Environmental risk communication as a collaborative process: guidelines for the technical writer

Tania Lee Harrison

Iowa State University

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Environmental risk communication as a collaborative process:

Guidelines for the technical writer

by

Tania Lee Harrison

A Thesis Submitted to the
Graduate Faculty in Partial Fulfillment of the
Requirements for the Degree of

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Signatures have been redacted for privacy

Iowa State University
Ames, Iowa

1993
To my husband, Rick Howard, for his patience and support.
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I. BACKGROUND: A THEORETICAL FRAMEWORK

Introduction

Since the early 1970s questions about the environment and how it impacts upon human lives have increasingly dominated people's minds. Incidents such as Three Mile Island, Love Canal, the Exxon Valdez, and the Superfund sites illustrate how chemicals pose hazards to the environment. Unfortunately, communities may not be aware of the chemical hazards that exist in the environment — the air, water, and soil — in which they live. These hazards, as the cases above demonstrate, pose both environmental and health risks — risks which may not be adequately communicated — to the people living in these communities. For example, research into the Three Mile Island incident "revealed serious deficiencies in the transfer of information from officials of the utility and the Nuclear Regulatory Commission to nearby publics" (Kasperson 275). Incidents such as Three Mile Island show that the communication of environmental and health risks is a highly politicized, extremely complex process which is of crucial importance to the people involved. For the purposes of this study, environmental risk communication is defined as:

any purposeful exchange of information about environmental risks [including those that are health-related] between risk assessors or risk managers and laypeople, such as residents, media representatives, members of the public, and interest groups. More specifically, risk communication is the act of conveying or transmitting information about levels of health or environmental risk; the assessments, models, and procedures on which risk estimates were made; or decisions, actions, or policies aimed at managing or controlling health or environmental risks." (Covello, Slovic and Winterfeldt, qtd. in Warner 38)
Examples of inadequate risk communication abound. At its most basic, risk communication is ineffective when the levels of antagonism between parties increases. Love Canal, Three Mile Island, and the Challenger explosion are just three of the most highly publicized incidents. But cases of inadequate environmental risk communication also occur which are not nationally publicized. For example, according to Marjorie Shovlin, a water quality specialist with the Metropolitan Water District of Southern California, and Sandra Tanaka, public affairs manager for the Los Angeles Department of Water and Power (LADWP), in 1985 after the detection of chemicals in the drinking water caused public confidence in the utility to decline, the LADWP proposed a project to prevent further contamination of the aquifer. In addition, the water would go through "an aeration tower where the contaminants would be stripped from the water and discharged to the atmosphere in the off-gas" (Shovlin and Tanaka 41). Although the LADWP determined that this plan posed no significant negative effects to the surrounding communities, it failed to account for public reaction.

The LADWP did not inform or involve the community in the risk assessment, management, or communication processes; residents first learned of the project from a newspaper article which described how "a 45-foot tall tower...would spew a mist of cancer-causing toxins into the air...at a site surrounded by homes and apartments" (Shovlin and Tanaka 42). Furthermore, residents contacted a local state legislator who "dubbed the proposed facility the 'Toxic Tower'" (Shovlin and Tanaka 42). Despite LADWP's subsequent efforts through public hearings and media interviews to disclose the quantity of
technical information that supported the safety of the project, the LADWP never fully recovered from its communication blunder—the public trust was broken.

Not all environmental risk communication is a failure. One example of a successful risk communication process is in the case of the Asarco copper smelter in Tacoma, Washington. According to journalist Barnett Kalikow, because this smelter emitted uniquely high amounts of arsenic, in 1983 the EPA decided to seek public input from the Tacoma community about regulating it in an effort to comply with the provisions of the Clean Air Act and a legislative ruling about arsenic emissions. Under the responsibility of the EPA, industry technicians, management, government officials, community leaders, and concerned members of the public became involved in the decision making process. Through public education about the risks, media attention, and public hearings discussing the potential risks and options to deal with the problem, the participants came to a regulatory decision about the smelter's fate—that the smelter should remain open in compliance with clean air standards. Despite the community's decision, Asarco decided to shut down this operation in 1984 because of falling copper prices and "the need to install a $150 million furnace to meet the state's sulfur dioxide emission standard" (55). In this case, although the risk communication process was successful, industry was not responsible for the process and did not follow through with the decisions made (the end result or product).

Despite the cases of the LADWP's aeration tower and the Asarco smelter, it is possible to achieve effective risk communication. For the purposes of this paper, risk communication is effective when it decreases the amount of hostility, mistrust, and anger present in the communication arena, and when it achieves
other desired results. These results differ depending on the purpose of the risk communication, but could include, for example, increased public awareness of risks, alleviation of concerns about risks, or a change in industry's risk decision making structure.

The purposes of this study are: 1) to examine risk communication assumptions, philosophies, and methods as shown in the literature and to classify them by communication model, creating three new models of environmental risk communication — the technological model, the audience-based model, and the integrative/collaborative model; 2) to provide technical writers who might find themselves in the position of communicating risk information with an introduction to the literature and three models which can be used to evaluate risk communication methods; 3) to address some critical issues in the environmental risk communication area, particularly ethics and scientific uncertainty; 4) to supply technical writers with a set of general principles for environmental risk communication utilizing the three models as a framework; and, 5) to serve as a springboard for other students/technical writers in the rhetoric and professional communication field who are interested in further research into this area. Achieving these purposes is important to the field of professional and technical communication because doing so establishes a new theoretical framework for evaluating the environmental risk communication process in much the same way that rhetorical principles are used to evaluate texts.

This study examines these three risk communication models and their different levels of public involvement in the environmental risk communication, management, and decision making processes. In addition, the
models are evaluated for their effectiveness in communicating environmental risk information. The evaluations assume that effective environmental risk communication does not occur when the public accepts the definitions of minimum risk as estimated by the experts, but rather occurs when risk outcomes are knowingly chosen by a well-informed public (Russell 21). Five questions direct my research:

- How are environmental risks communicated to the public?
- Can these communication methods be classified according to communication models?
- What challenges and factors affect and influence environmental risk communication?
- Of the risk communication methods used, which is the most effective, and why?
- What should the technical writer know about risk communication and how does the technical writer apply this knowledge to communicating environmental risk information?

While the above questions direct this study, several fundamental issues emerge that are also pertinent to the technical writer communicating environmental risk information including scientific uncertainty and ethics. While these themes are not addressed in specific sections, they are woven throughout the paper. Scientific uncertainty is particularly critical because environmental and related health risks, unlike other health risks such as an epidemic of the flu or AIDS, do not appear immediately and are not visible for empirical study. Furthermore, environmental risks affect more than people's health, lives, and property. Non-environmental risks have had monetary and
other quantitative values placed upon them, which are used extensively for cost/benefit analysis in risk assessment. However, the environment (clean air and clean water, for example) has no standard quantitative value — people value it in varying degrees and in different ways. In addition, the health risks associated with pollutants are hard to scientifically quantify — we don’t know what long term exposure to relatively small quantities of chemicals does to the human body or the ecosystem. The scientific uncertainty associated with the effects of chemicals in the environment and how each chemical and combinations of chemicals affect human beings’ health is only a piece of this extensive issue.

Risk communication has become an important part of the risk analysis/assessment, and management fields, as well as part of the journalism field. For the purposes of this study, risk analysis is defined as “the identification of a specific environmental hazard and the estimation of the corresponding levels of risk” (Leiss and Krewski 91); risk assessment is defined as the process of identifying, through various scientific methods, such as modeling, the seriousness of a hazard, estimating the magnitude of the risk by determining dose-response relationship and dose received by a population, and evaluating the risk by determining whether a particular risk is acceptable through risk-cost-benefit analyses, method of expressed preferences, method of natural standards (Shrader-Frechette 8); and, risk management is defined as a “process starting with risk identification, characterization and estimation, through the evaluation or assessment phase and ending with the choice of policy or action to reduce the hazard and to monitor the results, which aims to control and reduce risks to
acceptable levels, reduce uncertainty in risk decisions, and increase public confidence in decisions about risk” (Grima 119).

Studying risk communication also has implications for the field of professional and technical communication. Although technical writers may not participate in risk assessment and management decision making, they are employed in a variety of fields which involve environmental risks. Because technical writers in these fields may be called upon to communicate these risks, this paper provides technical writers with a theoretical grounding in the risk communication literature, a sense of their role in the risk communication and management processes, and a set of guidelines on how to communicate effectively with all participants in the risk communication process. While much of the usefulness of these guidelines depends on corporate attitudes and management decisions regarding risk communication, technical writers still need to learn about their specific situations, including management’s philosophy, context, audience, and rhetorical purpose. With the understanding that the guidelines in Chapter III are not meant to be all inclusive, they can still provide technical writers with a place to start. Specifically, the guidelines in the integrative/collaborative model emphasize the much broader issues important in social constructionist theory over clarity and concision, which are typical guidelines for writing.

