management issues involving a hydroelectric facility in British Columbia. The body of water of concern was the Alouette River, and the company, BC Hydro, was the sponsor of the project. The Alouette Stakeholder Committee was made up of 17 official members drawn from a wide array of organizations, from various interest groups and local citizens. The goal of the committee and BC Hydro was to select the best possible operating plan for the Alouette River. After 15 meetings, the group reached complete consensus on all major issues it was asked to address. This is an example of how the public can be a part of a successful decision-making team.[11]

Rule 2: Listen to the audience
If people feel that they are not being heard, they cannot be expected to listen. Effective risk communication is a two-way activity.[9]

Rule 3: Be honest, frank, and open
Organizations should disclose risk information as soon as possible without minimizing or exaggerating the level of risk, to create an atmosphere of trust and credibility. They should lean towards sharing more information, not less.[9]

Rule 4: Coordinate and collaborate with other credible sources
University scientists, physicians, citizen advisory groups, trusted local officials, and national or local opinion leaders are among the credible sources available for collaboration.[9]

Rule 5: Meet the needs of the media
Print and broadcast media are prime transmitters of information on risks. Communication should be accessible to reporters and should include digestible sound-bites. Sound-bites are brief statements, often made by organizations or reporters, intended to explain information or defend a position in simple, memorable, easily understandable terms. If organizations don't simplify, the press will simplify the message at the risk of adding misinformation.[9]

Rule 6: Speak clearly and with compassion
Technical language and jargon are barriers to successful communication with the public. Clear, non-technical language and sensitivity to cultural norms is essential. Personalizing risk data along with graphics to clarify the message will enhance public understanding.[9]

Rule 7: Plan carefully and evaluate performance
Risk communication will be successful only if carefully planned and evaluated. Organizations should identify important stakeholders, pretest messages to focus groups, and train staff in communication skills.[9]

3. Risk Perception and the Preparation of Messages

3.1 Risk Perception

Risk perception is one of the most complex and challenging aspects of risk communication. Research on risk perception has shown that misunderstanding of probability, biased media coverage and misleading personal experiences often cause risks to be misjudged, underestimated or overestimated.[12] Strong initial views are resistant to change. New evidence is considered "reliable and informative" only if it is consistent with initial beliefs. Contrary evidence tends to be dismissed as unreliable, wrong, or unrepresentative.[13]

Risk communicators must make a distinction between *objective risk* (actual risk) and *subjective risk* (perceived risk). Whereas risk is objective, risk perception by nature is subjective. It is imperative for risk communicators to consider the factors that influence risk perception before creating any message or statement. Researchers have studied the characteristics of risk that influence risk perception/outrage. A comparison of characteristics of underestimated risks vs. overestimated risks is listed in Table 3-1. The most important perception factors are listed below[14]:

Dread
Certain risks invoke more dread than others. Cancer, for example, causes more dread than heart disease because cancer is seen as a terrible way to die. When asked to estimate the average lifetime chance of developing breast cancer, the average woman in a 2005 survey guessed that the risk was three times higher than the actual risk.[15]

Control
People are more afraid of events when they feel a lack of control. An example: per mile traveled, the risk that one will die in a car accident is far greater than the chances of dying in a plane crash, yet fear of plane crashes is greater than fear of car crashes, because in an airplane there is very little sense of control.[14]

Natural vs. man-made risk
Man-made risks evoke more fear than natural risks. Nuclear energy sources are often a greater cause of concern than the radiation produced by the sun, even though the sun's radiation leads to many skin cancer deaths each year. Likewise, a toxic Superfund site causes more concern than radon, even though radon exposure kills more Americans each year than all the Superfund sites combined.[6] (For a definition and explanation of radon, see the glossary.)

RADON GETS IN THROUGH:
1. Cracks in solid floors.
2. Construction joints.
3. Cracks in walls.
4. Gaps in suspended floors.
5. Gaps around service pipes.
6. Cavities inside walls.
7. The water supply.
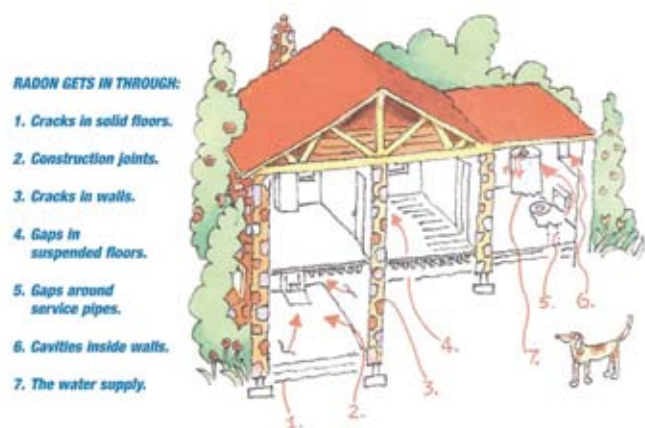
Figure 3-1. Natural vs. man-made risks: Radon in homes increases risk of lung cancer, but since it is a natural threat there is less fear and outrage.

Figure 3-2. Natural vs. man-made risks, and unknown risks: A man-made risk with unknown hazards such as the Superfund site shown above (Bunker Hill, Washington, at the Couer d'Alene River Basin) causes more fear and outrage.

Effects on children

If children are exposed to, say, asbestos or lead paint in schools, this is perceived as a greater danger than when adults are exposed to the same substances.[14]

Figure 3-3. Since lead paint affects the cognitive development of children, there is great public concern about lead.

Scientifically unknown/new risks

Many risks, such as a toxic Superfund site, are unfamiliar, and therefore produce a lot of alarm. Another example would be the SARS epidemic of 2003, which caused great alarm, compared to the yearly influenza epidemic, even though the flu causes more deaths each year.[14]

Awareness

Wide coverage by media and public health officials will often create more alarm in the public. An example is the West Nile Virus, which has received a lot of coverage in the media in recent years. Meanwhile, air pollution is a risk that many Americans are exposed to every day. Health effects include an increased risk for cancer, respiratory ailments (including asthma), and developmental and reproductive problems. Yet, the press rarely reports about the dangers of air pollution, so most laypeople are not worried about it.[16]

Possibility of personal impact

People who are close to a risk, and who have a clear knowledge of the consequences, will have a greater perception of risk.[14]

Trust

Public perception of risk is greater if the lines of communication are from sources that are perceived to be untrustworthy. For instance, studies or statistics about the relationship between smoking and lung cancer from a tobacco company may be mistrusted by many.[14]

Table 3-1. A Summary of Risk Perception Factors[14]

Underestimate Risk	Overestimate Risk
Not dreaded (i.e. heart disease)	Dreaded (cancer)
Voluntary	Coercive (involuntary)
Natural	Industrial
Scientifically well understood	Scientifically unknown
Known	Unknown
Controllable by the individual	Controllable by others
In the hands of a reliable source	Managed by an unreliable source
Managed in a responsible way	Managed in an irresponsible way
Reversible	Irreversible
Immediate health effects	Delayed health effects
Children not as victims	Children as victims
Moral/ethical	Immoral/Unethical
Not memorable	Memorable
Random/scattered	Catastrophic
Little media attention	Much media attention
Victims statistical	Personal impact
Risk to future generation	No risk to future generation

For a hypothetical situation, if the risks are primarily in the "overestimate risk" column of Table 3-1, the public will overestimate the risk and overreact and/or panic. If the risks are primarily in the "underestimate" column, it will be difficult to persuade the public to adopt risk-decreasing behaviors. The role of the risk communicator is to overcome these risk perception factors so a balanced assessment of risk can be produced.

Cost-benefit ratio
If there is a perceived benefit in a specific choice, the risk associated with that behavior or choice will seem smaller than when no such benefit is perceived. In a study of residents living near a Tacoma, Washington, copper smelter (which emitted arsenic), the respondents with more tolerance towards the smelter believed that its benefits outweighed its dangers.[17]

Choice
A risk that humans choose to take seems less hazardous than one imposed by another person. This explains why many people skydive or bungee jump, but fear a visit to the dentist.[14]

Memory of risks
A memorable incident makes a risk easier to evoke and imagine, and therefore seem greater. For example, the September 11 attacks instantly made "terrorism" a huge fear among the American public, although actual acts of terrorism on American soil are still exceedingly rare.[14]

Figure 3-4. A memorable incident such as the September 11, 2001 attacks caused terrorism to become a huge fear for the American public, although terrorist acts remain fairly rare, at least on American soil.

Spread over space and time
Unusual catastrophic events such as nuclear accidents (e.g., the Chernobyl nuclear accident in 1986) are perceived as riskier than commonplace events, such as a hurricane or blizzard. This is perhaps why many people refuse to evacuate during hurricanes despite repeated warnings – they think it's "just another storm." Along the same lines, people often drive in blinding snowstorms that cause extremely icy roads and practically no visibility.[14]

Effects on personal safety and personal property
An event is perceived as risky when it affects basic interests and values such as shelter, finances and human life. Examples are hurricanes and earthquakes.[14]

Reversibility
Risks perceived to have potentially irreversible adverse effects are less readily accepted and perceived to be greater than risks posing no permanent, personal threat.[14]

Ethical or moral nature
Risks perceived to be ethically or morally objectionable (e.g., rape, robbery) are less readily accepted and perceived to be greater than risks perceived not to be ethically objectionable or morally wrong, such as a skiing accident.[14]

Delayed effect
People fear hazards that have a delayed effect (e.g., carcinogens) more than hazards with immediate health effects.[14]

High risk to future generations
Activities that pose a threat to future generations (e.g., radiation from a nuclear accident) are judged to be a more risky than those that threaten the current generations, such as influenza.[14]

3.2   Preparing Messages in Advance

Preparing an appropriate, concise, effective message prior to an event actually occurring is probably the most crucial part of risk communication. When preparing messages, it is important to consider the several risk communication theories that are outlined below.

3.3   Risk Communication Theories

Risk Denial
Risk denial is a common reaction to a specified risk. Studies have shown that individuals may acknowledge the existence of a risk, yet assume that they personally are not vulnerable to it and are more knowledgeable about hazards relative to others. In the Tacoma survey, those who lived the closest to the copper smelter tended also to be employees at the smelter. These residents were most likely to deny any risk from the smelter's arsenic emissions, even though they were most vulnerable to the emissions. When a risk is counterbalanced with a perceived benefit, very often the risk is simply denied.[17] Stigmatization, fear, withdrawal, hopelessness and helplessness can also contribute to risk denial.[18] In the case of an infectious disease (such as AIDS), stigmatization or fear of stigmatization may be so

great that ignorance is preferable to seeking help. Fear is also a psychological consideration in a crisis – it is often debilitating and prevents quick, decisive action. In other cases people may feel that the threat is real, but that there is nothing they can do about it. Thus they withdraw into hopelessness and helplessness.