The basic aim of this thesis is to provide technical writers who might need to communicate environmental risk information with an overview/introduction to the major issues, methods, and literature in environmental risk communication. As a cross disciplinary study between two fields, in a sense this thesis is also a breakthrough, demonstrating the importance of studying and
incorporating the entire field of risk communication (traditionally a part of the technical field of risk analysis) into the field of technical/professional communication. Given the multiple purposes of this thesis and its cross disciplinary nature, there are several important areas of the broad issue of environmental risk communication which are not addressed. This study specifically addresses the technical writer in industry who is communicating about local environmental and health risks. However, it must be acknowledged that technical writers may also be involved in the environmental risk communication process as part of other organizations, such as government agencies and environmental or public advocacy groups. In these organizations, the technical writer's rhetorical purposes will differ from those of the technical writer in industry. Furthermore, this study focuses on local environmental issues because although global environmental issues, such as acid deposition, global climate change, ozone depletion, and loss of biodiversity, are very important, these issues entail a risk communication process that is far too complex for the scope of this study. At the global level, risk communication involves both a much higher degree of uncertainty about risks and many more participants. While many international issues and events involving environmental risks, such as Bhopal for example, are important and relevant, this thesis focuses on environmental risk issues in the U.S. to limit the arena to a familiar political and regulatory process. Despite the focused scope of this study, the information contained can still be used by technical writers in positions requiring risk communication.
To lay the foundation for the theoretical framework, the next section reviews current research which addresses the various methods of environmental risk communication.

Literature Review

This literature review provides a brief introduction to the risk communication literature by dividing the experts’ views into three models based on their assumptions, philosophies, and communication methods. Experts in this field are found in government, industry, and in a variety of educational disciplines. Because this study also addresses the role of the technical writer in the risk communication process, the literature review includes a brief overview of the literature available on this area as well.

In the last twenty years, since the highly publicized environmental issues of the 1970s and the passage of the Occupational Safety and Health Administration’s (OSHA) “Worker Right to Know” laws in 1983 and 1986, risk and hazard communication has included two arenas, both of which are considered in this study: hazard communication in the workplace, and specifically, risk communication among industry, government agencies (such as the Environmental Protection Agency (EPA) ), and the public. Approaches to environmental risk communication between industry, government, and the public can be classified into one of several models, which I have termed the technological model, the audience-based model, and the integrative/collaborative model.
As the fields involved with risk have gone through great changes, including an increase in highly publicized risk events (the Exxon Valdez is only one such event) and an increase in public awareness of risks, risk communication methods and philosophies have changed as well. The following list divides industrial, academic, and government approaches to risk communication into three models, or “camps,” based on underlying assumptions, philosophies, and communication methods.

- Technological model: incorporates methods which emphasize technical solutions to communication problems, focus on the agency/industry, and follow a linear model of communication. (Cox and Ricci, 1992; Davé, 1988; Douglas, 1985; Festa, 1985; Mabbett, 1986; Jones, 1988; Reilley, 1989).

- Audience-based model: incorporates strategies which recognize the existence of audiences with different perceptions of risk than industry and the importance of forming risk messages for those audiences. (Baybutt, 1989; Cannell and Otway, 1988; Sandman, 1987; Sandman, 1988; Smith, Desvousges, Johnson, and Fisher, 1990; Slovic, 1987; Siegel, 1989).


The views of the above individuals and brief discussions of the different risk communication models are covered in more detail in the following sections.
The Technological Model

The technological model is based on several communication methods and philosophies which emphasize technical solutions to communication problems, focus on the agency/industry, and follow a linear model of communication. One area in which these methods occur is the workplace. With the passage of the OSHA's "Worker Right to Know" law in 1983 and 1986 employers are required to inform workers of the types of chemical hazards they encounter in the workplace through comprehensive hazard communication programs, including worker training and Material Safety Data Sheets (MSDS). Workers are not expected to participate in the process of hazard communication; they are simply the recipients of hazard information. As the communication of hazard information does not involve worker participation, it is characteristic of the technological model.

The one-way communication method characteristic of the technological model of environmental risk communication first developed from the need to implement OSHA's Worker Right-to-Know Standard. Niru Davé (1987), a safety professional, explains the components of the OSHA hazard communication standard (29 CFR 1910.1200) issued in 1983 and expanded in 1987 and provides guidelines for employer implementation. This standard "is intended to reduce the risk to workers by requiring hazard evaluation of chemicals (by chemical manufacturers and importers), and requiring employers to inform and train workers of the hazards of chemicals they get exposed to and how to protect themselves" (21).

This standard is designed to promote safety in the workplace by providing workers with information about chemicals and other potential hazards in the
workplace. According to John Festa (1985), director of the Chemical Control Programs for Environmental & Health Programs of the American Paper Institute, and Barbara Mabbett (1986), senior environmental health scientist, an effective hazard communication program in the workplace needs to provide workers with scientific data and chemical information to fulfill the obligations of worker right-to-know without requiring any feedback from the employees. Because it emphasizes unidirectional communication of technical information this approach is consistent with the technological model of risk communication. Environmental and health risks may also be communicated from industry and government agencies to the community in a similarly linear way when manufacturers producing or emitting chemicals into the environment that cause health risks communicate these risks to the public.

Another characteristic of the technological model is that it emphasizes technical and scientific solutions, such as risk analysis and risk comparisons, to communication problems. The prevalent attitude is that if risks are explained clearly enough and in simple enough terms, the public will understand industry's risk evaluation results. According to John Douglas (1985), a science writer, improved risk assessment and management techniques are the only tools needed to effectively communicate the industry's risk information to the public. He says, "risk assessment attempts to determine the seriousness of some health hazard. The steps include identification of a potentially hazardous substance, determination of its dose-response relationship to various health problems, estimation of likely public exposure to the substance, and characterization of the resulting health risk in quantitative terms. Risk management techniques can then be used to aid in setting priorities for action and to analyze alternative
control strategies" (7). Furthermore, "these methods can also be used to communicate the realities of risk to an increasingly agitated and skeptical public, by showing the relative importance of various risks and what trade-offs would be needed to control them" (7). Douglas also advocates using risk comparisons and cost/benefit studies, as well as closing gaps in scientific knowledge to improve risk assessment and management. He argues that to put risk into perspective for the public, a common framework for decision making is needed which translates abstract risk analysis into concrete terms. This translation of risk information for the technically illiterate public is a common concept in the technological model.

Louis Cox and Paolo Ricci (1992), independent researchers and consultants, also focus on a scientific approach to risk management and advocate strategies that are indicative of the technological model of risk communication. They claim that decision making with scientific knowledge is very difficult due to scientific uncertainty. However, because policymakers cannot wait for more accurate information before making decisions involving risk, they must be able to address the issue of uncertainty. In their discussion of various types of uncertainty and ways to cope with them, Cox and Ricci conclude that methods, including scenario building and modeling, from applied risk assessment provide some of the means to deal coherently with decision making under uncertainty.

Another problem with scientific uncertainty in risk communication is that even scientists cannot be certain which chemicals are going to be hazardous for the environment and people's health. According to William Reilley (1989), deciding first which chemicals are hazardous and then how to regulate them is a tremendous challenge because of scientific uncertainty. He states "if the experts don't agree on the seriousness of the risk associated with environmental
hazards, how are the American people — the ultimate decision makers in our democratic society — to judge? And what happens if expert opinion differs, as it often does, from the public's perception of the risks they face?” (10). Because conflict occurs when government and public's perceptions of risk differ, in order to make rational decisions, Reilley argues that industry needs more data. Although Reilley emphasizes scientific solutions to risk communication problems, he also somewhat advocates methods that are partially collaborative when he says, “communication is not a one-way street. The public also has a responsibility to the dialogue — by listening with a critical ear, by weighing the available information to the best of their ability, and by supporting actions to deal with subtle problems, not just dramatic ones” (10). Despite this contradiction, Reilley seems to fully advocate technical solutions to communication problems more than a collaborative approach.

Pamela Jones (1988), an environmental issues/public relations professional, further focuses on technical solutions to risk communication problems. She dichotomizes the chemical controversy between environmental groups, who want to change the status quo for the public good, and industry, who wants to preserve the status quo for profit. She states that environmental groups affect public perceptions of risk by taking advantage of people's paranoia of chemicals, repeating examples of how the system doesn't work to protect people, and using the media to convey their message. To counteract this, industry has no choice but to put forth its own information. She claims that the social and political aspects of the risk controversy are the problems for science and industry — not the technological aspects. Jones also acknowledges that industry's focus on technical solutions has its shortcomings. She states that
“typically industry focuses its efforts at meeting the needs of its customers, shareholders, and regulators ... at the expense of ... societal wants and needs” (50). Furthermore, Jones argues that “industry often does not even know what the concerns of the public are, and even if it did, the corporate system of the chemical manufacturers often does not allow these considerations in meeting their bottom line sales goals ... And lastly, industry does not commit to exploring ways to involve the lay public with technological decision making. It persists in laying the decisions almost solely at the feet of the technical elite — scientists and scientific advisory panels” (50). To counteract this, and turn risk communication into a positive opportunity rather than a negative experience, industry needs translators to take technical and scientific information and make it understandable for the public. Jones’ assertions are all indicative of an industry-centered view, which is a central part of the technological model.

Because methods of environmental risk communication which are more linear and emphasize the importance of technical solutions may not be acceptable to the community, experts in several sectors advocate an approach to environmental risk communication which is more audience-based.