Very often people will recognize a risk but consider themselves less personally in danger than other people. A survey that asked participants about their personal vulnerability to eight risks (contaminants in drinking water, smoking, radon, chemical residues on food, AIDS, low-level radioactive waste, and high blood cholesterol) found that respondents recognized potential harm to others, but rated their own personal vulnerability to the eight risks as lower.[19]

Trust Determination Theory
The trust determination theory proposes that when people are upset they often doubt that others are listening, caring, empathetic, competent, and/or committed. Thus the first and most important goal of preparing a risk communication message is building trust with the audience or stakeholders.

According to a survey conducted by the Center for Risk Communication, factors that build trust and credibility are: caring and empathy; competence and expertise; honesty and openness; and dedication and commitment.[20,21] Caring and empathy are the most important factors in building trust and credibility. Studies also show that people make their initial judgments about caring and empathy within the first 30 seconds.[22] It is also important to build trust and credibility by using support from credible third party sources. According to surveys, health professionals, scientists, educators and advisory groups have high credibility and promote trust on health, safety, and environmental issues. Media and activist groups have medium credibility, while industry and paid consultants have low credibility.

An example of an industry that regained public trust was Johnson & Johnson Co. during the Tylenol tampering incident of 1982. The company aggressively removed all Tylenol from retail shelves. The recall cost the company $100 million, but the public perception was that Johnson & Johnson was concerned about public health and safety.[20]

Mental Noise Theory
The mental noise theory hypothesizes that when people are stressed or upset, they have difficulty hearing, understanding, and remembering information.[22] Providing messages to the public that are brief, concise, and clear, while still providing all necessary information is a way to overcome this challenge. Ways to ameliorate mental noise include:
- Provide a limited number of clear messages: 3 key messages
- Keep messages brief: 9 seconds or 27 words
- Repeat messages
- Use simple language (6-8 grade level)
- Use visual aids: graphics, slides, charts, diagrams, video, photographs
- Use personal stories, rather than impersonal statistics

Negative Dominance Theory
The negative dominance theory hypothesizes that people tend to focus more on the negative than on the positive in emotionally charged situations.[21] Solutions to the negative dominance theory include:[23,24]
- Balancing negative key messages with positive, constructive or solution-oriented key messages
- Employing a ratio of at least 3:1 positive to negative words
- Avoiding unnecessary, indefensible, or nonproductive use of absolutes and the words "no," "not," "never," "nothing," "none."

Body Language
Body language, the language of gestures and postures, is an important – and often decisive – factor in risk communication.[22] Experts believe that it provides up to 75% of message impact, is noticed intensely, and overrides verbal communication. There are some general rules for appropriate body language in risk communication. The speaker should make eye contact; not doing so makes the audience feel that you are dishonest, unconcerned, or nervous. Sit up straight; not doing so can convey lack of interest or concern. Do not cross arms; this can be seen as defiant, defensive or uninterested. Frequent hand to face contact can seem dishonest or nervous. Drumming or tapping hands or feet conveys nervousness, hostility or impatience. Resting a hand on the head can give the impression of boredom or fatigue. A raised voice can send a message of hostility, nervousness or deceit. In other words, risk communicators should be trained about proper body language when speaking to stakeholders.

Figure 3-5. Body language can affect viewer perception, irrespective of the actual words spoken.

Presentation Format

When people lack strong prior opinions or understanding, they can be easily manipulated by the way risk information is presented. In one study, participants were asked to imagine they had lung cancer and had to choose between two therapies, surgery and radiation. Some subjects were then presented with the cumulative probabilities for surviving after the treatment. Other subjects received the same probabilities, except framed in terms of dying rather than surviving. Framing the statistics in terms of dying rather than surviving dropped the percentage of subjects choosing radiation over surgery from 44% to 18%.[25] In another study, a hypothetical situation about the risk of side effects of an influenza vaccine was presented in either a probability format (i.e. 5%) or a frequency format (i.e. 1 out of 20). The 42 subjects given the probability format of 5% were more likely to describe the risk as "uncommon" or "rare," as opposed to the 43 people given the frequency format (1 out of 20).[26]

Pitfalls in Risk Communication[22]

The Association of State and Territorial Health Officials lists common pitfalls made by organizations when communicating risks. These include over-reliance on jargon, losing one's temper, speaking in overly abstract terms, resorting to personal attacks, giving unrealistic promises and guarantees, referring to financial concerns, blaming other people/organizations, talking "off the record," using improper risk comparisons, and talking for too long.

3.4 Other Guidelines for Risk Communication

1. The **primacy/recency** principle. This principle states that the most important messages should occupy the first and last position in a list[26], since information that is mentioned first or last on a list is the most likely to be remembered. The primacy/recency effect has been confirmed in various psychological tests. In one experiment, college students viewed lists of 15 commercials in a laboratory simulation and recalled the product brand names. In an immediate test, the first commercials in the list were well recalled (a *primacy effect*), as were the last items (a *recency effect*), in comparison with the recall of middle items.[27] The primacy/recency effect has also been replicated with recall of non-words[28] and affective word lists.[29] Non-words in this case are letters of the alphabet jumbled together; affective word lists are words that are related in some way. For instance, an affective word list would be: sadness, grief and heartbreak.

2. Speak with **compassion, conviction, and optimism**. This guideline is modeled after the behavior and persona of Prime Minister Winston Churchill. In a time of great stress and turmoil, Churchill was an anchor who embodied Britain's indomitable spirit during World War II. There are many quotations which reflect Churchill's compassion, conviction, and optimism, such as:

   • "Success is not final, failure is not fatal: it is the courage to continue that counts."

   • "The pessimist sees difficulty in every opportunity. The optimist sees the opportunity in every difficulty."

   • "We shall not fail or falter; we shall not weaken or tire...Give us the tools and we will finish the job."[30]

Figure 3-6. British Prime Minister Winston Churchill's oratory style serves as a model for effective risk communication.

3. **Average Grade Level Minus Four:** During stressful situations people do not comprehend information at their normal grade level. If a person's normal reading level is eighth grade, during a crisis his reading/comprehension might drop to fourth-grade level. In a study that compared children who attended a school with high aircraft noise (from London Heathrow airport) versus schoolchildren who attended a school with no aircraft noise, the children chronically exposed to aircraft noise were associated with high levels of stress, as well as poorer reading comprehension and sustained attention.[31]

4. **Stick to three main points.** According to information theory, both short-term memory and attention span are limited by the number of items the mind can consider simultaneously.[32] This is one of the oldest rules of risk communication – Aristotle wrote about it in *Art of Rhetoric*. Famous examples of the "Rule of Three" are Julius Caesar's "I came, I saw, I conquered," or the Declaration of Independence's "Life, liberty, and the pursuit of happiness." Information theory also states that generally, people organize their thinking in terms of only three or four items.[33]

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5. **Use visual aids**, such as pictures or graphs, analogies, examples, and photographs that can enhance audience comprehension. Experiments have shown that effective working memory may be increased by presenting material in a mixed (auditory and visual) rather than a single mode.[33]

6. For every negative statement, include three positive statements. This is the **1N=3P rule**. This rule is derived from the Negative Dominance Theory, which has also been replicated in psychological studies. In an experiment where subjects were asked to rate pleasant and unpleasant noun pairs, the unpleasant noun of a pair made a stronger impression in recall tests than the pleasant noun.[34] If forced to make a negative statement, here is the template to follow:

   1. Positive news
   2. Acknowledge negative
   3. Positive statement 1
   4. Positive statement 2
   5. Positive statement 3
   6. Follow up

7. In the event that the speaker cannot answer a question that is asked, follow this template:

   - Repeat the question
   - Admit to not knowing the answers
   - Give the reasons why
   - Indicate follow-up with a deadline for getting the information
   - **Bridge** to a positive statement: "While I don't have that specific information at the moment I want to remind everyone ..."

Below is a table that summarizes general rules for risk communication, taking into account risk perception, risk communication theories, and common pitfalls of risk communication.

3.5 Risk Communication to the Media and General Public

The mass media exerts an influence on people's perception of risk, so it is important for risk communicators to understand the media's strengths and limitations as a tool for risk communication. Some risk communicators have charged the media with exaggerating some risks and ignoring others, and focusing on rare, headline-grabbing hazards (terrorism, for example) while ignoring more commonplace risks (heart attacks). However, evidence suggests that it is not so much media bias that affects risk perception, but the media's availability and the medium with which the information is transmitted. Television news may convey greater danger, resulting in increased levels of fear among audience members than print media conveys. It is one thing to read about hurricanes, but seeing destroyed homes and downed trees on television makes the risk much more vivid. In addition, television often conveys information in less depth than written media.[19]

However, it is unclear how much impact the media actually has on an audience's risk perception. Studies indicate that while the media can amplify general societal risk perception, personal risk perceptions are much harder to change. Personal risk judgment is based more on personal experiences and direct information.[19,35]

Table 3-2. General Guidelines for Good Risk Communication

Good Communication	Poor Communication
Clearly state and estimate the risk Ex: "We have a serious and immediate problem requiring attention ..."	Exaggerate or minimize the risk Ex: "No one has anything to worry about"; "It's time to panic"
Use clear, non-technical language – write in an eighth-grade reading level if talking to the general public	Use technical language/jargon – for example, filling the speech with acronyms ("For the RfD, go to EPA's IRIS")
Use credible sources – government agencies, scientific experts, reliable news sources (AP, Reuters, etc.)	Use non-credible sources – lobbying groups, industries
Listen to the audience – assume that if one communicates in a clear, appropriate manner, the audience will understand	Ignore the audience's concerns – a "they won't understand anyway" mentality
Remain calm – do not get agitated or defensive	Get angry – "That's a stupid question ..."
Keep messages brief – main message about 25-30 words (and 10 seconds)	Make messages long-winded – droning on and on with long lists
Balance a negative statement with 3 positive statements	Use an overload of negative statements, and words like "no," "never," "nothing"
Place most important messages first and last	Hide most important message in the middle of the speech
Use visual aids and graphics – charts, videos, pictures, graphs	Use impersonal statistics – "the chances of one having an exposure of more than 50 ppb is about 1 in 100"
Repeat messages – three times, to make sure the most important points are remembered	Mention an important message in passing – "Oh, by the way, the hurricane warning is effective immediately ..."
Speak with a serious tone – it will give the impression of taking the audience seriously	Add humor – can often come off as flippant or be misunderstood as a lack of concern

There is, however, evidence that the media's focus is related to public attitudes. Thus, situations with "high outrage" factors receive greater coverage. A study of seven British newspapers found that threats with high definition (infectious diseases, rabies, and food poisoning) were disproportionately reported relative to their frequency of occurrence.[36]

Another issue between the media and risk communicators is the fact that few journalists have the scientific background to sort through and understand the complex and often contradictory opinions of risk "experts."[37] Therefore it is important for risk communicators to be well prepared and well organized before any interview with a journalist. There are many ways of getting emergency information to the media: press releases, press conference, satellite media tours, telephone news conference/web casts, commercial press releases, email list-servs, web sites, and video streaming. There are plusses and minuses to every method of communication with the media.[18] The method ultimately chosen will be based on the urgency of the situation, the risk communicator's time constraints, need for consistency, the media's time constraints, and financial considerations.