The Audience-Based Model

Methods which are included in the audience-based model recognize the existence of audiences with different perceptions of risk than industry and the importance of forming messages for those audiences. These methods draw upon research in risk perception to discover the public’s (audience) concerns about environmental risk so that communicators can formulate the best message possible to address those concerns, depending on the technical writer’s rhetorical
purpose. The best environmental risk message could have any number of characteristics, depending on context, audience and purpose.

Peter M. Sandman (1987), professor of environmental journalism and Director of the Environmental Research Program at Rutgers University, first addresses the idea that the public perceives environmental risk differently than industry when he states that “the conclusion is inescapable: the risks that kill you are not necessarily the risks that anger and frighten you” (21). He sees the problem as one of definition. To some experts, risk means the expected annual mortality from a hazard. However, this definition is only a narrow aspect of risk. Risk can also be defined more broadly — as a compound measure of the perceived probability and magnitude of an “adverse effect” (Shrader-Frechette 18), which, in other words, is an impact of a chemical, behavior, or technology on ecosystems and on humans. But to the public, risk has an even different meaning altogether. To illustrate this idea Sandman redefines the terms used in the risk assessment process by calling the definition of risk as expected annual mortality “hazard” and all other factors that collectively influence risk perception “outrage.” He explains that “risk is then the sum of hazard and outrage. The public pays too little attention to hazard; the experts pay absolutely no attention to outrage” (22). He provides a list of outrage factors, including voluntariness, control, fairness, and familiarity, developed from risk perception studies of which communicators need to be aware. These outrage factors are discussed in more depth in the next chapter. He finally concludes that to create effective communication, industry needs to diminish outrage, and the public must become informed (22). This concept of risk as the sum of “hazard” (the definition of risk as expected annual mortality) and “outrage” (the other factors
which affect public perception of risk) is one of the cornerstones of the audience-based model and will be discussed in greater depth in the next chapter.

Similarly, William Cannell (1988), Civil Aviation Authority Directorate of Research (UK), and Harry Otway, CEC Joint Research Centre Head of Technology Assessment Centre (Italy), explain that the differences in audience perspectives in risk communication are due to value differences and conflicts of interest within society. They state that "research in risk perception and cognitive science, as well as basic democratic ethics, suggests that risk communication should expose, rather than conceal, value differences and conflicts of interest within society; only then will [communicators] begin to satisfy the needs of their audience in resolving uncertainties about how to behave in the face of perceived threats" (519). More effective risk communication will help resolve conflicts over controversial technologies. They further differentiate between the professional task of "ensuring that the public is adequately informed about risk," and the political task of "resolving conflicts of interest" (521). This differentiation is important to the question of risk communication because it dichotomizes risk communicators and risk mediators. In the integrative/collaborative model, however, these functions are essentially combined. They conclude by arguing for an "audience-centered" approach, focusing on the perceptions of the audience as a valid component to risk communication (521).

V. Kerry Smith (1990), professor at North Carolina State University, William H. Desvousges, senior economist at Research Triangle Institute, F. Reed Johnson, professor of economics at the U.S. Naval Academy, and Ann Fisher, economist with the EPA, go one step further and argue that research findings on communication about radon indicate that risk communication policies can be
effective in modifying risk perceptions (42). They also provide guidelines for designing an environmental risk communication program that will modify the public’s perceptions of environmental risk. These guidelines include using more than abbreviated fact sheets to explain risks to the public, including quantitative information about the range of risk estimates, and having realistic expectations about risk communication (57).

Other researchers, drawing upon the definition of risk as hazard plus outrage, advocate making technical information more accessible to the public. Martin Siegel (1989), an industry-affiliated public and government relations expert, states that “if a way could be found to explain the data more clearly, communities would accept the risks we define as minimal and take seriously the risks we see as serious” (22). Siegel does not believe that simply finding a way to make the data more understandable, however, is the answer. He emphasizes that, in addition to explaining the data as simply as possible, greater priority must be given to understanding and addressing the variables that influence the public perception of risk.

According to Paul Baybutt (1989), a specialist in risk, safety, and reliability, because perception studies offer insight into how the public’s collective mind works, enough information exists on how to communicate risk information to the public. However, the problem lies in timing. Baybutt makes the distinction that “risk information can be communicated proactively before any incidents occur, or it can be communicated reactively after an incident,” and that it is preferable to communicate risks proactively (85). Baybutt also offers step by step guidelines on how to interact with the public and present information and then addresses and refutes some common objections to communicating risks,
including disclosure of sensitive information to the public, potential negative
reaction from proactive information release, potential liability, and shift of risk
management decision making to the public away from the company. This
approach, combining technical emphasis with an understanding of the public, is
typical of the audience-based model.

Similarly drawing upon risk perception, Paul Slovic (1987), president of
Decision Research and professor of psychology at the University of Oregon, also
advocates methods of risk communication which are more audience-based. He
holds that a need exists to understand the ways in which people think about and
respond to risk (236). Furthermore he states that “disagreements about risk
should not be expected to evaporate in the presence of evidence. Strong initial
views are resistant to change because they influence the way that subsequent
information is interpreted” (237). This attention in the communication process
to public perceptions of risk is one of the key components to the audience-based
model.

While many experts focus on industry and the public as the only
participants in the risk communication process, another participant is the media.
Peter Sandman (1988) offers an audience-based approach to telling reporters
about risk, recognizing that the media neither positively nor negatively
influence risk communication, but are neutral. Sandman describes the media’s
role in the communication process as a not always objective channel of risk
information. He further says that communicators need to recognize this role
and try to work with media representatives, not against them, incorporating the
media as part of an overall communication strategy. Sandman recognizes that
the media play a critical role in the communication process as an element which can influence public opinion.

While the audience-based model incorporates methods developed from risk perception studies which are advocated by a number of industry scientists and representatives in the risk communication field, many government and academic researchers take the audience-based approach even further and argue for an approach to risk communication that not only incorporates the public's perceptions of environmental risk, but involves the public, as well as all other affected parties, as participants in the process.

The Integrative/Collaborative Model

Like the previous two models, the integrative/collaborative model also includes characteristic methods and philosophies of environmental risk communication. However, it goes beyond the other two models in terms of public involvement because it incorporates methods which recognize and integrate all participants in the risk communication and management process and the context within which these processes occur. The literature justifies an integrative/collaborative approach to risk communication on the basis of both legislation and effectiveness.

The first reason experts cite for the use of an integrative approach is legislative. The passage of the Emergency Planning and Community Right-to-Know Act in 1986 (Title III of the Superfund Amendments and Reauthorization Act of 1986) ensures that a community has the "right to know" about the chemical hazards in their environment. Implicit in the legislation is the idea that all people affected by a risk should participate in communication about that
risk. Instead of simply communicating risks linearly, or even developing risk communication messages with the audience's concerns in mind, these risk communication methods attempt to integrate the community's views and concerns into the risk management and decision making process.

John Ahearne (1990), chair of the National Research Council on Risk Communication, suggests that although public participation may be implied in the legislation, the degree of public empowerment needs to be clear from the start (38). He further states that “the Administration Procedures Act requires all agencies to consider and address all public comments on proposed actions” (38). Although he advocates a two-way process of risk communication which requires a good understanding of public thinking and honesty on the part of the communicator, he also believes that “in a democracy, a responsible risk communication process is a governmental duty” (39), removing the bulk of responsibility from industry or the public. While recognizing that government has a responsibility in risk communication, it is unwise to remove responsibility from either the public or industry. When all stakeholders in risk communication have responsibility, they are less likely to blame one segment of the process for problems that occur.

Charles Elkins (1987), director of EPA's Office of Toxic Substances, also justifies an integrative approach with legislative reasons. He discusses methods of risk communication that integrate the public into the decision making process from the industry perspective, which can be defined as concerned with public opinion, profit-oriented, and focused on technology as the answer to risk problems and questions. He explains that the Emergency Planning and Community Right-to-Know Act of 1986 (Title III of the Superfund Amendments
and Reauthorization Act of 1986) is “based on the belief that the more information that citizens have about environmental conditions in the communities, the better equipped they will be to ensure their own protection from unacceptable risks to their health and safety. The law requires disclosure by industry of both the presence and release into the environment ... of hazardous substances” (23). He also holds that the major challenge to the practice of this law is that raw data isn’t sufficient if the public doesn’t know how to interpret it. He further claims that industry needs to do more than make the raw data available and that industry, government and the community need to work together on public information programs to help people understand the data.

In discussing public involvement in the risk communication, assessment and management process in the case of the Asarco smelter in Tacoma, Barnett Kalikow (1984), a journalist, argues for involving the public more closely in managing environmental and health risks. Typically, although legislation requires a period of public comment, hearings are not usually publicized and are not typically well attended. However, in this case, the communication process was different, and successful, primarily because the EPA instead of Asarco assumed responsibility for the communication and decision making process. The EPA held public workshops to inform people and then held public hearings (57), following the principle that “everything would be well publicized and the agency would actively seek participation from community organizations ranging from environmental and other citizen action groups to [the company’s] management and the union” (57). While it had its drawbacks, in this case, the risk communication process as part of the assessment and management process
was very successful because each participant in the process was able to understand the other participants' perspectives.