As a rule, the media are more interested in the following[20]:

- Human interest stories (as opposed to statistics)
- Bad news (as opposed to good news)
- Personal perspectives (i.e. "An eyewitness account of ...")
- Yes or no (safe or unsafe) answers (as opposed to nuanced, ambiguous answers)
- Front-page headline news stories
- Quick, digestible sound-bites

During a press conference or another form of communication with the media, it is important to remember some dos and don'ts:

Do:
- Present a short, concise, and focused message
- Make the most important points immediately
- Give action steps in positives, not negatives
- Repeat the message
- Create action steps in threes
- Use personal pronouns for the organization

Don't Use:
- Technical jargon
- Filler information that is not pertinent to the main message
- Condescending or judgmental phrases (i.e. "Anyone with a bit of sense would realize ...")
- Attacks or judgmental language
- Promises/guarantees ("Read my lips, no new taxes" is a well-known example.)
- Speculation; stick to the facts
- Discussion of money or financial considerations; these are deemed to be less important in a tense situation than human and safety issues
- Humor, as it gives an impression of flippancy

Also, remember to break up information into more digestible pieces for the media. Many experts resent doing this, but if they don't simplify the news for journalists, they will do it themselves, and much confusion and misinformation may result. Table 3-2 lists some of the Do's and Don'ts of communicating with the media.

Acronym	Text
ATO	Agency Tender Official
CDRL	Contract Data Requirements List
C.F.R.	Code of Federal Regulations
CLIN	Contract Line Item Number
CO	Contracting Officer
CSO	Competitive Sourcing Official
FAIR	Federal Activities Inventory Reform
FAR	Federal Acquisition Regulation
FICA	Federal Insurance Contribution Act
FTE	Full-time Equivalent
FWS	Federal Wage System
GAO	General Accounting Office
GFP	Government-Furnished Property
GS	General Schedule
HRA	Human Resource Advisor
MEO	Most Efficient Organization
OMB	Office of Management and Budget
OPM	Office of Personnel Management
PWS	Performance Work Statement
SCA	Service Contract Act
SCF	Standard Competition Form
SLCF	Streamlined Competition Form
SSA	Source Selection Authority
SSEB	Source Selection Evaluation Board
U.S.C.	United States Code
VERA	Voluntary Early Retirement Authority
VSIP	Voluntary Separation Incentive Pay

Figure 3-7. Filling a speech with acronyms like the ones listed above often just confuses listeners.

4. Message Mapping – Design and Structure

4.1 Purpose and Structure of a Message Map

The principles of risk communication can be applied when creating a message map. The message map is an organized means for displaying layers of information. It contains detailed, hierarchically organized responses to anticipated questions or concerns. It helps organizations meet several risk communication goals[38]:

- Identify stakeholders early on in the communication process.
- Anticipate the questions and concerns of the stakeholders before they appear.
- Organize our thoughts and ideas and prepare messages in response to the concerns and questions of the stakeholders.
- Develop key messages and supporting information in the context of a clear, concise, transparent, and accessible framework.
- Promote an open dialogue about the messages both inside and outside the organization.
- Provide the spokesperson with a user-friendly guide.
- Make sure that the organization has consistent information and messages.
- Make sure that the organization speaks with a single voice.

A message map template is a three-tiered grid containing multiple boxes (see Figure 4-1 below).

- The top tier of the template identifies the audience for the message map as well as the question or concern that the message map is intended to address.
- The second tier of the message map contains three key messages that answer the question or concern.
- The third tier contains supporting information, which is blocked in groups of 3's under each key message. Supporting messages amplify the key messages, and provide additional facts or details. They can take the form of visuals, analogies, personal stories, hotline numbers, and/or citations of credible sources of information.

Stakeholder: Question or Concern:		
Key Message 1	**Key Message 2**	**Key Message 3**
Supporting Information 1-1	**Supporting Information 2-1**	**Supporting Information 3-1**
Supporting Information 1-2	**Supporting Information 2-2**	**Supporting Information 3-2**
Supporting Information 1-3	**Supporting Information 2-3**	**Supporting Information 3-3**

Figure 4-1. Template of a message map.

4.2   The Overarching Message Map

The Overarching Message Map (see Figure 4-2 below) is the most important message map. If a message map were a newspaper article, the Overarching Message Map would be the headline and the first paragraph. It contains and displays the organization's key messages. At an EPA sponsored workshop for Water Utilities and Water Security and Message Mapping in March 2005, an Overarching Message Map[38] was described as:
- What the speaker/organization most wants people to know about the issue or topic
- What the speaker/organization would put in the opening statement at a presentation or press conference relating to the issue and topic.

Suppose the situation is an ongoing influenza epidemic. The Overarching Message Map would look something like what is shown on Figure 4-3.

Figure 4-3. A message map can serve as a guideline for a health awareness poster like the one above.

Stakeholder: Public, health care workers		
Question or Concern: What does the public most need to know about the influenza epidemic?		
Key Message 1	**Key Message 2**	**Key Message 3**
Vaccination a top priority for:	*Symptoms*	*Highly contagious*
Supporting Information 1-1	**Supporting Information 2-1**	**Supporting Information 3-1**
Elderly	Fever	Avoid direct contact with others
Supporting Information 1-2	**Supporting Information 2-2**	**Supporting Information 3-2**
Health care workers	Congestion (cough, sore throat)	Avoid sharing food, drinks
Supporting Information 1-3	**Supporting Information 2-3**	**Supporting Information 3-3**
Immuno-compromised individuals	Muscle aches and pain	Keep bedding (sheets, linens) clean

Figure 4-2. Example of an overarching message map.

5. Creating a Message Map[38]

A message map can be one of the most useful of risk communication tools. It is important, however, to create well-constructed message maps in order to effectively communicate with the public by clearly explaining the situation, the risks, and the remedies. Before getting started, remember these important guidelines:

- Be prepared. Know the subject and the audience.
- Prepare your key messages. Remember, limit to three key messages and a maximum of three supporting statements for each key message.
- Keep answers short and focused.
- Speak and act with integrity. Tell the truth.

5.1   The Creation of a Message Map Can Be Separated into Eight Steps

Step 1: Identify stakeholders
The first step is to identify stakeholders. Stakeholders include the public at large as well as all interested, affected, or influential parties in a situation. Supposing the risk alert concerned influenza, stakeholders would include the public at large, health care workers, public health officials, as well as those most at risk for influenza (the elderly, for example).

Identifying stakeholders is also a crucial step of the message mapping process because risk communicators must adjust their messages to fit the needs and capabilities of an audience. A situation where the stakeholders are children/laypeople would yield a very different message map than a message map where the stakeholders are doctors or health workers.

Step 2: Identify anticipated stakeholder questions and concerns
Prepare a complete list of specific questions and concerns for each major group of stakeholders. A list of the Most Commonly Asked Questions by a Journalist is contained in Section 9.0. The questions that are generated or anticipated are the first tier of the message map grid. Questions and concerns typically fall into three categories, overarching questions, informational questions, and challenging questions. Overarching questions are broad in topic and are developed by the organization to analyze the general status of a situation. Informational questions ask about a specific aspect of the situation. Challenging questions are often hostile/tense in tone. Examples are:

1) *Overarching* questions: "What do people need to know?"
2) *Informational* questions: "What is the budget for your response?"
3) *Challenging* questions: "Why should we trust what you are telling us? How many people have to die before you take more aggressive action? Can you guarantee that people are safe? What are you not telling us?"

Lists of specific stakeholder questions and concerns can be generated through[34]:

- Focus groups
- Surveys
- Media content analysis
- Reviews of complaint logs, hot line logs, toll free number logs, and media logs
- Focused interviews with subject matter experts
- Public meeting records, public hearing records, and legislative transcripts

Step 3: Identify frequent concerns
Make an analysis of the list of specific concerns, and identify common groups of underlying general concerns. Case studies indicate that most high-concern issues are associated with no more than 15-25 categories of concern. As part of this step, it is useful to create a matrix or table matching the stakeholders (in order of priority) with their concerns. Here is a list of common sets of concerns:[39] human health, trust, safety, environment, information, ethics, economics, responsibility, legal, process, pets/livestock, religion, fairness.

Step 4: Develop key messages
When preparing the messages, it is important to consider the risk communication theories outlined in Section 3.3 (mental noise, negative dominance theory, etc.). During staff brainstorming sessions, key words should emerge for each message. Each issue should have no more than three key messages. These key messages fill in the second tier of the message map.

Step 5: Develop supporting information
The fifth step of constructing a message map is to develop supporting facts, information, or proofs for each key message. Suppose for a message map about influenza one key message was, "All high-risk groups must be vaccinated." The supporting messages in this instance would be directed to the high risk groups: the elderly, the immuno-compromised, or health care workers.

These supporting messages fill in the third tier of the message map for this key message.

Step 6: Conduct testing
The sixth step of message mapping is to conduct systematic pre-testing. The message testing should start by asking experts on the topic at hand, who were not involved in the original message-mapping process, to validate the accuracy of the information. Subsequently, the message map should be tested on focus groups that are representative of target stakeholders. (For instance, supposing the message map was about influenza, a focus group could be elderly citizens planning to get the flu vaccine.)

Step 7: Overarching Message Map[39]
An Overarching Message Map contains the organization's core messages. The Overarching Message Map addresses:

- What people most need to know about the issue or topic
- What to put in the opening statement at a presentation or press conference relating to the issue or topic

One method for assuring that the message of the Overarching Message Map is delivered to the audience is **bridging**. Bridging is a tool used by risk communicators to connect statements and responses in a smooth, straightforward manner. During an influenza epidemic, an example of a bridging statement might be: "I want to remind you again that the influenza vaccine is easily available at all local hospitals and clinics ...."

Step 8: Delivery
The key to successful delivery is anticipation, preparation, and practice. Once the message map has been pre-tested, it should be delivered through a trained spokesperson through suitable media (i.e. a news conference or a recorded reply in emergency telephone lines, etc.). The stakeholders must feel that their concerns are treated seriously. Audiovisual aids are often very helpful in a presentation.

The presentation sequence should follow these guidelines:[22]

1. Introduction
Perceived empathy is a vital factor in establishing trust and building credibility, and it is assessed by your audience in the first 9-30 seconds. Include a statement of concern, a statement of organizational intent, and a statement of purpose and plan for the meeting.

2. Key messages and supporting data
Stress the three key messages you want the public to have in mind after the meeting. Then mention the supporting data, which amplifies, clarifies, or bolsters the key messages.

3. After the presentation
After the speaker has given all the information contained in the message map, he must answer questions from the media and stakeholders. The speaker should prepare beforehand answers to some common, anticipated questions and concerns from the press and stakeholders.

6. Message Mapping in Action: Three Examples

The next three sections will provide examples of message maps relating to real-life crises. These message maps provide a guideline for commonly asked questions during a crisis. In each case, real-life events provide some context and familiarity. They include West Nile Virus of 2002, the anthrax bioterrorism event of 2001, and the 1993 Cryptosporidium drinking water contamination episode in Milwaukee.