Former EPA Director William Ruckelshaus (1986) also emphasizes that the democratic nature of our country means that the government derives its powers from the people. Because the Freedom of Information Act and “all environmental laws include the right of citizens to intervene in the administrative process, to demand hearings,” he contends that “the right of the citizen to participate is written in our law” (533). He discusses two main principles to involving the public effectively in the risk communication process: access to the decision maker and sufficient information to make decisions (534). Although Ruckelshaus contends that it is important to involve the public because the public is ultimately responsible for environmental risk decision-making, an equally valid case could be made that the public is effectively not responsible. Instead, the EPA, OSHA, or another government/regulatory agency is responsible because government creates and enforces regulations, and answers to industry, the public, and the media for its actions.

Similarly, Milton Russell (1987), professor of economics and senior fellow in the Energy, Environment, and Resources Center at the University of Tennessee, also claims that, because of our Constitution and democratic society, “it is public, not expert opinion, that counts” (20). He further says that “success in risk communication is not to be measured by whether the public chooses the set of outcomes that minimizes risk as estimated by the experts. It is achieved instead when those outcomes are knowingly chosen by a well-informed public” (21). Furthermore, part of the environmental professional’s responsibility is to
provide information to the public in a usable form so that the public can be an informed participant (21).

Former EPA Director Lee Thomas (1986) argues for building risk communications into the regulatory policy with the Superfund Community Relations policy. He advocates a two way system of communication which will “empower the community to discuss risk in a rational and technically competent way” (262). He argues that “the public must share directly in decisions that affect it, and we must ensure that it does so with a fuller understanding of the inevitable trade-offs involved in the social management of risk” (263). An important component to the integrative/collaborative approach to risk communication is that everyone, including members of the community, must be technically fluent, though not necessarily expert, in all aspects of risk communication.

Besides legislative justification, several researchers use effectiveness as a reason for a more integrative approach. Drawing upon input from a large number of industry risk communicators, B. J. Hance, research associate in the Environmental Communication Research Program at Rutgers University, Caron Chess, associate director, and Peter Sandman (1990) suggest in their guidelines for effective environmental risk communication that communication about risk needs to involve everyone affected by the hazard—industry, government, media, and the community. Assuming that involving all affected parties is the goal, they discuss a number of specific ways for industry communicators to achieve successful collaboration between all participants in the risk communication process.
After demonstrating the need for, describing the pieces of, and discussing how to achieve community right to know, Hadden (1989), University Research Institute, University of Texas at Austin, advocates improving the principle of community right to know by broadening the statute, implementing it better, and empowering citizens to become active participants in the policy process, not just passive recipients of risk information. She makes the important point that different actors in the risk communication process would endorse different levels of public participation. For example, industry might advocate informed consent up to point where the balance of power is maintained; however, environmental and public advocacy groups might argue for a level of public involvement in decision making that results in a shift in the balance of power.

It is important for technical writers to be aware of the different political philosophies, motivations, and agendas of all the actors, including themselves, in the risk communication process.

Former EPA Director William Ruckelshaus (1984) describes what the EPA needs to do and plans to do to "make it easier for the public to understand how decisions are made, establish more consistent standards for assessing a broad range of environmental and public health risks, and enable us to handle the ever more sophisticated and subtle findings of science" (58). As one method of involving the community, he advocates a public education program that can be integrated into the decision-making process.

Another characteristic of the integrative/collaborative approach is that it recognizes that context is an important component in the risk communication process. Although Sheldon Krimsky and Alonzo Plough (1988), researchers at Tufts University, set risk analysis into a dichotomy between technical expertise
and social/cultural perception, they argue that risk communication is a collaborative process involving many factors, including the participants, but also including context. They further argue that public response to environmental hazards is influenced by social, cultural, and political considerations, and that risk events are comprised partly of physical processes and partly of socially constructed processes (4). The discussion of the significance of context in environmental risk communication, as illustrated through five case studies, is an important component of the integrative/collaborative model.

Although some researchers advocate methods of risk communication that are more collaborative and argue that opinions of experts and the public need to be coordinated in the decision making process, others advocate methods which are included in the technological and audience-based models. In the next chapter, I will describe each of these three models in depth, explaining their definition, development, and results of use in communicating environmental risks to the public.

The Role of the Technical Writer

The role of the technical writer in the risk communication process is not one which is extensively discussed directly in the literature. However, because technical writers play an important role in the communication of environmental risks, either to the public or within an organization or corporation and particularly when they function as more than conduits of information, the literature review includes a brief overview of the research available on this area. Much of the discussion about the role of technical writers in communicating risk information directly or indirectly touches upon the
question of ethics in technical communication. While this topic is far too vast and complex to fully address in this paper, when discussing the role of technical writers in relation to communicating risk information, the study of ethics in technical writing has specific applications on the issues of responsibility, rhetorical aim, and the process and content of risk messages.

The first facet of the technical writer's role is that of ethical responsibility. Gregory Clark (1987), assistant professor of English at Brigham Young University, describes two competing perspectives on ethics that guide the communication of technical information. The first of these is the professional perspective which "confines ethical issues to the immediate boundaries of the professional's work: legal and moral questions remain beyond it" (190). According to Clark, the professional perspective of ethics is built on a definition of the communication process where the technical communicator is a bridge between the creators and users of ideas, and that ethical communication is "a matter of transporting information effectively" (191). In risk communication, this idea is very consistent with both the technological model and, particularly, the audience-based model where the goal is to communicate risk information clearly enough for the audience to understand it. Conversely, the academic perspective, addressing ethics in a broader context, is "founded on the assumption that communication is a process of interaction rather than transportation" and "describes a person who communicates technical information as functioning as an interpreter rather than a bridge" (191). This view of ethics seems to be more in line with the integrative approach because it is context-based, social, and interpretive.
Arguing that neither of these perspectives is adequate, Clark describes an approach to ethics, based in classical rhetoric, which is built on principles of cooperation and "works toward the purpose of developing a shared understanding upon which good collaborative judgements can be made" (193). In this instance the responsibility is to the collaborative community. He further argues that "from this perspective, ethical technical communication functions as a cooperative exchange between the people who can provide information and the people who need to use it" (195). Clark's view of ethics provides a basis for understanding the responsibility of the technical communicator to provide and interpret environmental risk information for the collaborative community.

While not addressing an environmental issue, an excellent example of ethics in communication of risk information is the case of the Challenger explosion. Several researchers argue that the failure in this tragedy was not just in the O-rings — it was also in the failure of engineers and management to effectively communicate and understand the dangers of launching the shuttle.

Dorothy Winsor (1989), an assistant professor of communication at General Motors Engineering and Management Institute, argues that "the Challenger blew up largely because of miscommunication" (528). She describes the series of events leading up to the launch, including the different communications that took place. It is clear from her descriptions that miscommunication took place; what is not clear, however, is who is responsible. These events seriously draw into question where the responsibility for miscommunication lies and has implications for the amount of ethical responsibility technical writers who communicate risk information have in ensuring that risks are fully understood by their audiences.
Winsor (1990) further discusses the *Challenger* explosion, addressing the nature of the question “why did it happen that various people in the organization involved knew about the faulty O-rings that caused the *Challenger* to explode but failed to pass on the information to decision makers?” According to Winsor, this question is itself faulty, implying a simplistic notion of knowledge and a conduit model of communication. She argues instead that knowledge “is not nearly so certain a state as we might think, even for technical experts; that knowledge is always shaped by both empirical evidence and social, contingent factors; and that any enterprise which has knowledge as one of its goals needs to consider the effects social factors have on people’s views of evidence” (12). She also contends that instead of a conduit model of communication where the recipients of information automatically comprehend it, data, no matter how clearly presented, do not automatically produce knowledge (15). This argument exposes another facet of the issue of scientific uncertainty — that in addition to uncertainty about the data itself, interpretation of data is also uncertain. Winsor’s view on how technical “knowledge” is passed between people in organizations also has ramifications for technical writers disseminating information about risks to the public because they must continually evaluate whether their messages are being comprehended and how they are being interpreted.

In discussing the communication aspect to the *Challenger* explosion, Paul M. Dombrowki (1991), Ohio University, addresses the issue of context in risk communication when he argues that meaning, even in highly technical matters, “is socially constructed and that professional communicators need to become more alert to the role of social factors in technical matters” (211). In the case of
the Challenger, the information about the charring of the O-rings causing a dangerous situation changed over time — as more launches were successfully completed with O-ring charring, the perception that the O-rings were faulty lessened. Because there also was a degree of scientific uncertainty about the effects of O-ring charring, management was not convinced of the danger. Dombroski states, “when engineers could not prove with certainty that the shuttle would burn itself apart, this absence of certainty was taken as a confirmation of management’s assumptions of flightworthiness” (212). This important relationship between scientific uncertainty and ethics is another issue of which technical writers need to be aware. Dombroski’s conclusion that professional communicators need to be aware that assumptions can alter the perception of information is similar to the view that risk perception alters the reception of risk communication by the public.

This example relates the issue of scientific uncertainty to the issue of ethics in technical communication because technical writers have an ethical role and responsibility to communicate risk information, even when uncertainty complicates technical knowledge. Environmental issues inherently have a large degree of uncertainty associated with them, but it is still important for the technical writer to communicate what knowledge there is about potential risks.