6.1   The West Nile Virus: Crisis Summary and Message Maps

Time and location of crisis:
The West Nile Virus started to attract much attention in the United States during the summer of 2002. Thirty-nine states and the District of Columbia reported a total of 4,156 cases of human West Nile Virus illness.[40]

West Nile Virus - a background:
West Nile Virus is indigenous in Africa, Asia, Europe, and Australia. West Nile Virus was first isolated in 1937 from the blood of a febrile (feverish) female patient in the West Nile district of Uganda.[41] The virus can cause severe human meningitis and encephalitis, both of which are characterized by inflammation of the spinal cord and brain.

The main route of human infection from West Nile Virus is through the bite of an infected mosquito belonging to the *Culex* genus. Mosquitoes become infected when they feed on infected birds. The virus eventually gets into the salivary glands of the mosquito. During later blood meals (when mosquitoes bite), the virus may be injected into humans and animals, where it can multiply and possibly cause illness. Although mosquito bites are the most common method of infection, blood transfusions and organ donations are also possible methods of infection. The majority (80%) of West Nile viral infections are asymptomatic – without any signs of disease. The most common (20%) clinical symptom is uncomplicated West Nile fever, which is not life-threatening. The virus, however, can cause severe or fatal neuroinvasive illness.

First indication of event:
The West Nile Virus's first introduction to North America was in 1999, when an unusual cluster of cases of meningoencephalitis was documented in New York City. The initial symptom was severe muscle weakness. At the same time, an epizootic disease (i.e. affecting a large number of animals) was causing the deaths of substantial numbers of birds in the New York City area. The West Nile Virus was isolated from tissue specimens obtained from American crows in Westchester County and a Chilean flamingo in a nearby zoo. West Nile Virus was determined to be the common cause of the encephalitis outbreaks among both birds and humans.[42]

The ArboNET surveillance system was established by the Centers for Disease Control in 2000 to monitor the spread of West Nile Virus in the United States. In 2002, 4,156 human West Nile virus illnesses were reported to ArboNET from 39 states and the District of Columbia. Of the 4,156 reported cases, 71% were neuroinvasive, 28% were uncomplicated West Nile fever, 1% was unspecified. There were 284 fatalities (6.8%) out of the 4,156 reported cases.
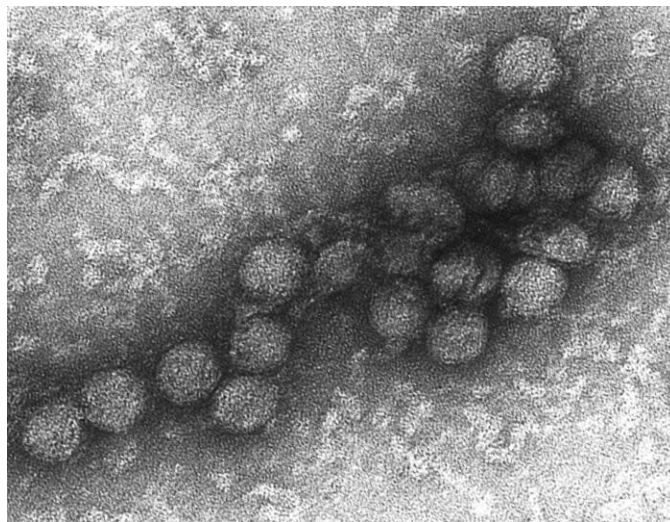

Figure 6-1. An electron micrograph of the West Nile Virus, which can infect mosquitoes, birds, humans, and other mammals.

Clinical features of West Nile Virus:

The symptoms of West Nile Virus closely resemble the symptoms of the St. Louis Virus, a flavivirus also transmitted by mosquitoes of the Culex genus, and other worldwide outbreaks of arboviral encephalitis.[43] Arboviruses are any of a large group of viruses transmitted by arthropods, such as mosquitoes and ticks, that include the causative agents of encephalitis, yellow fever, and dengue. A flavivirus is one form of arbovirus. The majority (80%) of West Nile viral infections are asymptomatic – without any signs of disease. For those infected who do get sick, the incubation period is approximately 2-14 days.[44] For those who do show clinical symptoms of infection, the most common (20%) clinical symptom is uncomplicated West Nile fever. Uncomplicated West Nile fever typically begins with an onset of fever, headache, and myalgia (muscle pain) often accompanied by gastrointestinal symptoms. The acute illness usually lasts less than one week, but prolonged fatigue is common. It is not life-threatening.

About one out of 150 people that are infected will develop neuroinvasive illnesses such as encephalitis (inflammation of the brain), meningoencephalitis (inflammation of the brain and surrounding membranes), and meningitis (inflammation of the membranes surrounding the brain). Encephalitis, meningitis, and meningoencephalitis, can be fatal, especially in older victims. Most West Nile case fatalities are due to encephalitis and meningoencephalitis.

What can the public do to avoid West Nile Virus?

Since the primary method of West Nile Virus infection is through mosquito bites, preventing bites is the best way to avoid WNV. There are simple steps the public can take to avoid being bitten by mosquitoes:

- Remove standing water, including old tires that serve as breeding grounds for mosquitoes.
- Wear long-sleeved shirts and pants and avoid going out during "bite hours" – dusk till dawn.
- Use bug repellant that contains DEET.

What is being done to prevent future outbreaks?

The methods of prevention of future West Nile Virus outbreaks fall into three categories: surveillance, source reduction, and chemical control.[45,46] Surveillance identifies mosquito species, location, ecologic locations, seasons, and breeding cycles. ArboNET is a nation-wide electronic database for states sharing information about WNV. Source reduction attempts to reduce mosquito opportunities by altering the habitat to make conditions unfavorable for larval breeding. In the case of West Nile Virus the *Culex pipiens* mosquitoes tend to breed in standing water. Chemical control involves the use of pesticides to reduce mosquito populations.
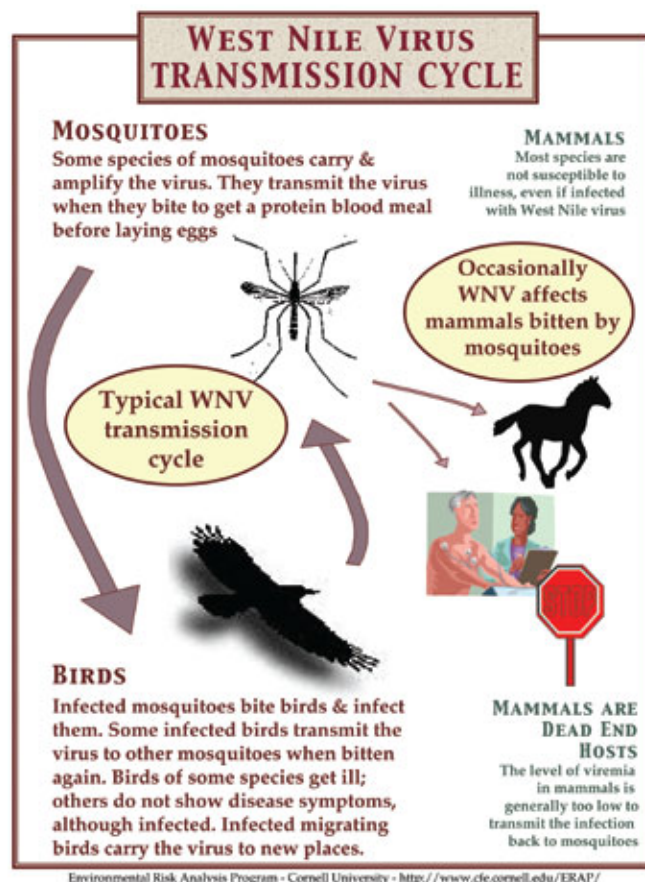

Figure 6-2. The West Nile transmission cycle, in which infected mosquitoes infect birds, humans, and other animals.

6.1.1 Message Maps about the West Nile Virus

Message Map 1: Overarching Message Map
This is an overarching message map, and it contains information the public most needs to know about the West Nile Virus: how one gets infected with the virus, the health effects of West Nile Virus, and the simple methods one can employ to avoid infection.

Stakeholder: Public/Media		
Question or Concern: What does the public most need to know?		
Key Message 1	**Key Message 2**	**Key Message 3**
West Nile Virus transmitted by infected mosquitoes	*Health effects of West Nile Virus are:*	*There are simple steps people can take to avoid infection*
Supporting Information 1-1	**Supporting Information 2-1**	**Supporting Information 3-1**
Mosquitoes become infected from biting infected birds	80% of all infections are asymptomatic	Spray with DEET
Supporting Information 1-2	**Supporting Information 2-2**	**Supporting Information 3-2**
Blood-blood transmission also possible	Uncomplicated West Nile Virus fever: 20%	Wear long-sleeved clothing
Supporting Information 1-3	**Supporting Information 2-3**	**Supporting Information 3-3**
Human-to-human contact not believed to be a mode of transmission	Encephalitis, Meningitis, Meningoencephalitis: 1 out of 150 cases, usually in elderly (<1%)	Remove any standing water

Message Map 2: What happened? What should the public know?
This message map answers the "who, what, when, where, why?" questions. In this case, the message map documents the epidemic in the United States during the summer of 2002, and how the West Nile Virus became a health risk via mosquitoes. The last key messages are about avoiding infection.

Stakeholder: Public/Media		
Question or Concern: What happened (Who, what, when, where, why?) What should the public know?		
Key Message 1	**Key Message 2**	**Key Message 3**
A West Nile Virus epidemic in the U.S. in the summer of 2002	*West Nile Virus transmitted by infected mosquitoes*	*There are simple steps people can take to avoid infection*
Supporting Information 1-1	**Supporting Information 2-1**	**Supporting Information 3-1**
4,156 cases of West Nile Virus in 39 states and the District of Columbia	Mosquitoes become infected from biting infected birds	Spray with DEET
Supporting Information 1-2	**Supporting Information 2-2**	**Supporting Information 3-2**
Of the cases, 71% neuroinvasive, 28% uncomplicated, 1% unspecified, 284 (< 7%) fatal	A flavivirus – a virus transmitted by mosquitoes	Wear long-sleeved clothing
Supporting Information 1-3	**Supporting Information 2-3**	**Supporting Information 3-3**
First U.S. cases discovered in New York City, 1999	Virus originally from Eastern hemisphere	Avoid exposure during "biting hours" – dusk to dawn

Message Map 3: How did you find out about the West Nile virus?
This message map explains the discovery of West Nile Virus in the United States, and how the first human cases were diagnosed.