While ethics and scientific uncertainty are important issues, the role of the technical writer is another important facet to technical communication. In discussing the organizational role of technical communicators, Teresa M. Harrison, Rensselaer Polytechnic Institute, and Mary Beth Debs, University of
Cincinnati, (1988) use a systems approach to organizational theory. They argue that technical communicators engage in tasks that permit them to function within the organization as ‘boundary spanners.’ As boundary spanners, technical communicators bridge social and physical distances between groups of individuals within and outside the organization, enabling these communicators to mediate the flow of information between the groups. In the process of disseminating information, technical communicators engage in sense making. That is, they translate information provided by one organizational group into terms that can be understood by various organizational audiences both within and outside the organization. (6)

Boundary spanning, which can be internal or external, puts the technical communicator in the role of interpreter. In external boundary spanning, technical communicators “establish links between the market and the organization” and “establish a corporate voice” (15). Because of its interpretive nature, this type of boundary spanning becomes a crucial element of the technical writer’s role in the integrative/collaborative model of environmental risk communication.

The discussion of ethics in the communication of technical information provides a number of valuable insights for the technical writer involved in environmental risk communication. Technical communicators need to determine what constitutes ethical behavior, and where their responsibilities lie; they need to be aware of the potential for miscommunication in complex communication situations where predetermined assumptions can alter the reception of information; and, they need to understand the role of the technical communicator in disseminating information.
II. RISK COMMUNICATION STRATEGIES

Although the different risk communication strategies have developed concurrently, they have also changed over time. According to Lee Thomas, the old method of communicating risks found with scientific assessments consisted of an "expert who examined the risk, made a judgement about how much risk was tolerable, and pronounced a particular situation safe or not safe (Risk Communication qtd. in Warner 38). At that time, people were relatively content to rely on experts' assessments of risks, rarely questioning them.

However, this method of communicating risk is no longer adequate. Highly publicized events in which environmental and health risks were not adequately communicated caused the public to lose faith in industry and government experts. Furthermore, according to Lee Thomas, the three very important components of risk communication have changed: the public, the government, and the nature of the risk. Thomas states: "The public has changed: it now demands to know what is going on, and in turn, government has been forced to deal with legislation to inform them. Because of these dramatic changes, a better method of risk communication, one involving the public and the expert, needs to be established" (Warner 38). Furthermore, Thomas says that "in the past, when the outcome of a risk analysis was causing conflict or unnecessary confusion, the public ignorance, bureaucracy, or the conflict of interest in industry was blamed" (Warner 38). Now, a great need for effective risk communication exists, not only to provide the public with information about risks, but also to increase their confidence in government and industry.

Obstacles to effective environmental risk communication still exist.
According to several researchers, risk communication problems arise from four major areas: 1) source problems, such as limitations of risk communicators and risk experts; 2) message problems, such as limitations of scientific risk assessments and the simplicity of risk comparisons; 3) channel problems, which are limitations in the means or media by which scientific information about health or environmental risks is transferred; and 4) receiver problems, which include characteristics of the intended recipients of the communication. Receiver problems include inaccurate perceptions of levels of risk, fear of risk information, lack of interest in risk problems and technical complexities, strong beliefs and opinions that are resistant to change, desire and demands for scientific certainty, and difficulties in understanding probabilistic information related to unfamiliar technologies (Slovic; Warner; and Hanson). It is important for technical writers to be aware of these obstacles so that they can attempt to overcome these obstacles. No matter which risk communication model is used, solving these problems and effectively communicating environmental risks with the community are important. The three models of environmental risk communication are examined more closely in the following sections.

The Technological Model

The technological model of environmental risk and hazard communication incorporates methods which characteristically emphasize technical solutions to communication problems, focus on the agency/industry, and follow a linear path where the message, isolated from context, moves between sender and receiver. This model, using methods advocated by many industry experts, typically causes the public to lose confidence in industry and
government because public concerns are not adequately met and agencies and industry do not appear to have the community’s interests in mind when making risk management decisions. As a result, many other experts have judged the methods of this risk communication model to be ineffective. Despite its ineffectiveness, the main characteristics of the technological model are evident primarily in two communication arenas: in the workplace between employer and employee, and in the community between industry and the public.

The first characteristic of the technological model of communication is that it emphasizes technical solutions, such as cost/benefit ratios, risk comparisons, and scientific assessments of risks, to communication problems. However, risk comparisons tend to infuriate and insult the public because they oversimplify the risk and make comparisons between dissimilar risks. While technical explanations of risk may be useful in some situations, technical solutions are generally inadequate because of the uncertainty associated with them. According to Cox and Ricci, “the uncertainty affecting environmental and health decisions is difficult to characterize fully because of its different forms and the large number of models, inputs, and outputs of the processes involved” (78). Focusing completely on technical solutions is inadequate for solving environmental risk problems because it is impossible to eliminate uncertainty. Instead, it is important to be able to draw upon other avenues, such as community input, of addressing these problems.

The second characteristic of the technological model of communication is that it focuses on the industry’s perspective of the risk management process. The public is viewed as highly irrational, overly emotional and sensitive about environmental and health risks, ill-informed about chemical risk technology,
and easily swayed by the media. The assumption made by industry is that if the public could understand the scientific process of risk analysis, it would accept industry's risk assessments and judgements of safety (Siegel 22). Companies expect the public to accept the risk assessment information from their experts without questioning it. When the public questions the assessment that the risk is minimal ("safe"), industry typically reacts by saying that the public simply doesn't understand because risk analysis is too technical for general comprehension.

Furthermore, as companies do not adequately understand or address the public's concerns (they typically don't even try to), a lack of trust in companies and agencies and a backlash against manufacturers and government results in which the public distrusts any information put forth about environmental risks. For these reasons, technological-based methods don't usually work because "disputes are not about facts, scientific data, or clauses in the law, but about values" (Ahearne 39). In this type of communication, when industry doesn't account for the differences in values, it fails to alleviate concerns about risk, even damaging risk communication efforts because industry and the government lose their credibility with the public.

The third characteristic of the technological model of communication is that it follows the Shannon-Weaver communication model. In this model, the message, isolated from context, moves between sender and receiver along a linear path. According to Bowman and Targowski, "Shannon and Weaver's model depicts communication as linear, a series of steps in which a message is conveyed from a source or sender to a destination or receiver, and 'communication' is defined as the replication of the original message at the
receiver's end of the transmission. For this reason, the Shannon and Weaver model has become known as the ‘transmission’ model of the communication process” (23). Furthermore, they state that “Shannon and Weaver’s ‘transmission’ model of communication has long been recognized as inadequate for describing the complex process of human communication... because it evaluates communication based on the efficiency of the channel” (21). Likewise, in environmental risk communication, if the message produced by industry was not accepted by the community, industry often blamed the channel (the media) for exaggerating the “truth” about risks and inflaming the public. Industry would also blame the receiver (the public) for not being technically fluent and objective enough about risk assessment and for being overly emotional about potential risks.

These linear methods of risk communication first developed after the passage of OSHA's “Worker Right to Know” law in 1983 and 1987. This law requires that workers be informed of the types of chemical hazards they encounter in the workplace through comprehensive hazard communication programs, including training programs, accessible material safety data sheets (MSDS’s), and written hazard communication.

According to John Festa the basic requirements of OSHA’s hazard communication standard include the following:

- Employers must ensure that all containers of hazardous chemicals in the workplace are labelled with hazard warning information.

- Employers must make copies of material safety data sheets for each hazardous chemical in the workplace available to employees.
• Employers must provide employees with information and training on the hazardous chemicals in their work area.

• Employers must develop and implement a written hazard communication program. (38)

Employers can fulfill these basic requirements in a variety of ways, but one thing remains constant: workers only participate in this process of hazard communication as the recipients of hazard information. The flow of information is linear, moving from the employer and managers to the workers, and the information is highly technical, requiring extensive explanation for employee comprehension. This linear flow of risk information is central to the technological model and is also present in risk communication between manufacturers producing or emitting chemicals into the environment that could possibly cause health risks and the public.

Returning to the case of the Los Angeles Department of Power and Water (LADWP) and the air-stripping tower will demonstrate why linear communication methods based on technical solutions are inadequate. According to Shovlin and Tanaka, the LADWP historically has used an informational communication process in which messages were “passed from the utility to the public without citizens being involved in any substantive way in decisions about water quality issues” (40). Projects, like the air-stripping tower, were decided solely on the basis of technical merit, without public involvement, and then decisions were communicated to the public.

After the detection of trichloroethylene (TCE) and tetrachloroethylene (PCE) in the drinking water caused public confidence to decline, LADWP decided to take an aggressive approach to improving water quality and communicating
about water quality issues with the public. According to Shovlin and Tanaka, LADWP continued to communicate information linearly to the public using risk comparisons, in which the risk of TCE in drinking water was compared to eating peanut butter containing aflatoxin (41) or other dissimilar risks. In the beginning, these efforts — a speaker’s bureau, meetings with community leaders and elected officials, tours of the water treatment facilities, exhibits on water quality, brochures and bill inserts, and an educational program in the local schools — were appreciated by the community because they were an improvement over previous methods.

However in 1985, the LADWP, using the “decide, then inform” approach, “proposed a project that involved drilling wells in the shallow, contaminated region of the aquifer to create a cone of depression that would prevent migration of contaminated water to the uncontaminated region of the aquifer. A collector line would bring the water to an aeration tower where the contaminants would be stripped from the water and discharged to the atmosphere in the off-gas” (41). The LADWP used the most advanced technical methods to determine that this plan posed no significant negative effects to the surrounding communities.

Unfortunately, while public input in the development of the groundwater strategy had been part of the recommendation to build the aeration tower, the LADWP did not inform or involve the community located in the immediate vicinity of the proposed site in the risk assessment, management, or communication processes. Learning about the project from a newspaper article which described how “a 45-foot tall tower...would spew a mist of cancer-causing toxins into the air...at a site surrounded by homes and apartments” (Shovlin and Tanaka 42), residents were outraged enough to contact a local state legislator who
“dubbed the proposed facility the ‘Toxic Tower’” (Shovlin and Tanaka 42). Despite LADWP’s subsequent efforts to disclose the quantity of technical information through public hearings and media interviews supporting the safety of the project, the LADWP never fully recovered. Public opinion was formed and no amount of positive technical information could convince the community that the project was safe. The project was completed only when LADWP agreed to install scrubbers which were technically unnecessary, but publically imperative. In this case, as in many others, the technological model of environmental risk communication was not adequate or successful.

The Audience-Based Model

Although many experts in the field continue to rely on technological methods of risk communication, others have recognized that many times these methods typically are not successful. This assumes that risk communication is successful when “it raises the level of understanding of relevant issues or actions and satisfies those involved that they are adequately informed within the limits of available knowledge” (NRC 26). In the mid-1980s government experts, such as former EPA Director William Ruckelshaus, began to recognize that industry’s efforts at communicating risks to the public were not adequately alleviating public concerns about environmental risks. At this time, experts in several sectors also began to advocate a more audience-based approach to environmental risk communication. Audience-based methods of risk communication draw upon research in risk perception so that communicators can formulate messages that adequately address the audience’s (public’s) concerns and fears about
environmental risks. The audience-based model of environmental risk communication, therefore, primarily focuses on using knowledge about the audience's risk perceptions when formulating messages, and derives its framework from basic rhetorical principles of communication theory.

The first characteristic of the audience-based model of environmental risk communication is that it emphasizes the audience's views about risk when creating messages. Risk perception studies are very important to the audience-based model because they provide an insight into the concerns of the public and how public perceptions of risk differ from industry perceptions. Ruckelshaus states "We have learned that it is crucial to start with ... public attitudes toward what we are talking about. If we don't start with an understanding of the receptor, we are doomed to failure" (Risk Communication qtd. in Warner 40).

This view that understanding the receptor (typically the public) is an important part of risk communication is a fundamental reason that using information from risk perception studies became widely accepted in risk communication.

Risk perception studies information, such as that in the research of Cannell and Otway, Slovic, and Smith, Desvousges, Johnson, and Fisher, has a very important role in the audience-based model of risk communication because "public perception research, a bid to understand the ways in which people think about risk, would enable better communication between experts, policymakers, and the public" (Warner 40). According to Slovic, while analysts use risk assessment to evaluate hazards, the majority of people rely on intuitive risk judgements, called risk perceptions (280). A basic assumption underlying efforts to understand risk perceptions is "that those who promote and regulate health and safety need to understand the ways in which people think about and respond
to risk” (Slovic 280). According to Cannell and Otway, communicators will only be able to satisfy the needs of their audience when value differences about risk are exposed rather than concealed. Furthermore, knowledge of risk perception is important in risk communication because initial views about risk resist change and influence the way subsequent information is interpreted. Therefore disagreements about risk do not necessarily disappear in the face of technical evidence (Slovic 281). Technical writers need to recognize that information about risk perception can help in audience analysis, an important part of communication developed in classical rhetoric.

It is evident from the research that public perception of risk differs from that of industry. For example, some scientists define risk as their estimate of the hazard involved, multiplied by exposure to get an expected annual mortality rate. But the public does not see risk as having just one variable. To the public, risk is the sum of hazard plus “outrage” (Sandman 21). Risk perception researchers (Slovic, Sandman, Covello, Keeney, and von Winterfeldt) have identified a number of outrage factors which influence public perception of risk, including the following:

- **voluntariness**—a voluntary risk, such as smoking, is more acceptable than one which is involuntary, such as air pollution from a smokestack.

- **control**—a risk over which one has control, such as driving, is more acceptable than one over which one has no control, such as riding in the passenger’s seat.

- **fairness**—risks that are unfairly distributed have a higher degree of outrage attached, such as one community which continually receives a higher level of hazardous waste.
trust—risk information from sources which are perceived as trustworthy is more acceptable than risk information from untrustworthy sources.

morality—risks that have immoral or evil connotations are less acceptable.

familiarity—familiar risks, such as eating apples with alar, are more acceptable than unfamiliar risks, such as nuclear reactors.

memorability—memorable events, such as Love Canal, can make risks even less acceptable.

artificiality—natural risks, such as earthquakes or radon, are more acceptable than unnatural risks, such as chemical spills or nuclear waste.

dread—some illnesses, such as cancer and AIDS, are dreaded more than others, such as emphysema, and so the associated risks are less acceptable.

diffusion in time and space—hazards which kill 50 people in one incident in a neighborhood are less acceptable than the same hazard which kills 50 people a year across the nation.

These outrage factors are important in risk communication because the greater the number and the seriousness of these factors, the greater the likelihood of public concern about the risk, regardless of the data (Siegel 21). Most importantly, if risk communication does not address these factors, it will almost always be unsuccessful at assuring the public that the risk is safe.

While risk perception studies form one of the basic tenets of the audience-based approach to environmental risk communication, another comes from a rhetorical approach to communication theory. Jack Selzer advocates the following guidelines in a rhetorical approach to business writing: 1) general rhetorical principles should be emphasized over particular “types” of
communication; 2) audience and purpose should be investigated thoroughly; and, 3) as much attention should be paid to process as to product (5). Applied to environmental risk communication, these principles, when combined with research in risk perception, form the basis of the audience-based model.

In Selzer's first principle, instead of a limited number of writing types, communicators should be able draw upon general rhetorical principles for any communication. These principles include assessing the audience and purpose, developing a communication strategy, and using invention, planning, and stylistic skills. This principle can be readily adapted to environmental risk communication in that instead of learning and relying upon the same types of risk communication, such as press releases, public hearings, and brochures, technical writers who are also risk communicators need to develop flexibility in their rhetorical skills, so that "they are capable of choosing the content, organization, and style that are appropriate for each new subject, audience, and purpose" (Selzer 6).

Selzer's second principle, fully considering audience and purpose, is the foundation of the audience-based model. Selzer contends that audience analysis is very difficult; however, the audience-based model of risk communication can use the tool of risk perception research to discover information about the audience. Furthermore, as discussed earlier, technical writers need to be fully aware of their various rhetorical purposes; in risk communication these purposes could include, but are not limited to, informing the public about a potential risk or persuading the public to accept a risk assessment.

Selzer's third principle, included in the audience-based model of risk communication, is that process should be as important as product. In the
technological model of risk communication, the product is the sole consideration; however, in this model, the process of formulating risk messages is also of key importance. This process should include invention, planning, composition and revision based upon what the communicator understands about the audiences and purposes of the message.

Selzer's principles combined with research in risk perception form the basis of the audience-based model of environmental risk communication. In using the information gained from risk perception research and Selzer's rhetorical principles, technical writers can formulate risk communication messages that, depending on the rhetorical purpose of the communication, address and alleviate public concerns about risk. In the audience-based model, information still generally flows from the technical elite (industry) to the public in the linear way of the technological model; however, industry communicators attempt to understand the public's concerns about risk and address them in their messages. While audience-based communication is an improvement over the technological model of risk communication, this approach has a similar scientific foundation because it still views the public's lack of technical expertise as one of the main problems in risk communication, and that problems would be solved if the audience was clearly informed about risk information. This model also continues to retain the power of risk decision making in the industry sector, away from the community.
While many experts in the field advocate audience-based methods of risk communication, others also advocate methods of risk communication that more directly involve members of the public as participants in the communication process. The integrative/collaborative model incorporates methods which recognize and involve all participants in the risk communication and management processes, understanding the context within which communication occurs. In this model, environmental risk communication occurs more than just after a risk event; it is a continually evolving collaborative process in which all parties affected by the risk re-evaluate risks with the goal of reducing them. Ideally, each participant is well-informed about the risk and the technical process of risk analysis so that informed discussion can take place. Environmental risk communication at this level is extremely complex because the "public" is not one audience, or even the only audience, but multiple parts of many audiences with wide ranging expertise, values, concerns, fears, and expectations. Furthermore, this collaborative process of risk communication can require a great deal of time, effort, and money to be successful. The integrative/collaborative model of risk communication encompasses the following characteristics:

- regards the public, government officials, industry experts, scientists, management, and the media as all necessary and important parts of the collaborative community;

- considers context, recognizing that communication does not occur in a vacuum;
• is not product, but process oriented (continually evolving); and,
• realizes that effective communication does not simply involve providing technical information to the public after the assessment and decision making is over, but occurs as an integral part throughout the risk assessment and decision making processes.

These characteristics form the basic principles of the integrative/collaborative model of environmental risk communication.