Stakeholder: Public/Media Question or Concern: How did you find out about the West Nile Virus?		
Key Message 1	**Key Message 2**	**Key Message 3**
First cases of meningoencephalitis in NYC, 1999	*Deaths of birds occurring in NYC area*	*Virus determined to be West Nile Virus*
Supporting Information 1-1	**Supporting Information 2-1**	**Supporting Information 3-1**
719 patients with reports of meningitis and encephalitis	West Nile infection among birds more geographically widespread than among humans	Mosquito with WNV bite birds
Supporting Information 1-2	**Supporting Information 2-2**	**Supporting Information 3-2**
62 of these 719 patients were confirmed West Nile Virus cases	Flavivirus isolated from birds	Mosquitoes with WNV also bite humans
Supporting Information 1-3	**Supporting Information 2-3**	**Supporting Information 3-3**
Illness resembled St. Louis encephalitis, as well as other outbreaks of encephalitis in Europe and Israel	Virus determined to be the common cause of the bird/human illnesses	Although most cases of WNV are asymptomatic, some cases can be fatal; prevention from mosquito bites is crucial

Message Map 4: What are the health effects associated with West Nile Virus?
There are three major health effects of West Nile Virus. The majority (80%) experience no health effects. About 20% have uncomplicated West Nile fever. One in 150 cases will develop potentially fatal neuroinvasive illnesses such as meningitis, encephalitis, and meningoencephalitis.

Stakeholder: Public/Media Question or Concern: What are the health effects associated with West Nile Virus?		
Key Message 1	**Key Message 2**	**Key Message 3**
Older people are more at risk for serious illness	*Most infections are not life-threatening*	*About 1 in 150 infections develop meningitis, encephalitis, or meningoencephalitis*
Supporting Information 1-1	**Supporting Information 2-1**	**Supporting Information 3-1**
Incubation period is 2-14 days	80% of all infections are asymptomatic	Muscle weakness often the first symptom
Supporting Information 1-2	**Supporting Information 2-2**	**Supporting Information 3-2**
Eventual clinical symptom is a neuroinvasive illness	20% have mild illness, called West Nile Fever, often accompanied by gastrointestinal symptoms	Encephalitis and meningoencephalitis most fatal
Supporting Information 1-3	**Supporting Information 2-3**	**Supporting Information 3-3**
About 20% or one-fifth of people over 70 died. Deaths occurred in people averaging 77 years old	Acute illness typically lasts one week, but patients report prolonged fatigue	In 2002 epidemic, of the 2,942 neuroinvasive illnesses, 276 (9%) were fatal

Message Map 5: What can people do to prevent West Nile Virus?
The simple steps people can take to prevent West Nile Virus fall under three categories: remove standing water, wear protective clothing, and use insect repellent.

Stakeholder: Public/Media Question or Concern: What can people do to prevent West Nile Virus?		
Key Message 1	**Key Message 2**	**Key Message 3**
Remove standing water	*Wear protective clothing*	*Use insect repellent*
Supporting Information 1-1	**Supporting Information 2-1**	**Supporting Information 3-1**
Remove old tires which collect water and serve as breeding grounds for mosquitoes	Wear long sleeved shirts	Repellents containing DEET are recommended
Supporting Information 1-2	**Supporting Information 2-2**	**Supporting Information 3-2**
Empty or clean flower pots and bird baths daily	Wear long pants	Use 23% DEET
Supporting Information 1-3	**Supporting Information 2-3**	**Supporting Information 3-3**
Empty and clean cat/dog water bowls daily	Especially at dawn and dusk	Do not use repellents that do not contain DEET

Message Map 6: What is being done to prevent this in the future?
The large-scale prevention measures against West Nile Virus fall into three categories: surveillance (monitoring outbreaks), source reduction (reduce breeding grounds), and chemical control (pesticides).

Stakeholder: Public/Media Question or Concern: What is being done to prevent this in the future?		
Key Message 1	**Key Message 2**	**Key Message 3**
Surveillance – monitor possible outbreaks (ArboNET)	*Source reduction – reduce opportunity*	*Chemical control – use pesticides*
Supporting Information 1-1	**Supporting Information 2-1**	**Supporting Information 3-1**
Larval mosquito surveillance	Reduce breeding ground	Larvaciding – killing larvae
Supporting Information 1-2	**Supporting Information 2-2**	**Supporting Information 3-2**
Adult mosquito surveillance	Water management	Adulticiding – killing adult mosquitoes
Supporting Information 1-3	**Supporting Information 2-3**	**Supporting Information 3-3**
Virus surveillance	Personal prevention measures	These efforts are usually far from complete

Message Map 7: How did this happen?
This message map outlines the history of West Nile Virus, from the very first isolated patient (in 1937) to its introduction into the United States.

Stakeholder: Public/Media		
Question or Concern: How did this happen?		
Key Message 1	**Key Message 2**	**Key Message 3**
Virus indigenous in Europe, Africa, Asia, and Australia	*Detected in NYC in 1999*	*Mode of introduction into United States unknown*
Supporting Information 1-1	**Supporting Information 2-1**	**Supporting Information 3-1**
West Nile Virus first isolated in 1937	Also detected in birds in North America	Mosquito-borne transmission
Supporting Information 1-2	**Supporting Information 2-2**	**Supporting Information 3-2**
Epidemics in Israel and South Africa	Extended its range to much of the East Coast of the United States	Blood-blood transmission also possible
Supporting Information 1-3	**Supporting Information 2-3**	**Supporting Information 3-3**
	Horses also infected	Human-to-human contact not believed to be a mode of transmission

6.2 Bioterrorism (Anthrax): Crisis Summary and Message Maps

Time and location of event:
The anthrax scare occurred during the fall of 2001 in the United States. Anthrax was deliberately spread through the postal system by sending letters with powder containing anthrax. These letters were all sent from Trenton, NJ, and mailed to Florida, Washington D.C., and New York City. The letters seemed to target government or media figures -- one letter was sent to anchorman Tom Brokaw's office, another to Senator Tom Daschle's office. This caused 22 cases of anthrax infection.[47] To date the culprits behind the anthrax attacks have not been found.
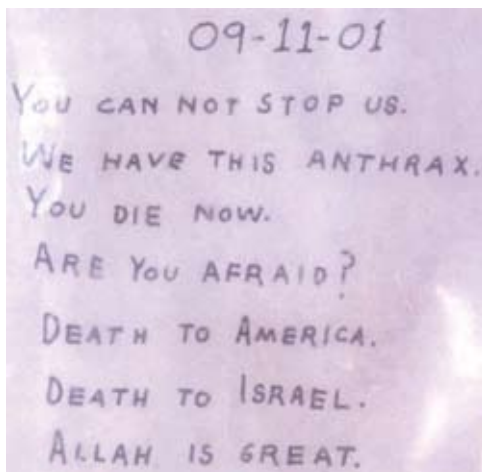

Figure 6-3. A photo of the letter sent to Senator Tom Daschle's office that contained anthrax spores.

Anthrax - a background:
Anthrax is an acute infectious disease caused by the spore-forming bacterium *Bacillus anthracis*. It has a long reputation as deadly bacteria – the fifth and sixth plagues of the Exodus might have been outbreaks of anthrax in cattle and humans, respectively.[46] Anthrax most commonly occurs in wild and domestic animals, but it can also occur in humans when they are exposed to infected animals or when anthrax spores are used as a bioterrorism weapon. In the mid-1800s, it became known as the wool sorters' disease in England and the rag pickers' disease in Germany and Austria because of the frequency of infection in mill workers exposed to imported, contaminated animal fibers. In the early 1900s, human cases of inhalational anthrax also occurred in the United States in conjunction with the textile and tanning industries.[49] Research on anthrax as a biological weapon began more than 80 years ago.[50]

First indicator of anthrax bioterrorism:
In September 2001, *Bacillus anthracis* spores were sent to several locations via the U.S. Postal Service. It wasn't until October 2, 2001, that a physician recognized a possible case of inhalation anthrax in a patient hospitalized in Palm Beach County, Florida. The diagnosis of *B. anthracis* was confirmed by the Florida Department of Health and the CDC on October 4. Evidence of *B. anthracis* was found at American Media Inc. in Boca Raton, Florida, where this first victim worked as a photo editor. This was the first known case of anthrax in the United States.[52] Eventually there were 22 confirmed or suspected cases of anthrax infection, all believed to be from contaminated letters delivered via the postal system. Eleven patients were inhalation cases, of these, five died; the other 11 were non-fatal cutaneous (under the skin) cases.[52]

Clinical features of anthrax:
Anthrax infection can occur in three forms: cutaneous, inhalation, or gastrointestinal. Most (95%) cases occur cutaneously

when the bacterium enters the skin. This can occur during handling of contaminated wool or leather, or touching of infected animals. The first symptom is an infected area of the skin: a raised itchy bump that resembles a bite, but within 1-2 days develops into a vesicle and then a painless ulcer. About 20% of untreated cases will result in death, so it is important to seek antimicrobial therapy quickly after infection.

Figure 6-4. A microscopic photograph of *Bacillum anthracis* that has had a long historical reputation as a deadly bacteria.

Inhalation anthrax is a biphasic illness – there are two distinct phases. In the first phase, the symptoms are not alarming; they may resemble a cold. After several days the symptoms may progress to severe breathing problems and shock. Unless treated, inhalational anthrax can be fatal. The incubation period is 1-6 days.

Gastrointestinal infection is the rarest form of anthrax infection. The intestinal disease form of anthrax may follow the consumption of contaminated meat and is characterized by an acute inflammation of the intestinal tract. Initial signs of nausea, loss of appetite, vomiting and fever are followed by abdominal pain, vomiting of blood, and severe diarrhea. Intestinal anthrax results in death in 25% to 60% of cases.

The most common treatment for anthrax is antibiotics, usually ciprofloxacin, doxycycline, and penicillin. The regimen is usually a grueling 60 days of antibiotic treatment. A vaccine is available, but it is usually given only to military personnel and "high risk" people such as those who work in laboratories that handle anthrax. Anthrax has little potential for person-to-person transmission.[53]

What can the public do to prevent anthrax exposure?
- Do not open any suspicious mail
- Keep mail away from the face
- Do not sniff/blow into mail
- Wash hands after opening mail
- Discard envelopes after opening mail
- Persons who think they might have been exposed should contact a health provider immediately

What has been done to prevent future attacks?
The CDC has developed plans and procedures to respond to an attack using anthrax. The plans fall into three categories: surveillance, education, and equipping.

Surveillance
The CDC has trained emergency response teams to help state and local governments control infection, gather samples, and perform laboratory tests in the national Laboratory Response Network (LRN). The LRN is a collaborative system linking state and local public health laboratories with advanced capacity laboratories—including clinical, military, veterinary, agricultural, water, and food-testing laboratories—to rapidly identify threat agents, including anthrax. The CDC is working closely with health departments, veterinarians, and laboratories to watch for suspected cases of anthrax. It has developed a national electronic database to track potential cases.

Education
The CDC has educated health-care providers, the media, and the general public about what to do in the event of an attack.

Equipping
To ensure that there are enough laboratories for quick testing of suspected anthrax cases, the CDC is working with hospitals, laboratories, emergency response teams, and health-care providers to make sure they have the supplies they need (antibiotics, assays) in case of an attack.

In 2004, President Bush signed into law the Project Bioshield Act, which establishes a permanent funding source through which the federal government can buy medical countermeasures (vaccines, diagnostic tests, human and animal drugs) from private companies. Project BioShield gives the FDA authority to make promising drugs, vaccines, or diagnostic tests quickly available in emergencies.[54]

The question might arise: if there is a vaccine for anthrax, why not distribute it widely, in the same way as yearly flu vaccines? The reason is efficiency. Since anthrax is still a rare infection, the percentage of people that need to be pre-vaccinated would be extremely high (63-95%) in order to prevent 90% of anthrax cases. Post-exposure vaccination, however, can shorten the duration of an antibiotic regimen. An article published in *Nature* written by Ron Brookmeyer, Elizabeth Johnson, and Robert Bollinger, concludes that treating patients with antibiotics and post-exposure vaccination is more practical and that the most efficient way of preventing anthrax is heightened awareness of clinical symptoms, surveillance, and mass antibiotic distribution.[55]

Figure 6-5. Cutaneous anthrax infection: when infection occurs after entering the skin, symptoms are a raised itchy bump that develops into a vesicle and then a painless ulcer.

6.2.1 Message Maps about the Anthrax Bioterrorism Event

Message Map 1: Overarching Message Map
This is an overarching message map, and it contains information the public most needs to know about the anthrax: how it was used as a bioterrorist tool, the symptoms of anthrax infection, and the three methods of infection (inhalation, cutaneous, gastrointestinal).

Stakeholder: Public/Media Question or Concern: Overarching Message Map – What does the public most need to know?		
Key Message 1	**Key Message 2**	**Key Message 3**
Anthrax bioterrorism event in fall 2001	*Symptoms of anthrax infection*	*Three methods of transmission*
Supporting Information 1-1	**Supporting Information 2-1**	**Supporting Information 3-1**
Anthrax spores transmitted through postal service letters	Inhalation: initial cold-like symptoms, progressing to severe breathing problems, death	Inhalation (lungs)
Supporting Information 1-2	**Supporting Information 2-2**	**Supporting Information 3-2**
22 cases, 5 deaths (all from inhalation)	Cutaneous: raised itchy bump that resembles a bite or skin infection	Cutaneous (skin)
Supporting Information 1-3	**Supporting Information 2-3**	**Supporting Information 3-3**
Treatable with antibiotics if diagnosed early enough	Gastrointestinal: nausea, loss of appetite, fever, severe diarrhea	Gastrointestinal (digestive)

Message Map 2: What happened? What should the public know?
In this case, the message map describes the anthrax event of 2001: how many people were infected, how the anthrax spores were transmitted, and three methods of clinical infection.

Stakeholder: Public/Media Question or Concern: What happened (Who, what, when, where, why?) What should the public know?		
Key Message 1	**Key Message 2**	**Key Message 3**
Anthrax bioterrorism event in fall 2001	*Anthrax spores transmitted through postal service letters*	*Letters sent to media and political figures*
Supporting Information 1-1	**Supporting Information 2-1**	**Supporting Information 3-1**
22 people were infected	Letters sent to Florida, NYC, and D.C.	American Media Inc.
Supporting Information 1-2	**Supporting Information 2-2**	**Supporting Information 3-2**
11 inhalation cases, 11 cutaneous cases	All of the identified letters mailed from Trenton, NJ	Tom Brokaw
Supporting Information 1-3	**Supporting Information 2-3**	**Supporting Information 3-3**
5 deaths, all from inhalation of anthrax	Sender of letters is still unknown	Senator Tom Daschle

Message Map 3: How did you find out about the anthrax bioterrorism?
This message map's key words are three key dates in the anthrax event of 2001: the first diagnosis, the date when anthrax spores were discovered at American Media Inc., and October 9, when the first cutaneous case of anthrax was recognized.

Stakeholder: Public/Media		
Question or Concern: How did you find out about anthrax?		
Key Message 1	**Key Message 2**	**Key Message 3**
October 2, 2001 – first diagnosis	*October 4, 2004 - Evidence of B. anthracis at American Media Inc.*	*October 9, 2004 - First cutaneous case of anthrax recognized*
Supporting Information 1-1	**Supporting Information 2-1**	**Supporting Information 3-1**
Patient awoke October 2 with nausea, vomiting, and confusion	Second AMI employee diagnosed on October 5	Patient worked in mail-room for anchorman Tom Brokaw
Supporting Information 1-2	**Supporting Information 2-2**	**Supporting Information 3-2**
Patient worked at American Media Inc.	Second employee worked in the mailroom	Marked by skin lesions
Supporting Information 1-3	**Supporting Information 2-3**	**Supporting Information 3-3**
Patient died October 4		NJ postal workers diagnosed with cutaneous and inhalation anthrax on October 13

Message Map 4: What are the health effects associated with anthrax?
Anthrax has three modes of transmission, with different symptoms. This message map's key words are the three modes of transmission: cutaneous, inhalation, and gastrointestinal. The supporting information describes the symptoms and prognosis of the cutaneous anthrax, inhalation anthrax, and gastrointestinal anthrax.

Stakeholder: Public/Media		
Question or Concern: What are the health effects associated with anthrax?		
Key Message 1	**Key Message 2**	**Key Message 3**
Cutaneous	*Inhalation*	*Gastrointestinal*
Supporting Information 1-1	**Supporting Information 2-1**	**Supporting Information 3-1**
Small sore that develops into a blister, then a skin ulcer	1-6 day incubation period; biphasic illness – having two distinct phases	Consumption of contaminated meat
Supporting Information 1-2	**Supporting Information 2-2**	**Supporting Information 3-2**
Treated with antibiotics	First phase: flu-like symptoms, then rapid deterioration	Nausea, loss of appetite, bloody diarrhea, fever, stomach pain
Supporting Information 1-3	**Supporting Information 2-3**	**Supporting Information 3-3**
Usually not fatal	Second phase: rapid deterioration, and death. Can be fatal	Death in 25%-60% of cases

Message Map 5: What can people do to prevent an anthrax infection?
Since anthrax was sent by mail, this message map is a guideline of how to handle mail, both for the public at large and postal workers. The third key message is steps to take if you think you have been exposed.

Stakeholder: Public/Media Question or Concern: What can people do to prevent anthrax infection?		
Key Message 1	**Key Message 2**	**Key Message 3**
Mail	*Postal workers[56]*	*If you have been exposed ...*
Supporting Information 1-1	**Supporting Information 2-1**	**Supporting Information 3-1**
Do not open suspicious mail	Wear protective, impermeable gloves	Call the doctor right away
Supporting Information 1-2	**Supporting Information 2-2**	**Supporting Information 3-2**
Keep mail away from face when opening it; do not sniff	Avoid touching eyes, skin, or other mucous membranes	Antibiotic treatment
Supporting Information 1-3	**Supporting Information 2-3**	**Supporting Information 3-3**
Wash hands afterwards	Wear long-sleeved clothing and pants to prevent skin exposure	Post-exposure vaccination

Message Map 6: What is being done to prevent anthrax outbreaks in the future?
The methods of preventing anthrax attacks in the future fall into three categories which serve as the three key messages for this message map: surveillance, education, and equipping.

Stakeholder: Public/Media Question or Concern: What is being done to prevent anthrax outbreaks in the future?		
Key Message 1	**Key Message 2**	**Key Message 3**
Surveillance	*Education*	*Equipping (Bioshield Act)*
Supporting Information 1-1	**Supporting Information 2-1**	**Supporting Information 3-1**
State and local governments	General public awareness	Safe laboratories for testing
Supporting Information 1-2	**Supporting Information 2-2**	**Supporting Information 3-2**
Health departments, hospitals	Postal workers	Antibiotics
Supporting Information 1-3	**Supporting Information 2-3**	**Supporting Information 3-3**
National electronic tracking database	Physicians so they can better recognize the clinical symptoms	Post-exposure vaccine

6.3 Water Contamination (Cryptosporidium): Crisis Summary and Message Maps

Time and location of event:
April 1993, in Milwaukee, Wisconsin. Outbreak sickened 403,000 people and 111 people died. Elderly and immuno-compromised individuals were most at risk.

Cryptosporidiosis - a background:
Cryptosporidiosis is a disease caused by the protozoan *Cryptosporidium parvum*. Its mode of transmission is fecal-oral (infection-laden stool from one person gets into the mouth of another). This can happen from improper sanitation, as well as drinking contaminated water. An oocyst is a dormant form of the protozoa. An oocyst is 2 to 6 microns in diameter. Once an animal or person is infected, the parasite lives in the intestine and passes into the stool. Millions of Cryptosporidium oocysts can be released in a bowel movement from an infected animal or human. Feces from an infected animal or human can contaminate water sources, which is the suspected cause in the Milwaukee outbreak. Cryptosporidium is often found in rivers, lakes, and streams contaminated with animal feces or which receive wastewater from a sewage plant. Prevalence of cryptosporidiosis among calves and other livestock is particularly high.

Overall there are three pathways of fecal/oral transmission/infection:
1) Transmission via water and food
2) Animal-to-person transmission
3) Person-to-person transmission

Cryptosporidium has many features that make it a very challenging contaminant to control. The parasite is protected by an outer shell that makes it resistant to chlorine-based disinfectants. The shell also allows the oocysts to live outside the body for a long time.[57] The ingestion of as few as 10 oocysts is enough to produce an infection.[58] Even more troublesome is the fact that to date there is no safe and effective treatment for cryptosporidiosis.[59]
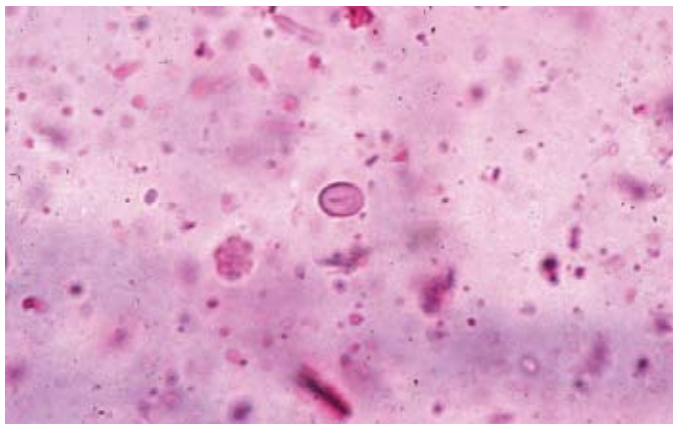

Figure 6-6. The protozoan *Cryptosporidium parvum*.

Cryptosporidium parvum oocysts have been recognized as a human pathogen since 1976.[60] In 1982, the number of reported cases began to increase dramatically as part of the AIDS epidemic, as immuno-compromised individuals are less able to ward off cryptosporidiosis. The Milwaukee outbreak is the largest in the United States, but there have also been outbreaks associated with swimming or amusement parks. In 1997 there was an outbreak of cryptosporidiosis associated with a water sprinkler fountain in Minnesota.[61]

First indicators of epidemic:
Milwaukee has two main water treatment plants: one located in the northern part of the city, the other in the southern part of the city. The water supply is from Lake Michigan. The southern plant predominantly serves the southern part of the city. These plants collectively are known as the Milwaukee Water Works (MWW).