The justification for the integrative/collaborative model is twofold. First, government risk communication experts and community advocates argue for public involvement based on the democratic process and environmental legislation. As previously discussed in the literature review, advocates of integrative methods of risk communication argue that participation in risk assessment and management is guaranteed by the Community Right-to-Know Law, the Freedom of Information Act, and other environmental legislation, as well as the Constitution (Elkins 23, Thomas "Talk" 262, Ruckelshaus "Tough" 533, Russell 20).

Whether or not public participation is guaranteed by law, EPA Administrator Thomas contends that it is partly the government's duty to "empower the community to discuss risk in a rational and technically competent way." ("Talk" 262). Once the community is technologically fluent in risk analysis and management issues, it can actively participate in the communication process. Warner continues this idea when she states "programs to implement the education of various sectors of the community put emphasis on technical tools and training for public officials. In this way people are trained to deal with risk and communication of risk on the local level, thus increasing its grassroots
effectiveness” (40). Although it is assumed that legislation guarantees the right to participate, it is also important to recognize that without enough knowledge about the technology of risk assessment and management, the public cannot participate effectively.

The second rationale for the integrative/collaborative model is grounded in Martin Nystrand’s social-interactive model of writing. This risk communication model adapts to the process of risk communication Nystrand’s assertion that writing is an interactive process, involving more than just the “generation, organization, and translation of ideas into text” (Nystrand 70). The integrative model also accepts the view that “meaning is a social construct negotiated by writer and reader through the medium of text, which uniquely configures their respective purposes” (Nystrand 78). The concept of meaning in Nystrand’s model becomes the risk decision in the integrative/collaborative model, and the writer and reader become, not just two individuals, but all the participants involved in the communication process. In this way the stakeholders in the environmental risk assessment, management, and communication process — technical risk analysts, community advocates, concerned citizens, government regulators, industry representatives, management, the media, and technical communicators — become equally important participants in the discourse community (Thompson; Zappen; Kent; Lipson), integrating all of their expertise and perceptions of the risk situation to create risk decisions together. In the integrative/collaborative model, as in Nystrand’s model, and unlike in the technological and audience-based models, messages are not isolated from social, political, and cultural context, but immersed in it.
The integrative/collaborative model offers the technical writer a basis for effective risk communication. However, the technological model fails to effectively communicate risks because it does not address public opinion until the public rises up and protests. The assumption that public understanding of advanced risk technology will solve risk communication problems fails to account for the difference in values between industry and the public — it simply assumes that the industry perspective is right. Similarly failing, the audience-based model stresses clarity — the goal is to simply find out what the audience needs and explain it clearly, assuming that the public will then accept industry’s risk assessment. This positivistic idea is totally upset in the integrative/collaborative model which assumes and demonstrates that the most effective risk communication is created by all participants in a collaborative, continually evolving process.

By building upon this theoretical foundation, technical writers can participate in achieving collaborative environmental risk communication. First, technical writers should ensure that risk communication messages, even if they are unidirectional, address the audience’s fears, concerns, and perceptions. Once industry representatives understand the importance of addressing public perceptions, realizing the importance of public involvement is next. Audience participatory risk communication, using the community’s feedback in risk assessment and management decision making, is the key to collaborative risk communication. Given its importance, the next section outlines some specific guidelines that technical writers and risk communication professionals can use to effectively participate in a collaborative environmental risk communication process with the community.
III. GUIDELINES FOR ENVIRONMENTAL RISK COMMUNICATION

When all stakeholders are involved as collaborative participants in the assessment, management, and communication of environmental risks, more effective decision making occurs and more widely accepted decisions are reached. While the ideal integrative/collaborative situation does not always occur, as individuals, communities, government, and industry realize the need, it is happening more and more frequently, even if change is effected only incrementally. Besides industry scientists, government officials, and public advocates, technical writer are also involved as participants in the risk communication process. Two questions about the technical writer involved in risk communication need to be addressed: 1) what is the role of the technical writer in the risk communication process; and 2) given their role, how can technical writers effectively participate in a collaborative process of communicating environmental risks with the community? These questions are discussed in the following sections.

The Role of the Technical Writer

Because technical writers play an important part in the communication of environmental risks, either to the public or within an organization or corporation, their role in this process needs to be explicitly addressed. Harrison and Debs’ conceptualization of the importance of the technical writer’s role in an organization has a direct application to the technical writer involved in environmental risk communication, especially in the integrative/collaborative
model of communication. A fundamental assumption of this section is that it is important to involve technical writers in the communication process from the very beginning; they should not be brought in at the end of the risk assessment process and expected to translate the information then. To be effective as an interpreter, the technical writer needs to be involved at every step of the risk communication process. Because the public trust is involved and people's lives and the environment are at stake, technical writers need to consider issues of ethics in technical communication when communicating risk information.

First, the technical writer's role in environmental risk communication involves organizational purpose. In discussing the organizational role of the technical writer, Harrison and Debs argue that technical communicators function as boundary spanners, which means they "translate information provided by one organizational group into terms that can be understood by various organizational audiences both within and outside the organization" (6). Boundary spanning puts the technical communicator into the role of information interpreter. External boundary spanning, where technical communicators interpret information between the organization and an outside audience, has specific applications to the integrative/collaborative model of environmental risk communication. In the technological model, technical writers would function as compilers of information to be presented to the public; in the audience-based model, they would incorporate their knowledge about their audience to create messages. In the integrative/collaborative model, however, technical writers have an expanded role. In this case, technical writers act as a mediator interpreting risk information from the industry or government agency, making it understandable for the community, and communicating
public concerns to the organization. Technical writers in the integrative model act as the grease in the gears, helping the communication process run more smoothly for everyone involved. Because technical writers are not passive conduits of information, but active participants, they need to consider issues of ethics, particularly in the integrative/collaborative model where technical writers interpret and mediate information between the parties. An example of an ethical consideration is that technical writers in this case have a responsibility to be objective and honest.

Second, technical writers also have an ethical responsibility in the process of communicating risk information. Clark’s approach to ethics, based in classical rhetoric and built on principles of cooperation, is especially applicable to the integrative model of risk communication. He argues that “ethical technical communication functions as a cooperative exchange between the people who can provide information and the people who need to use it” (Clark 195). This view of ethics provides a basis for understanding the role of the technical communicator as a provider of environmental risk information to the affected community while maintaining a responsibility to the collaborative community which includes all participants.

Again, an excellent example of ethical responsibility in risk communication is in the case of the Challenger where miscommunication and misinterpretation of risk information contributed to the disaster. Winsor’s description of the events leading up to the Challenger explosion and her assertions about the nature and communication of technical knowledge seriously question where responsibility lies in the communication process.
Winsor's view on how technical knowledge is passed between people in organizations is also applicable to the communication of environmental risks to the public and is especially compatible with the integrative/collaborative model for several reasons. The first part of her argument that knowledge "is not nearly so certain a state as we might think, even for technical experts" (12) is very similar to the understanding in the integrative model that risk entails scientific uncertainty and that science will not always produce the answers to risk questions. The second part of her argument "that knowledge is always shaped by both empirical evidence and social, contingent factors; and that any enterprise which has knowledge as one of its goals needs to consider the effects social factors have on people's views of evidence" (12) is consistent with the integrative/collaborative model's emphasis on context and its inclusion of risk perception information. Furthermore, Dombroski's assertion that meaning, even in highly technical matters, "is socially constructed and that professional communicators need to become more alert to the role of social factors in technical matters" (211) is also consistent with the emphasis placed on context in the integrative/collaborative model.

Although risk information in the integrative/collaborative model is socially constructed by the participants and dependent upon context, it is also interpreted by technical writers who mediate among all the participants. When technical writers act as boundary spanners in the process of communicating environmental risks, it is particularly important that they comprehend the nature of technical information as outlined by Winsor and Dombroski in order to make ethically responsible choices about how to communicate that information. These include decisions about what is ethical behavior, and where
technical writers’ responsibilities lie. Furthermore, technical writers need to understand that miscommunication can occur in complex communication situations, and they need to be aware of their role in communicating risk information. Given their role as potential interpreters of risk information between industry, government, the media, and the community, the next section discusses some specific guidelines for the technical writer.

**Guidelines for the Technical Writer**

Effective environmental risk communication based on the integrative/collaborative model is achieved through several steps. Citizens must be empowered to become involved in the technological decision-making process. Therefore, communication becomes, not a message travelling a linear path from industry to the community, but a series of messages travelling between and becoming altered by all participants in the process. For this to happen, industry and government must recognize that the public has a great deal of valuable insight into environmental risk and is an important part of the risk assessment, management and communication process. Management must accept and involve the public as a legitimate partner in the risk communication process. Additionally, industry and government must become aware of the social and cultural aspects of risk. The public also has a responsibility — to become fluent in the technical aspects of risk. When all parties are aware of each other’s perspectives on risk, communication about and the assessment and management of these risks can result in better decisions.
In this process of communicating environmental risks, the technical writer also plays an important role. To execute this role and perform their responsibilities, technical writers need a set of guidelines which can be used for communicating environmental risks with the community. Keeping in mind that effective risk communication is an ongoing process with more than a single communication event, the following risk communication fundamentals, which have been compiled from the experts (Hance, Chess, Sandman, Ahearne, Covello, Benjamin, Belluck, Kasperon, Keeney, von Winterfeldt, Baybutt, and the National Research Council) and my own knowledge, are designed to assist the technical writer involved in the risk communication process. The following phases of the communication process — preparation, communication, and follow-up — do not occur linearly, but continually, cyclically, and/or concurrently.