Starting on March 21, 1993, plant records revealed an increase of turbidity on the southern plant. Turbidity refers to how clear the water is. The greater the amount of total suspended solids (TSS) in the water, the murkier it appears and the higher the measured turbidity. From January 1983 through January 1993, the turbidity of treated water did not exceed 0.4 nephelometric
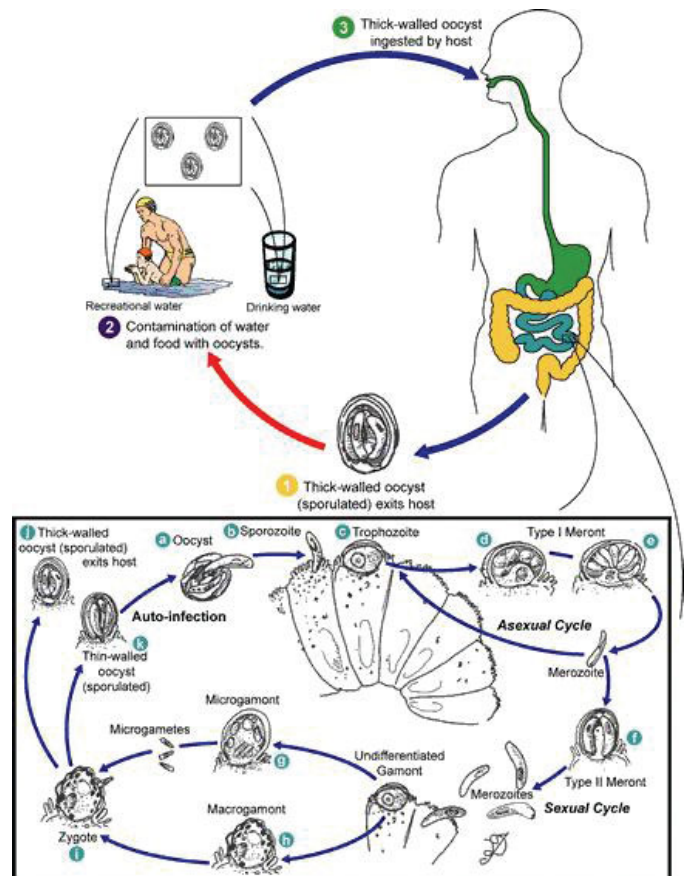

Figure 6-7. The life cycle of Cryptosporidium and how the oocysts enter the human body.

turbidity unit (NTU). An NTU is used to measure turbidity of water, as turbidity is often an indicator of contamination (in this case, from Cryptosporidium oocysts). From March 23 to April 1, 1993, the maximal daily turbidity of treated water was consistently 0.45 NTU or higher, with a peak of 1.7 NTU on March 28 and 30.[62]

Meanwhile, on Thursday, April 1, 1993, a pharmacist in Milwaukee noted a dramatic increase in sales of over-the-counter anti-diarrheal and anti-cramping medications. Normally, his drugstore sold $30 a day of these medications. Starting April 1, the pharmacy drug sales increased to approximately $500 to $600 a day. The pharmacist contacted the health department to inquire about unusually frequent reports of gastrointestinal problems.[63]

On April 5, the Wisconsin Division of Health was contacted by the Milwaukee Department of Health after widespread cases of gastrointestinal illness, absenteeism among teachers, students, and hospital workers. On April 7, the laboratories identified Cryptosporidium oocysts in stool samples from seven adults in the Milwaukee area. By April 7, there was an advisory to Milwaukee residents to boil their water, and the southern plant was closed on April 9. Overall an estimated 403,000 people were infected, 4,400 people were hospitalized, and 111 people died.[62]

Clinical features of cryptosporidiosis:
Cryptosporidiosis is transmitted by ingestion of oocysts excreted in the feces of humans or animals. Cryptosporidiosis has three methods of transmission: 1) via water and food; 2) animal to person; and 3) person-to-person.[64] The incubation period is approximately 2 to 10 days. Children under two years old, immuno-compromised individuals[65,66] and the elderly[67] have a greatly increased chance of serious sickness from Cryptosporidium.

The most common symptom of cryptosporidiosis is watery diarrhea. Other symptoms include: dehydration, weight loss, stomach cramps or pain, fever, nausea and vomiting. Some people with cryptosporidiosis will be asymptomatic (without noticeable clinical symptoms). In healthy individuals the symptoms will typically last for about 1 to 2 weeks. However, in persons whose immune system is weakened, cryptosporidiosis can be serious, long-lasting, and even fatal.[68] Cryptosporidiosis is often misdiagnosed as "stomach flu."

What can you do to prevent cryptosporidiosis[68]?
- Wash hands frequently
- Practice safer sex
- Avoid touching farm animals
- Avoid touching the stool of pets
- Avoid swallowing water while swimming in the ocean, lakes, rivers, or pools, and when using hot tubs
- Wash or cook food thoroughly
- Drink safe water. Boiling and filtering water tends to get rid of the Cryptosporidium oocysts, but not all filters are effective – look for the words "reverse osmosis," or absolute pore size of one micron or less, or one that has been NSF rated for "cyst approval"

Daily age-adjusted rate (± standard deviation) of GIH per 100,000 elderly during the Milwaukee cryptosporidiosis outbreak

| North plant | Central area | South plant |
| 1.03 ± 2.7 | 1.34 ± 1.6 | 2.53 ± 2.6 |

Figure 6-8. The Southern plant of Milwaukee Water Works predominantly serves the southern part of the city. In 1993 water from the southern plant became contaminated with Cryptosporidium oocysts, causing many hospitalizations, especially in the elderly and immuno-compromised. As the picture above shows, there were less gastrointestinal hospitalizations in the northern and central areas of the city.

What can be done to prevent future outbreaks?
The main method of preventing future outbreaks is improved water-treatment technologies. Cryptosporidium oocysts have a tough wall that makes them resistant to traditional methods of disinfection, such as chlorination. The most effective methods of removal are filtration and ozone treatment.[69] However, many cities (Boston, Seattle, Portland, and San Francisco) do not filter municipal drinking water. In New York City, the Croton reservoir is filtered, but the Delaware and Catskill reservoirs are not.[70] Since the Milwaukee incident, the practice of recycling filter backwash water was eliminated. The Milwaukee plants have also installed continuous turbidity monitors on each bed, with an alarm sounding and the system shut down if the turbidity of filtered water exceeds 0.3 NTU.[62]

Watershed protection is another method of preventing contamination. Septic system regulations and control of runoff into surface water reservoirs such as lakes or streams can help keep human and animal waste out of water supplies.

6.3.1 Message Maps for Cryptosporidium Infection

Message Map 1: Overarching Message Map: What does the public most need to know?

This message map touches upon three key messages: that there is an outbreak of cryptosporidiosis in Milwaukee, people most at risk of becoming seriously ill from cryptosporidiosis, and the symptoms of the disease.

Stakeholder: Public/Media Question or Concern: Overarching Message Map – What does the public most need to know?		
Key Message 1	**Key Message 2**	**Key Message 3**
Outbreak of cryptosporidiosis in Milwaukee	*High risk groups are:*	*Symptoms and precautions*
Supporting Information 1-1	**Supporting Information 2-1**	**Supporting Information 3-1**
From contaminated water supply	Immuno-compromised (HIV+, diabetes)	Watery diarrhea most common symptom. Can also have nausea, fever, vomiting
Supporting Information 1-2	**Supporting Information 2-2**	**Supporting Information 3-2**
Two water treatment plants: southern and northern	Elderly	Incubation period: 2-10 days
Supporting Information 1-3	**Supporting Information 2-3**	**Supporting Information 3-3**
Southern plant reported increased turbidity on March 21	Young children	Symptoms last 1-2 weeks

Message Map 2: What happened? What should the public know?

This message map answers the "What happened?" questions. In this case, the Milwaukee Water Works' Southern plant was contaminated with Cryptosporidium oocysts, and an estimated 403,000 Milwaukee residents were infected.

Stakeholder: Public/Media Question or Concern: What happened? (Who, what, when, where, and why?). What should the public know?		
Key Message 1	**Key Message 2**	**Key Message 3**
Outbreak of cryptosporidiosis in Milwaukee	*From contaminated water supply*	*403,000 people infected*
Supporting Information 1-1	**Supporting Information 2-1**	**Supporting Information 3-1**
Cryptosporidium is a protozoan (oocyst)	Southern plant reported increased turbidity on March 21	April 7 – stool samples from seven adults confirmed cryptosporidiosis
Supporting Information 1-2	**Supporting Information 2-2**	**Supporting Information 3-2**
Released from feces into water supply	Two treatment plants: southern and northern	Watery diarrhea main symptom
Supporting Information 1-3	**Supporting Information 2-3**	**Supporting Information 3-3**
Oocyst resistant to chlorine treatment, can live outside the body for long periods of time	Notice on April 7 to boil water	111 deaths

Message Map 3: How did you find out about the Cryptosporidium outbreak?
Three main events led to the discovery of the Cryptosporidium contamination: water plants reported increased turbidity, there was a spike in pharmaceutical sales of over-the-counter anti-diarrheal medicine, and there was widespread absenteeism in schools and offices, which led to the Milwaukee Department of Health being contacted. On April 7 stool samples confirmed cryptosporidiosis.

Stakeholder: Public/Media		
Question or Concern: How did you find out about the Cryptosporidium outbreak?		
Key Message 1	**Key Message 2**	**Key Message 3**
Pharmaceutical sales	*Water-treatment plant (MWW)*	*Absenteeism*
Supporting Information 1-1	**Supporting Information 2-1**	**Supporting Information 3-1**
Milwaukee pharmacist noticed a rise in OTC anti-diarrheal medicine	Increased turbidity noted March 21, 1993 at southern plant	Among teachers, students, and hospital workers
Supporting Information 1-2	**Supporting Information 2-2**	**Supporting Information 3-2**
Normal sales: $30/day	Normal turbidity: 0.45 NTU	Absentees all had gastrointestinal illness
Supporting Information 1-3	**Supporting Information 2-3**	**Supporting Information 3-3**
After April 1 sales: $500-$600 a day	Outbreak period turbidity peaked at 1.7 NTU (March 28 and 30, 1993)	

Message Map 4: What are the health effects of cryptosporidiosis?
This message map is straightforward: its key messages are the main symptom of cryptosporidiosis, the modes of transmission, and the groups of people who are most at risk of serious illness from Cryptosporidium.

Stakeholder: Public/Media		
Question or Concern: What are the health effects associated with exposure to Cryptosporidium?		
Key Message 1	**Key Message 2**	**Key Message 3**
Watery diarrhea	*Three modes of fecal-oral transmission*	*High risk groups*
Supporting Information 1-1	**Supporting Information 2-1**	**Supporting Information 3-1**
Incubation period: 2-10 days	Eating/drinking contaminated food or water	Immuno-compromised, elderly, children under the age of 2
Supporting Information 1-2	**Supporting Information 2-2**	**Supporting Information 3-2**
Symptoms last 1-2 weeks	Animal-to-person (feces from animal somehow gets into food/water)	Illness can be very serious and prolonged, with no known treatment
Supporting Information 1-3	**Supporting Information 2-3**	**Supporting Information 3-3**
Can have dehydration, nausea, fever, stomach pain, vomiting. Some people show no symptoms	Person-to-person	Death may result

Message Map 5: What can people do to prevent Cryptosporidium infection?
The ways to prevent infection fall under three categories: safe-drinking water habits, good hygiene/sanitation, and avoiding touching farm animals.

Stakeholder: Public/Media Question or Concern: What can people do to prevent Cryptosporidium infection?		
Key Message 1	**Key Message 2**	**Key Message 3**
Safe-drinking water habits	*Good hygiene/sanitation*	*Animals*
Supporting Information 1-1	**Supporting Information 2-1**	**Supporting Information 3-1**
Pay attention to public announcements about contamination	Wash hands, especially after bowel movement or changing diapers	Avoid touching farm animals
Supporting Information 1-2	**Supporting Information 2-2**	**Supporting Information 3-2**
Filter water (NSF rated for "cyst approval" or pore size of one micron or less)	Practice safer sex	Avoid touching the stool of pets
Supporting Information 1-3	**Supporting Information 2-3**	**Supporting Information 3-3**
Boil water for persons that are immunocompromised	Wash/cook food	Wash hands after picking up stool of pets

Message Map 6: What can be done to prevent this in the future?
The three ways to prevent future outbreaks of Cryptosporidium are: more vigorous water treatment (filtering, ozone treatment), watershed protection (as fecal matter can easily wash into surface water reservoirs), and public awareness and surveillance.

Stakeholder: Public/Media Question or Concern: What can be done to prevent this in the future?		
Key Message 1	**Key Message 2**	**Key Message 3**
Water treatment	*Watershed protection*	*Public awareness and surveillance*
Supporting Information 1-1	**Supporting Information 2-1**	**Supporting Information 3-1**
Filter municipal water supplies	Septic system regulations (septic tanks not allowed to run into lakes)	Monitor turbidity levels
Supporting Information 1-2	**Supporting Information 2-2**	**Supporting Information 3-2**
Ozone treatment is effective	Runoff control	Boil water for high risk groups
Supporting Information 1-3	**Supporting Information 2-3**	**Supporting Information 3-3**
Milwaukee plant automatically shuts down if turbidity exceeds 0.3 NTU	Difficult to do, especially around rural areas with a lot of cattle and other livestock	Filter water for high risk groups

Message Map 7: How did this happen?

Unmet water quality standards, inadequate diagnosis, and the existence of populations vulnerable to infection all contributed to the 1993 outbreak. Cryptosporidium oocysts passed through the city's filtration system, cryptosporidiosis was often misdiagnosed by doctors, and immuno-compromised individuals became seriously ill.

Stakeholder: Public/Media		
Question or Concern: How did this happen?		
Key Message 1	**Key Message 2**	**Key Message 3**
Inadequate water treatment	*Inadequate diagnosis*	*Three main vulnerable populations*
Supporting Information 1-1	**Supporting Information 2-1**	**Supporting Information 3-1**
Cryptosporidium oocysts passed through city's filtration system	Diagnosed often as viral gastroenteritis or "intestinal flu"	Elderly (often in nursing homes)
Supporting Information 1-2	**Supporting Information 2-2**	**Supporting Information 3-2**
Marked turbidity in southern water treatment plant	Many patients do not seek treatment for diarrhea	Immuno-compromised (HIV+, etc.)
Supporting Information 1-3	**Supporting Information 2-3**	**Supporting Information 3-3**
Northern plant not affected	No known treatment	Very young children

7. Conclusions

Risk communication is a relatively new concept of communicating environmental and health hazards to the public. Much of it was developed by Vincent Covello. The National Research Council of the United States gave the following definition of risk communication: *"Risk communication is an interactive process of exchange of information and opinions among individuals, groups, and institutions. It often involves multiple messages about the nature of the risk or expressing concerns, opinions, or reactions to risk messages or to the legal and institutional arrangements for risk management*.[5]

Different situations require different methods. Some situations will have very high public outrage but little actual hazard, which is a measure of the actual risk. Other situations will have the reverse situation. An important factor to consider in all risk communication situations is *risk perception*. As a general rule, the public tends to underestimate risks that are: not dreaded, voluntary, natural, scientifically well-known and well-understood, controllable by the individual, in the hands of a reliable source, reversible with immediate health effects, with adults as health victims, unmemorable and without significant media attention, and that pose no risk to the future population. The general public tends to overestimate risks that are: dreaded, involuntary, industrial, scientifically unknown, controlled by others, managed by an unreliable, irresponsible source, with irreversible, delayed health effects, children as victims, catastrophic, that receive media attention, and have a risk to future generations.

In addition to applying risk perception information, risk communication has "Seven Cardinal Rules," according to Covello:

Rule 1: Accept and involve the public as a legitimate partner
Rule 2: Listen to the audience
Rule 3: Be honest, frank, and open
Rule 4: Coordinate and collaborate with other credible sources
Rule 5: Meet the needs of the media
Rule 6: Speak clearly and with compassion
Rule 7: Plan carefully and evaluate performance

Message mapping is simply one of the useful tools used by risk communicators to warn of hazards to the public. It consolidates many of the rules of risk communication (speaking briefly, limiting oneself to three key messages) and can be applied to many situations, as shown in the examples in this paper. It helps organizations meet several risk communication goals:

- Identify stakeholders early on in the communication process.
- Anticipate the questions and concerns of the stakeholders before they appear.
- Organize our thoughts and ideas and prepare messages in response to the concerns and questions of the stakeholders.
- Develop key messages and supporting information in a context of clear, concise, transparent, and accessible framework.
- Promote an open dialogue about the messages both inside and outside the organization.
- Provide the spokesperson with a user-friendly guide.
- Make sure that the organization has consistent information and messages.
- Make sure that the organization speaks with a single voice.

A message map is designed as a three tier grid, with emphasis on the three key messages.

- The top tier of the template identifies the audience for the message map as well as the question or concern that the message map is intended to address.
- The second tier of the message map contains three key messages that answer the question or concern.
- The third tier contains supporting information, which is blocked in groups of 3's under each key message. They can take the form of visuals, analogies, personal stories, hotline numbers, and/or citations of credible sources of information.

This template can be used during news conferences, presentations, or any area where the risk of a hazard needs to be communicated.

8. Glossary

Arbovirus – Any of a large group of viruses transmitted by arthropods, such as mosquitoes and ticks, that include the causative agents of encephalitis, yellow fever, and dengue.

Biphasic – Having two distinct stages (as in an illness).

Bridging – A method used in risk communication to reiterate and clarify key points. For example, *"I want to remind the public* that the probability of death is very small if discovered early..."*

Cutaneous – Of, relating to, or affecting the skin. A cutaneous transmission (such as for anthrax) means transmission through skin.

Epizootic – Affecting a large number of animals at the same time within a particular region or geographic area. Used of a disease.

Fecal-oral – A method of transmission of disease in which the infection-laden feces from one person finds its way into the mouth of another person.

Flavivirus – A family of viruses transmitted by mosquitoes and ticks that cause some important diseases, including dengue, yellow fever, tick-borne encephalitis virus, and West Nile fever.

Hazard – Experts' assessment of risk.

Immuno-compromised – Having an immune system that has been impaired by disease or treatment. Most often used in connection with infections such as AIDS or HIV+ status.

Incubation Period – The amount of time between infection to the onset of clinical symptoms.

Key Message – Information that the target audience most needs or wants to know.

Message Map – A detailed, hierarchically organized response to anticipated questions or concerns during a crisis/event.

Myalgia – Muscle pain or tenderness.

Oocyst – A thick-walled structure in which sporozoan zygotes develop and that serves to transfer them to new hosts. An example of an oocyst would be the Cryptosporidium oocysts.

Outbreak – A sudden increase in the prevalence of a disease. In 1993 Milwaukee had an *outbreak* of cryptosporidiosis.

Outrage – Public perception of how substantial or alarming a risk is.

Overarching Message Map – The message map that contains the organization's core message. The focus is on what people most need to know about the situation or topics, and provides an opening statement at a press conference, presentation, or news alert.

Protozoa – Any of a large group of single-celled, usually microscopic, eukaryotic organisms, such as amoebas, ciliates, flagellates, and sporozoans.

Radon – A toxic, colorless gas that comes from the decay of radium and uranium found in the soil/earth/rock. This toxic, colorless gas can seep into residences. Different geographic areas will have different levels of radon. Radon is a carcinogen and can cause lung cancer.[71]

Risk – Judgment concerning the likelihood, severity, or importance of a threatening event or condition; the probability of loss of which people value.

Risk Perception – The subjective perception of risk/danger. Not necessarily correlated with actual risk.

Risk Communication – An interactive process in which information and opinions are exchanged among individuals, groups, and institutions in response to an event or a risk.

Sound Bite – A short phrase or sentence that deftly captures the essence of the speaker's main message.

Stakeholder – All interested, affected, or influential parties in an event, usually including the public at large.

Turbidity – The cloudiness of the water. The greater the amount of total suspended solids (TSS) in the water, the murkier it appears and the higher the measured turbidity.

9. Most Frequently Asked Questions by Journalists During a Crisis[22]

1. What is your name, title, job responsibilities and qualifications?
2. Can you tell us what happened, and when and where it happened?
3. How many people were harmed?
4. Are those that were harmed getting help?
5. How certain are you about this information?
6. Is the situation under control?
7. Is there any immediate danger?
8. What is being done in response to what happened?
9. What are you advising people to do?
10. How long will it be before the situation returns to normal?
11. Can the situation worsen? What is the worst case scenario?
12. What help has been requested or offered from others?
13. What responses have you received?
14. How much damage occurred and what additional damage do you expect?
15. Who else is involved in the response?
16. Why did this happen?
17. What was the cause?
18. Did you have any forewarning that this might happen?
19. Can the situation worsen?
20. If you are not sure of the cause, what is your best guess?
21. Who is to blame?
22. Could this have been avoided?
23. Do you think those involved handled the situation well enough?
24. Who is conducting the investigation?
25. What have you found out so far?
26. Why was more not done to prevent this from happening?
27. What is your personal opinion?
28. Are people overreacting?
29. Has anyone broken the law?
30. What are you not telling us?
31. What effects will this have on the people involved?
32. What precautionary measures were taken?
33. Do you accept responsibility for what happened?
34. Has this ever happened before?
35. Can this happen elsewhere?
36. What lessons were learned and were they implemented?
37. What can be done to prevent this from happening again?
38. What would you like to say to those that have been harmed and their families?
39. Are people out of danger? Are people safe?
40. Will there be inconvenience to employees or to the public?
41. How much will all this cost?
42. Are you able and willing to pay the costs?
43. Who else will pay the costs?
44. What does this all mean?

Figure 9-1. In crisis situations, journalists and reporters always want answers, NOW!

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