**Preparation**

The technical writer's preparation for the integrative/collaborative process of environmental risk communication consists of the following: developing an open attitude, gathering information about the communication situation, and building the collaborative community.

*Developing an open attitude.* The first part of developing an open attitude towards integrative risk communication is to accept and involve the public as a legitimate partner in the communication process. This is more of a management decision than an actual step for the technical writer. Once the decision is made to involve the public, finding ways to do so is the next step. Another part of developing an appropriate atmosphere in which the
communication process can take place is in the public’s attitude toward your company or organization. Because it is difficult, if not impossible, to effectively communicate in an atmosphere of distrust, actively seek to improve the company’s trust and credibility. To help build trust, be honest, frank and open, and treat people with fairness and respect for their right to make their own decisions. If trust is extremely low, follow these suggestions:

- Acknowledge any past mistakes that the company has made and do not try to cover them up. Willingness to admit when the company has made an error will help to repair a bad situation. Covering up mistakes will worsen the situation.

- When past mistakes come up, don’t get angry or defensive. Recognize them and concentrate on improvement.

- Demonstrate that the company has learned from past mistakes and is trying to improve. (Hance, Chess, and Sandman 39).

While developing an open attitude will help situate the communication process in an atmosphere of open exchange, before that exchange can take place, the technical writer also must learn about the situation in which communication will take place.

**Gathering information.** In the second part of preparing for the environmental risk communication process, gathering information, it is important to define the rhetorical purposes for communicating risks, develop realistic expectations and clear objectives, formulate a risk communication strategy, set goals for the communication process, select communication channels (media, public meetings, etc.), and choose the type and form of risk information to present. Without these boundaries, it is difficult to evaluate whether or not communication is successful. Information gathering for risk
communication has two basic components: technical knowledge and audience/context identification. Technical writers, to fulfill their organizational purpose as interpretors of technical risk information and mediators in the communication process, need to first attain expertise in the risk subject matter and risk communication. Find out as much as possible about the technical aspects of environmental risk assessment, analysis, management, and decision-making, including the various channels available for risk communication.

Audience/context identification is another important component to gathering information for the risk communication process. Technical writers need to: identify audiences, such as community activist groups, and be able to address all the key ones; understand the audience, the areas of public concern, and what information people want; and, comprehend the social, cultural, political, and economic context in which environmental risk communication and decision making will take place. Identifying the audience and its concerns is important to building relationships with the community, formulating effective risk messages, and involving the public as active participants in the ongoing assessment, communication, and management processes.

**Building the collaborative community.** The third part of preparing for environmental risk communication is building the collaborative community. In the integrative/collaborative approach this step involves establishing relationships with members of the community as an early part of the process before the communication event rather than waiting until the communication event or afterwards. In building the collaborative community, the technical writer, drawing upon the knowledge gained about the different segments of the community and their concerns, contacts the individuals involved and conveys
that she is available to them to answer their questions and help meet their risk information needs. Once the communication about risk information itself begins, or if a controversy occurs, the technical writer will already have a personal understanding of the people involved. Ideally, building relationships with members of the community will make the communication process more interactive and more effective. In this part of the process, it is also important to involve the media as an ally rather than an adversary because the media is also an important participant in the risk communication process, as a channel and potential interpreter of risk information. In the integrative/collaborative model, as an ally, if the media is provided with information rather than having to resort to investigation, they can be a valuable means for disseminating risk information to the public.

Communication

While the process of environmental risk communication involves all three phases, the actual communicating of risk information is only one piece of that process. The communication of environmental risk information by the technical writer in the integrative/collaborative process consists of the following: involving the community, communicating with the community, and responding to the community.

Involving the community In the integrative/collaborative process of risk communication the importance of involving the community is a basic assumption. Although achieving public involvement can be difficult, there are some specific strategies available to the technical writer. First, it is important that all events related to risk communication are well publicized. Drawing upon the
contacts made when building the collaborative community, technical writers can make sure that community leaders are informed. Second, develop and utilize all possible avenues of communicating risk information, including citizen advisory boards, public hearings, news conferences, and outreach programs. Third, besides the formal avenues of communicating risk information, find informal ways to interact with people, such as open houses, plant tours, newletters, neighborhood nights, and teachers’ seminars (Hance, Chess and Sandman 62). More important than the method of involving the community is that the community is involved and that their views and concerns are heard, taken seriously, and integrated into risk decision making.

Communicating the risk information. In the integrative/collaborative model, while communicating environmental risk information is only a small part of the process, it is an important part. To make the process as effective as possible the technical writer should remember the following guidelines in communicating risk information with the public:

- If in doubt about when to release information, lean toward early release because it is better for maintaining the public trust, and there is more time for meaningful public involvement in decision making.

- Share all the information that is important to the audience, particularly keeping in mind the main outrage factors in risk perception.

  - Voluntary vs. involuntary
  - Natural vs. industrial
  - Controlled by the individual vs. controlled by the system
  - Fair vs. unfair
  - Open process vs. closed process
  - Morally relevant vs. morally irrelevant
  - Familiar vs. Unfamiliar
  - Memorable vs. not memorable
• Dreaded vs. not dreaded
• Trustworthy vs. untrustworthy
• Knowable vs. not knowable

• Speak clearly, in plain English, and with compassion. Try not to use technical jargon. Instead, use the plain language equivalent. If a technical term is absolutely necessary, define it clearly first and then introduce the technical term.

• Put the risk into perspective for the community rather than trying to minimize it or to convince people to accept it.

• Use care when simplifying risk information.

• Be careful when using comparisons. Do not use risk comparisons that trivialize risk simply as a way to get the public to accept industry’s definition of risk.

• Acknowledge uncertainty.

• Make sure the message is complete.

These general guidelines are designed to help the technical writer effectively communicate environmental risks with the community. While in other models, fulfilling the rhetorical purpose might include using propaganda to influence the audience, in the ideal integrative/collaborative model, propaganda would not only be unnecessary, but unethical as well. When the public has a significant role in decision making, there is no need or desire for this type of communication. The integrative/collaborative model is also more concerned with the broader, socially constructed communication issues than clarity and concision, two of the typical guidelines for technical communication.

**Responding to the community.** Once a message has been communicated, the community will typically react to it. Not only should technical writers expect and be prepared for public response to risk information, they also need to know
how to reply to the community and their potential objections. It is particularly important to listen and respond personally when communicating in emotionally charged situations. Responding personally is sometimes as simple as showing that you care by acknowledging people's emotions, shared values, and your own feelings; it can also be as complex as resisting the urge to respond defensively. It is important, however, that technical writers who are in the position of mediator maintain their responsibility to the collaborative community of which they are an important part.

Follow-up

The last phase of the integrative/collaborative process of environmental risk communication is follow-up. In this phase the technical writer receives feedback from the participants in the communication process and then acts upon this feedback by providing further data and new information and answering any additional questions.

Receiving feedback is an important component in the process of risk communication. Because technical risk information has the potential for being misunderstood, technical writers who communicate risk information need to continually evaluate whether they are providing honest information and whether their audiences fully comprehend risk messages. However, evaluation of risk communication is only useful in a communication situation where feedback from the audience is considered.

Technical writers should continually try to get feedback from as many segments of the community as possible so that they can evaluate their efforts to communicate with communities and improve them. Obtaining feedback is also
an integral part of the two-way process of communication in the integrative/collaborative model. Feedback from the community can be obtained in any number of ways, including public opinion polls, focus groups, and questionnaires. However, it is mainly important that the community understand that the technical writer is accessible to them and wants their input. Once the public knows that the technical writer will listen to their specific concerns, the best ways of obtaining their feedback will become clear.

Although the above guidelines provide specific ways in which the technical writer should communicate environmental risk information with the community, the basic guiding principle for effective risk communication is that the public deserves to know the chemical hazards that exist in their environment and the opportunity to participate in the communication and decision-making processes. When all people affected by environmental hazard are able to communicate rationally about them, then the best possible decisions will be made.
VI. CONCLUSION

Being informed about and reducing the environmental risks which surround us in our daily lives is important for many individuals and communities. Legislative concerns and public pressure from communities have convinced industry and government to begin involving the public in risk assessment, management, and communication — processes which traditionally were off limits to the public. Because technical writers are involved in the communication of environmental risks between industry, government, the community, and the media as interpreters, mediators and boundary spanners, this paper has provided guidelines for the technical writer involved in the risk communication process. To develop these guidelines, this thesis first reviewed the available literature on risk communication, classified and evaluated the assumptions, philosophies, and methods of environmental risk communication according to three models, and addressed several issues important to risk communication, including ethics, scientific uncertainty, and the technical writer's role in risk communication.

Because this study is cross disciplinary, bringing the area of risk communication into the rhetoric and technical communication field, it has opened up a number of areas for further research into risk communication as it relates to rhetorical and professional/technical writing. Further research is needed, especially into the areas that are not addressed in this paper, including ethics, scientific uncertainty, communication about global risk issues, technical writing in government or an environmental/public advocacy organization, and evaluation of specific risk communication events based on this framework.


Thomas, Lee M. "We Must Talk about Risk." Chemtech. 16 (May 1986): 262-3.


